The Lancet Countdown on Health and Climate Change

Policy brief for Médecins Sans Frontières

2022

LANCET COUNTDOWN: TRACKING PROGRESS ON HEALTH AND CLIMATE CHANGE

MEDECINS SANS FRONTIERES
DOCTORS WITHOUT BORDERS

Introduction

"The lean season was at its peak when the cyclones hit and as people have largely lost their sources of income, it's very likely this will impact their food supply and nutrition. Especially because many people here were already so vulnerable."

Mathilde Guého, MSF Emergency Coordinator in Madagascar

As an independent international medical humanitarian organisation responding to health crises in more than 70 countries, Médecins Sans Frontières/Doctors Without Borders (MSF) is seeing first-hand the suffering caused or exacerbated by climate change and environmental degradation, most often experienced by the most vulnerable people. We are witnessing how climate change directly threatens health – for example, through death and injury due to extreme weather – and how climate change impacts health indirectly, through food insecurity and shifting patterns of climate-sensitive infectious diseases.

Recognising the role of the climate crisis in amplifying humanitarian needs, MSF is adapting its operations to be more responsive to the populations it serves while also facing up to the challenges of measuring and reducing its own environmental footprint.

Members of MSF's emergency team conduct an assess-ment in a flood-hit village in Dera Murad Jamali district, Balochistan, Paki-stan. In August 2022, severe floods in Pakistan affected more than three million people and inundated one third of the country.[3] Climate change may be one of several factors that brought about the devastating floods.[4] MSF, August 2022.

Construction workers rehabilitate the hospital in Nosy Varika, Madagascar, after it was damaged by cyclones Batsirai and Emnati in February 2022. The storms were the latest in a series of shocks the country has faced in recent years.[1,2] iAko M. Randrianarivelo, March 2022.

Health impacts of climate change: vulnerable groups disproportionately affected

CASE STUDY: DROUGHT, INSECURITY AND MALNUTRITION IN NORTHERN NIGERIA

War and instability in Ukraine threaten to worsen food insecurity across Africa, as many communities rely on imports of staple foods whose production has been disrupted.[7] MSF teams have been responding to a growing malnutrition crisis affecting tens of thousands of children in northern Nigeria. In a 2022 screening campaign in one local government area in Zamfara state, North West Nigeria, more than half the children screened were suffering from malnutrition.[8] In Borno State in the North East, more malnourished patients arrived at MSF nutrition centres over six weeks in May and June 2022 than at any time since the programme opened in 2017 – including at the peak of the hunger gap season in previous years.[9]

In the North West region, intensified violence by armed groups has disrupted livelihoods and pushed an estimated 500,000 people to flee.[10] Competition for resources, likely aggravated by climate change, is believed to be a factor behind the violence.[11] In the North East, a years-long conflict drives long-term displacement, which undermines food cultivation and access to healthcare.[12]

A farmer cultivates his land near the village of Riko, Katsina State, North West Nigeria. MSF is responding to a growing malnutrition crisis in this chronically food-insecure region of Nigeria.[5,6] George Osodi/MSF, June 2022.

Communities around the world are facing significant climate change-related threats, such as irregular rainfall, extreme heat and drought, frequent and intense storms, and changing patterns of infectious disease.[13] The health consequences of these hazards are amplified by systemic factors such as conflict, poverty, and inequity, which deprive communities of key determinants of health. Without essentials like clean air and water, nutritious food, and health, energy and sanitation infrastructure, communities are less able to prepare for and cope with the risks presented by climate change. At the same time, climate change is often an amplifier of these same vulnerabilities, creating a vicious cycle. A multi-faceted nutrition crisis in northern **Nigeria** demonstrates how conflict, poverty and displacement amplify the impacts of climate change on health.[14] In turn, climate change drives increasing food and resource scarcity with potential to precipitate violence in the region.

Nigeria is highly vulnerable to climate change,[15] which has aggravated food insecurity across the country through changing rainfall patterns, drought and the drying of the Lake Chad Basin, and higher temperatures.[16,17] In 2021, 65% of African land (defined by WHO region) experienced at least one month of severe drought (Lancet Countdown Indicator 1.2.2). In comparison, 9% of the land experienced such droughts on average in 1951-1960, and there has been a steady upward trend in the amount of land experiencing drought since the 1980s. Extreme and exceptional droughts have also increased across this time period. Furthermore, the 2022 Lancet Countdown report indicates that rising temperatures in Nigeria are leading to shorter crop growth seasons, which undermine crop productivity. The length of the growing season for maize declining steadily since 1981, a 3.4% decrease with respect to a 1981-2010 baseline (Indicator 1.4). At a global level, the Lancet Countdown finds that the increase in heatwaves since 1981–2010 resulted in 98 million more people reporting moderate to severe food insecurity in 2020 across 103 analysed countries.

Meanwhile, in Magaria, **Niger**, the effects of climate change have exacerbated drought and reduced good harvests, while population growth and urbanisation have strained farmland, plunging many people into food insecurity.[19] At the same time, changing rainfall patterns are causing shifts in malaria transmission, which combine with malnutrition to create high rates of illness.[20]

In Niger, changing rain patterns are impacting food production and the spread of infectious diseases. In Magaria, in southern Niger, MSF is supporting a community-based health project to respond to high rates of malnutrition and malaria in remote areas. Mario Fawaz/MSF, August 2021.

"It is very alarming what the communities are saying, because here we live off agriculture and livestock farming, and these two sectors don't meet the needs of the people. The rains are becoming scarce and unevenly distributed... now they are concentrated in one month."
Salissou Abdel Aziz, MSF Health Promotion Supervisor in Niger

With over 60,000 staff globally,[21] climate change is also affecting MSF operations. Many staff members live and work in communities at heightened risk of climate-related harms such as the increasing frequency and intensity of extreme weather events which are both health emergencies, and a threat to the mental and physical health of health care workers. We are innovating simple, cost-effective, and environmentally responsible interventions that can make MSF medical programmes more responsive to the needs of staff working with and in affected communities, as highlighted in the example from Pernambuco state, **Brazil**, below.

CASE STUDY: MENTAL HEALTH OF FRONT-LINE WORKERS IN BRAZIL

In May and June of 2022, Pernambuco state, Brazil, experienced record-breaking rains, floods and landslides in which climate change played a role.[22] More than 130 people were killed and 40,000 displaced. Whole neighbourhoods were wiped away by landslides, with low-income neighbourhoods particularly badly affected. The disaster took a heavy toll on the health of the community. Working with local authorities and disaster management agencies, MSF teams found that while many other aspects of the crisis response were addressed, the mental health needs of front-line workers had been overlooked. In response, the teams offered mental health and psychosocial support and group training sessions on self-care to people in the health, social work and education sectors, including trainers who would offer the same sessions to others. During the five-week program, nearly 500 front line workers received support.

Unprecedented rainfall, flooding and landslides in Pernambuco state, Brazil, claimed more than 130 lives and displaced around 40,000 people. Local authorities mounted a robust humanitarian response; after consultation with the Ministry of Health and emergency response agencies, MSF began supporting people working on the response, including educators, social workers, and medical staff. Henry Rodríguez/MSF, June 2022.

Adaption through anticipation, responding to unmet needs

As the broad-reaching health consequences of climate change demand agile, adapted responses, MSF is seeking to better anticipate and prevent needs generated by climate-related epidemics and disasters. Working alongside local communities, we are improving practices and filling gaps in health care and humanitarian response. For example, a pilot project integrating public health and environmental data is helping us to anticipate, and more effectively respond to, peaks of malaria cases in South Sudan.

Malaria is one of the leading causes of childhood death and disease in South Sudan, where it is endemic.[28,29] Seasonal peaks and outbreaks present a challenge for operational planning and preparedness, as they can be highly variable in many areas. By the time health facilities begin experiencing increased malaria caseloads, it is too late to plan and deploy preventative measures. However, rainfall, temperature and other environmental indicators of malaria transmission have been shown to foretell peaks of malaria with weeks or even months of advance time[30,31,32] in other contexts, suggesting that it may be feasible to predict the timing and peak of malaria outbreaks.[33] Indeed, the Lancet Countdown data suggests that the length of the transmission season for malaria increased by 13·8% in the highlands of Africa (1500 m above sea level, including those in South Sudan) from 1951–60 to 2012–21 (indicator 1.3).

Health systems that have access to, and use, climate data in this way are better able to deliver robust preparedness and responses to climate-related hazards. However, according to data from the WHO reported by the Lancet Countdown 2022, less than 40% of countries reported having climate-informed health surveillance systems for vector-borne diseases in 2021 (Indicator 2.2.1).[34]

Health services and humanitarian responders require support to build up the necessary means and expertise to respond to ever-growing needs, especially where health systems are weak. Adaptation-related funding is currently inadequate to support health and health care in a warming climate and is particularly important in crisis-prone settings where funding tends to fall short.[35] (*Lancet* Countdown, Indicator 2.2.4).

Recycling waste in the Mbare Waste Transfer Station recycling program in Mbare, a neighbourhood of Harare, Zimbabwe. The Waste Transfer Station is a community-based initiative set up by MSF in 2019 and supported by the Ministry of Health. It allows recyclers to exchange recyclable solid waste for cash. Solid waste that is incinerated or ends up in landfills represents a significant source of pollution and greenhouse gas emissions contributing to climate change.[23] Rubbish also clogs stormwater drains and sewer lines, resulting in stagnant water and flooding, which in turn leads to outbreaks of water-borne and climate-sensitive diseases including cholera and typhoid.[24,25] Recycling solid waste can help to avert emissions and protect health, particularly where sanitation infrastructure is weak.[26,27] Believe Nyakudjara/MSF, April 2022.

CASE STUDY: USING CLIMATE DATA TO ANTICIPATE MALARIA PEAKS IN SOUTH SUDAN

The Malaria Anticipation Project (MAP)[i] was launched in 2021 to support MSF teams in anticipating and responding to increased malaria caseloads by developing a malaria early warning system. The early warning system is based on predictive models. Multiple easily accessible datasets are used as inputs, such as: routinely collected malaria data; climatic indicators such as rainfall, temperature, humidity, and wind speed; and remote sensing indices, such as the vegetation health index. MAP is currently being piloted in Lankien, Jonglei State, South Sudan, where MSF supports several health facilities. Efforts will then focus on assessing potential impact; management strategies and public health interventions, such as bed net distributions and advocacy; and on sharing this innovation with the local Ministry of Health and other actors.

A successful rollout of the MAP in Lankien means that MSF and other malaria responders in the area will be able to forecast health care activities in line with local needs and priorities, and more effectively mobilise resources for a robust and timely response to malaria outbreaks.

A child is weighed at a mobile clinic in Rubkona, Unity State, South Sudan. In neighbouring Jonglei state, MSF is piloting the Malaria Anticipation Project, which integrates climate and health surveillance data to anticipate and respond to high malaria caseloads. Sean Sutton/MSF, November 2021.

[i] MAP is supported by MSF's Sapling Nursery Fund and the Sweden Innovation Unit, and was developed in partnership with Arup, an international multi-disciplinary engineering and consultancy firm, with the oversight of an academic committee comprised of Rachel Lowe from the London School of Hygiene and Tropical Medicine, and Ellie Sherrard-Smith and Thomas Churcher from Imperial College London.

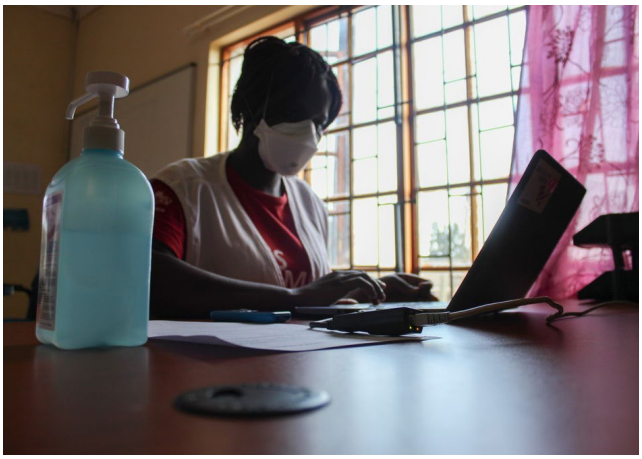
Toward more responsible humanitarian action: challenges and successes

MSF, as a medical humanitarian organisation, is driven by the principle of 'do no harm': to avoid taking any measure that risks doing greater harm than good. As such, the organisation recognises its duty to reduce and mitigate the environmental impacts of its work. Lancet Countdown data for 2022 show that trends in carbon dioxide (CO_2) emissions from the healthcare sector are going in the wrong direction, with the proportion of greenhouse gas emissions attributable to the sector on the rise (Indicator 3.6).[38]

Our core work is to respond to urgent humanitarian needs. But in the contexts where this work happens, it is often difficult to do it in an environmentally responsible way: for example, where reliable grid electricity or waste treatment infrastructure are lacking. In addition, the procurement and global transport of medicines and other supplies often involves significant greenhouse gas emissions. Finding innovative and context-specific ways to reduce and mitigate our environmental footprint is a challenge; but it is also an opportunity to realise health, economic, and other co-benefits. In Hangha hospital, in Sierra Leone, the use of energy-efficient equipment and alternative energy sources reduces costs, while improving resilience to energy-related shocks and insecurity.

Despite the challenges, MSF is making progress: informed by new and adapted monitoring tools like the custom-built Environmental Impact Toolkit, the organisation is developing roadmaps to a lower-carbon future. In December 2021, we committed to reduce carbon emissions by 50% compared to 2019 levels by 2030, in alignment with science-based targets.[39,40] New policies and protocols rationalise energy use and reduce carbon emissions from flights;[41] and telemedicine is increasingly used to tackle access challenges as well as reduce the carbon footprint inherent in travel.[42] MSF teams around the world are reaping the co-benefits of using solar energy to power health care, from oxygen concentrators to, in select cases, entire facilities. These examples demonstrate that, even in environments where there is limited supportive infrastructure, health care services can shift their operations to become less reliant on fossil fuels, and their unstable supplies and prices.

"Decarbonising the way we implement and support our medical emergency projects in over 70 countries is not a small task. But we are determined to get there and we are working from all angles to find solutions. If we want to spare future generations from more suffering and disasters, we all need to take responsibility."
Dr. Christos Christou, MSF International President



MSF nurse in Eswatini Rejoice Ncube consults a patient via video link. Catalysed by the COVID-19 pandemic, telehealth communication is increasingly used within MSF to expand access to health care.[36] Given that a major source of MSF's carbon emissions is staff transportation, the development of widely accessible and reliable telehealth networks -- along with the expansion of other virtual alternatives to professional travel, such as video conferencing and 'virtual field visits'[37] - can contribute to broader efforts to reduce the organisation's environmental footprint. Jakub Hein/MSF, May 2020.

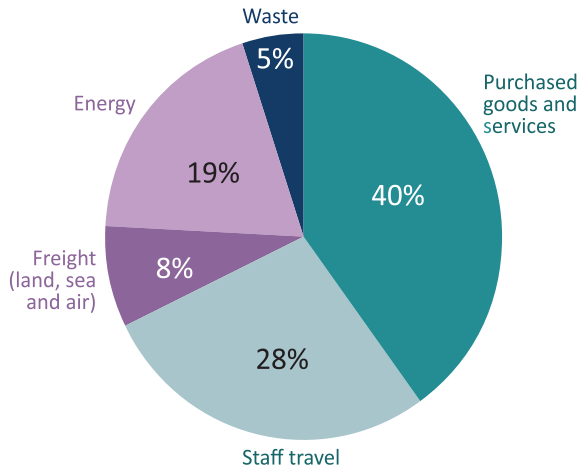


Fig 1. Primary sources of MSF's CO_2 emissions. An audit of MSF programme carbon emissions in approximately 30 countries carried out in 2022 found that nearly half of carbon emissions in 2019 were produced in the supply chain, followed by about 28% produced by staff travel, 19% by the production and consumption of electricity and heat, and 8% in shipping and 5% in waste. Such audits are providing a foundation for planning and roadmaps to more environmentally responsible operations.

CASE STUDY: SOLAR POWERED HOSPITAL IN SIERRA LEONE

Sierra Leone bears one of the world's heaviest burdens of maternal and child illness and death.[44] The loss of many health care workers during the 2014 Ebola outbreak created significant gaps in health care for rural and remote populations in Kenema district, in the east of the country.[45] The 182-bed MSF hospital in Hangha town, Kenema district, which opened in March 2019, runs on a holistic renewable energy system, including synchronised generators, photovoltaic solar panels, batteries and the option for city power connection.[46] Synchronised generators help the system keep up with variations in energy demand and make the energy supply more reliable, while increasing the lifetime of the generators and achieving the optimal operating range of each. This hybrid diesel-renewable system powers services in the hospital, including a lab, imaging suite, blood bank, emergency room, intensive care unit, three inpatient services, a maternity unit and a neonatal ward. Its use averts 173.1 tonnes of CO_2e annually-- about the same as the emissions produced by 37 gasoline-powered vehicles[47]- and allows for a €40,000 savings on diesel per year. The hospital currently runs on approximately 50 to 60% renewable energy, with plans for this to increase.[48]

> "Many communities where we work understand the importance of shifting to more sustainable energy solutions, and there is much local expertise to tap into."
>
> Iñaki Goicolea, Energy & HVAC (Heating, Ventilation, and Air Conditioning) Team Leader, MSF

Morning rounds in the intensive therapeutic feeding centre at the MSF Hangha Hospital, Kenema District, Sierra Leone. Peter Bräunig/MSF, Sept 2020.

Recommendations

1

Health care and humanitarian activities contribute to climate change through their significant environmental footprint. This is counterproductive, as climate change is aggravating the negative health impacts that these activities aim to address. Further, data show that healthcare CO_2 emissions are on the rise as a proportion of total global emissions (*Lancet* Countdown Indicator 3.6).[49]

Recommendation: Health and humanitarian organisations, including MSF, should promote environmental footprint reductions and accountability in their programming. All sectors, including health care and the humanitarian system, must reduce and mitigate their negative environmental impacts as a matter of urgency.

2

Systemic factors, such as conflict, poverty, inequity, and lack of access to health care, amplify climate-related risks to health. In turn, climate change undermines the foundations of good health, aggravating their impact, and exacerbating existing humanitarian crises. As a result, some people and communities are impacted disproportionately. The associated expansion of humanitarian needs demands an increased mobilisation of financial and human resources.

Recommendation: Bilateral and multilateral donors must make and follow through on clear commitments to support communities most affected by climate change in protecting and promoting health. Funding commitments for loss and damage must be met; and it is critical that this funding complements, rather than diverts from, existing humanitarian, development and health funding mechanisms.

3

Health services and humanitarian responders require support to build up the necessary means and expertise to respond to ever-growing needs, especially where health systems are weak. Adaptation-related funding is currently inadequate to support health and healthcare in a heating climate, and is particularly important in crisis-prone settings where funding tends to fall short.

Recommendation: Programme and project activities with health benefits must be robustly funded and supported with technical expertise. This includes activities that equip health systems to resist and respond to climate-related threats. High-income countries must follow through on previous financial commitments, such as that to double adaptation funding for the most impacted lower- and middle-income countries by 2025, and provide for adaptation activities with health benefits.[50] They must do so at the same time acting without delay to reduce fossil fuel use and meet their own emissions reduction targets. Humanitarian financing streams must be preserved and enhanced to allow for rapid responses to increasingly complex and multifaceted crises.

4

Adaptation efforts are effective when they are sensitive to context and responsive to the needs and preferences of affected communities. To ensure sustainability, they should engage local communities in leadership roles, be designed to enhance and synergise with local resources, and build the capacity necessary for adaptation and response on a broader scale.

Recommendation: Health systems and humanitarian organizations, including MSF, must step up efforts to support local communities in adaptation through capacity-building, knowledge exchange, partnership and collaborative decision-making.

Recommendation: Health systems and humanitarian organisations must recognise the provision of mental health and psychosocial support and other protections for people responding to extreme weather situations as a critical part of their duty of care.

References

1. Médecins Sans Frontières. Food assistance urgently needed as nutrition crisis grips southern Madagascar [Internet]. Geneva, Switzerland: Médecins Sans Frontières: 2021 Jul 9 [cited 2022 Oct 14]. Available from: https://www.msf.org/drought-leaves-skyrocketing-levels-malnutrition-madagascar

2. *Lancet* Countdown (2022) Per Indicator 1.4 of the *Lancet* Countdown Report for 2022, the growing season for maize in Madagascar was 3.9% shorter in 2021 compared to the previous year, likely due to the influence of higher temperatures. *Lancet* Countdown, 2022.

3. Ahmed M. UN chief links Pakistan floods and climate change, urges international community to deliver aid. PBS [Internet]. 2022 Sep 9 [cited 2022 Oct 14]. Available from: https://www.pbs.org/newshour/world/un-chief-links-pakistan-floods-and-climate-change-urges-international-community-to-deliver-aid

4. Mallapaty S. Why are Pakistan's floods so extreme this year? Nature [Internet]. 2022 Sep 2 [cited 2022 Oct 14]. Available from: https://www.nature.com/articles/d41586-022-02813-6

5. Médecins Sans Frontières. Out of sight: the neglected malnutrition crisis which threatens thousands of children's lives [Internet]. Geneva, Switzerland: Médecins Sans Frontières; 2022 Jul 7 [cited 2022 Oct 14]. Available from: https://www.msf.org/neglected-malnutrition-crisis-threatens-thousands-children-northwest-nigeria

6. Ibid.

7. Balana B, Andam K, Amare M, et al. The Russia-Ukraine crisis presents threats to Nigeria's food security, but potential opportunities for the fertilizer, energy sectors. 2022 Jun 9 [cited 2022 Oct 17]. In: IFPRI Blog [Internet]. Washington, DC, USA: International Food Policy Research Institute. Available from: https://www.ifpri.org/blog/russia-ukraine-crisis-presents-threats-nigerias-food-security-potential-opportunities

8. Médecins Sans Frontières. Out of sight: the neglected malnutrition crisis which threatens thousands of children's lives [Internet]. Geneva, Switzerland: Médecins Sans Frontières; 2022 Jul 7 [cited 2022 Oct 14]. Available from: https://www.msf.org/neglected-malnutrition-crisis-threatens-thousands-children-northwest-nigeria

9. Médecins Sans Frontières. Urgent humanitarian response needed to avoid deadly consequences in Borno [Internet]. Geneva, Switzerland: Médecins Sans Frontières; 2022 Jun 30 [cited 2022 Oct 17]. Available from: https://www.msf.org/urgent-humanitarian-response-needed-avoid-deadly-consequences-borno-nigeria

10. Médecins Sans Frontières. Out of sight: the neglected malnutrition crisis which threatens thousands of children's lives [Internet]. Geneva, Switzerland: Médecins Sans Frontières; 2022 Jul 7 [cited 2022 Oct 14]. Available from: https://www.msf.org/neglected-malnutrition-crisis-threatens-thousands-children-northwest-nigeria

11. Majekodunmi AO. Nigeria's pastoralists face a triple burden of conflict and climate change. 2022 Jul 6 [cited 2022 Oct 17. In: Africa at LSE blog [Internet]. London, UK: London School of Economics and Political Science. Available from: https://blogs.lse.ac.uk/africaatlse/2022/07/06/nigerias-pastoralists-face-a-triple-burden-of-disease-outbreaks-conflict-and-climate-change/

12. Médecins Sans Frontières. Urgent humanitarian response needed to avoid deadly consequences in Borno [Internet]. Geneva, Switzerland: Médecins Sans Frontières; 2022 Jun 30 [cited 2022 Oct 17]. https://www.msf.org/urgent-humanitarian-response-needed-avoid-deadly-consequences-borno-nigeria

13. Romanello M, Di Napoli C, Drummond P, et al. The 2022 report of the Lancet Countdown on health and climate change: health at the mercy of fossil fuels. *Lancet* 2022; 399

14. Médecins Sans Frontières. Nigeria: Katsina, the hungry state [Internet]. Luxembourg City, Luxembourg: Médecins Sans Frontières: 2022 Aug 8; [cited 2022 Oct 14]. Available from: https://msf.lu/en/news/all-news/nigeria-katsinathe-hungry-state

15. Notre Dame Global Adaptation Initiative. Nigeria [Internet]. Notre Dame, Indiana: University of Notre Dame; (no date) [cited 2022 Oct 14]. Available from: https://gain-new.crc.nd.edu/country/nigeria (accessed Oct. 14, 2022).

16. Ani KJ, Anyika VO, Mutambara E. The impact of climate change on food and human security in Nigeria. Int J Clim Change 2022; 14(2): 148-167. doi: 10.1108/IJCCSM-11-2020-0119

17. Usigbe L. Drying Lake Chad Basin gives rise to crisis. Africa Renewal [Internet]. 2019 Dec 24 [cited 2022 Oct 17]. Available from: https://www.un.org/africarenewal/magazine/december-2019-march-2020/drying-lake-chad-basin-gives-rise-crisis

18. Lancet Countdown Report, 2022, Indicator 1.4 Food Security and undernutrition.

19. Médecins Sans Frontières. In Niger, climate change impacts food production and malaria rates [Internet]. New York City, New York: Médecins Sans Frontières; 2021 Dec 1 [cited 2022 Oct 14]. Available from: https://www.doctorswithoutborders.org/latest/niger-climate-change-impacts-food-production-and-malaria-rates

20. Médecins Sans Frontières. Working with the community: Three ways to alleviate hospitals in Niger [Internet]. Geneva, Switzerland: Médecins Sans Frontières; (no date) [cited 2022 Oct 14]. Available from: https://storymaps.arcgis.com/stories/cf15ba75f6584a03a6e24be5a431ec2c

21. Médecins Sans Frontières. International Activity Report 2021 [Internet]. Geneva, Switzerland: Médecins Sans Frontières; 2022 [cited 2022 Oct 17]. Available from: https://www.msf.org/international-activity-report-2021

22. World Weather Attribution. Climate change increased heavy rainfall, hitting vulnerable communities in Eastern Northeast Brazil [Internet]. London, UK: World Weather Attribution; 2022 Jul 4 [cited 2022 Oct 17]. Available from: https://www.worldweatherattribution.org/climate-change-increased-heavy-rainfall-hitting-vulnerable-communities-in-eastern-northeast-brazil/

23. United States Environmental Protection Agency. Climate change and municipal solid waste (MSW) [Internet]. Washington, DC, USA: Environmental Protection Agency; (no date) [updated 2016 Feb 21, cited 2022 Oct 17]. Available from: https://archive.epa.gov/wastes/conserve/tools/payt/web/html/factfin.html

24. Médecins Sans Frontières. Water, waste and vaccination: Fighting cholera and typhoid in Zimbabwe [Internet]. Toronto, Canada: Médecins Sans Frontières; 2020 Feb 25 [cited 2022 Oct 17]. Available from: https://www.doctorswithoutborders.ca/article/water-waste-and-vaccination-fighting-cholera-and-typhoid-zimbabwe

25. World Health Organization. Typhoid [Internet]. Geneva, Switzerland: World Health Organization; 2018 Jan 31 [cited 2022 Oct 17]. Available from: https://www.who.int/news-room/fact-sheets/detail/typhoid

26. Nor Faiza MT, Hassan NA, Mohammad Farhan R et al. Solid waste: Its implication for health and risk of vector borne diseases. *JWBM* 2019:1(2);14-17. doi: 10.26480/jwbm.02.2019.14.17

27. Ozoh AN, Longe BT, Akpe V, Cock IE. (2021). Indiscriminate solid waste disposal and problems with water-polluted urban cities in Africa. Int J Environ Waste Manag 2021;8(2):001-008. Available from: https://www.internationalscholarsjournals.com/articles/indiscriminate-solid-waste-disposal-and-problems--with-waterpolluted-urban-cities-in-africa.pdf

28. World Health Organization. South Sudan weekly disease surveillance bulletin 2019 [Internet]. Geneva, Switzerland: World Health Organization; 2019 [cited 2022 Oct 17]. Available from: https://www.afro.who.int/publications/south-sudan-weekly-disease-surveillance-bulletin-2019

29. Pasquale H. Malaria prevention strategies in South Sudan. South Sudan Med J 2020;13(5):187-90. Available from: https://www.ajol.info/index.php/ssmj/article/view/205377

30. Abiodun GJ, Maharaj R, Witbooi P, Okosun KO. Modelling the influence of temperature and rainfall on the population dynamics of Anopheles arabiensis. *Malar J* 2016;15:364. doi: 10.1186/s12936-016-1411-6

31. Boyce R, Reyes R, Matte M, et al. Severe flooding and malaria transmission in the western Ugandan highlands: Implications for disease control in an era of global climate change. *J Infect Dis* 2016;214(9):1403-10. doi: 10.1093/infdis/jiw363

32. Nizamuddin M, Kogan F, Dhiman R, et al. Modeling and forecasting malaria in Tripura, India using NOAA/AVHRR-Based Vegetation Health Indices. Int J of Remote Sens Applications 2013;3(3). Available from: https://www.academia.edu/download/69700424/Modeling_and_Forecasting_Malaria_in_Trip20210915-1728-1vqehnm.pdf

33. Lowe R, Chriombo J, Tompkins A. Relative importance of climatic, geographic and socio-economic determinants of malaria in Malawi. *Malar J* 2013;12:416. doi:10.1186/1475-2875-12-416

34. Lancet Countdown Report, 2022, Indicator 2.2.1: Climate Information Services for Health.

35. Lancet Countdown Report, 2022, Indicator 2.2.4: Health Adaptation-Related Funding.

36. Médecins Sans Frontières Sweden Innovation Unit. How MSF is supporting the growth of telehealth services [Internet]. Stockholm, Sweden: Médecins Sans Frontières; 2022 May 7 [cited 2022 Oct 17]. Available from: https://msf-siu.org/blog/how-msf-is-supporting-the-growth-of-telehealth-services

37. 6. Médecins Sans Frontières. "What is a virtual field visit?" MSF Climate Smart Internal Update [PDF]. 2021 June [cited 2022 Oct 17].

38. Lancet Countdown Report, 2022, Countdown indicator 3.6: Mitigation in the Health Sector

39. Médecins Sans Frontières Transformational Investment Capacity. Environmental Impact Toolkit [Internet]. Toronto, Canada: Médecins Sans Frontières; (no date) [cited 2022 Oct 17]. Available from https://msf-transformation.org/news/environmentalimpacttoolkit/

40. Médecins Sans Frontières. MSF commits to reduce carbon emissions to help safeguard the most vulnerable [Internet]. Geneva, Switzerland: Médecins Sans Frontières; 2022 Mar 29 [cited 2022 Oct 17]. Available from https://www.msf.org/climate-emergency-msf-commits-reduce-carbon-emissions-help-safeguard-most-vulnerable

41. Médecins Sans Frontières Transformational Investment Capacity. Travel cost reduction and rationalization [PDF]. Toronto, Canada: Médecins Sans Frontières; (no date) [cited 2022 Oct 17]. Available from: https://msf-transformation.org/wp-content/uploads/2020/08/Travel-Rationalization-Project-Summary-2019.12.01.pdf

42. Médecins Sans Frontières Sweden Innovation Unit. How MSF is supporting the growth of telehealth services [Internet]. Stockholm, Sweden: Médecins Sans Frontières; 2022 May 7 [cited 2022 Oct 17]. Available from: https://msf-siu.org/blog/how-msf-is-supporting-the-growth-of-telehealth-services

43. Médecins Sans Frontières. In Sierra Leone, MSF is scaling up projects and reinforcing the health system to meet growing needs [Internet]. New York, New York, USA: Médecins Sans Frontières; 2021 Jul 15 [cited 2022 Oct 17]. Available from: https://www.doctorswithoutborders.org/latest/sierra-leone-msf-scaling-projects-and-reinforcing-health-system-meet-growing-needs

44. UNICEF Sierra Leone. Maternal, neonatal and child health [Internet]. Freetown, Sierra Leone: UNICEF Sierra Leone; (no date) [cited 2022 Oct 17]. Available from: https://www.unicef.org/sierraleone/maternal-neonatal-and-child-health

45. National Ebola Response Centre, Sierra Leone and Elston et al. in Vandi MA, van Griensven J, Chan AK, et al. Ebola and community health worker services in Kenema District, Sierra Leone: please mind the gap! *Public Health Action* 2017:7(Suppl 1);S55-561. doi: 10.5588/pha.16.0082

46. 5. Gitau W, Ten Palomares M. Climate Smart highlights: Inside MSF's solar-powered hospital in Sierra Leone. MSF Climate Smart Internal Update [PDF]. 2021 April [cited 2022 Oct 17]. Per *Lancet* Countdown indicator 3.6: Mitigation in the Health Sector. *Lancet* Countdown Report, 2022.

47. United States Environmental Protection Agency. Greenhouse gas equivalenies calculator [Internet]. Washington, DC, USA: United States Environmental Protection Agency; (no date) [updated 2022 Oct 11, cited 2022 Oct 17]. Available from: https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator

48. Médecins Sans Frontières. In Sierra Leone, MSF is scaling up projects and reinforcing the health system to meet growing needs [Internet]. New York, New York, USA: Médecins Sans Frontières; 2021 Jul 15 [cited 2022 Oct 17]. Available from: https://www.doctorswithoutborders.org/latest/sierra-leone-msf-scaling-projects-and-reinforcing-health-system-meet-growing-needs

49. Ibid.

50. UN Environment Programme. What does COP26 mean for adaptation? [Internet]. Nairobi, Kenya: UN Environment Programme; 2021 Nov 17 [cited 2022 Oct 17]. Available from: https://www.unep.org/news-and-stories/story/what-does-cop26-mean-adaptation

Organisations and acknowledgements

This briefing paper is a collaborative effort of the *Lancet* Countdown on Health and Climate Change, a global academic effort that monitors the links between health and climate change through annual data on more than 45 indicators, and Médecins Sans Frontières, an international medical humanitarian organisation providing assistance in crisis situations in more than 70 countries.

Main contributors, in alphabetical order: Louisa Baxter, Kady Cowan, Carol Devine, Maria Guevara, Dikolela Kalubi, Monique Kamat, Danish Malik, Alexandra Malm, Nádia Duarte Marini, Lachlan McIver, Liliana Palacios, Fabiano Sartori, Bhishmaraj Srivastava, Sandra Smiley, Simba Tirima, Léo Lysandre Tremblay, Angela Uyen, Caroline Voûte.

Reviewers, in alphabetical order: Juan Carlos Arteaga España, Joe Belliveau, Elisa de Siqueira, Ruby Gill, Nasir Ghafoor, Courtney Howard, Frances MacGuire, Faraz Qasim, Marina Romanello, Monica Rull, Patricia Schwerdtle, Maria Ten Palomares, Maria Walawender.

THE *LANCET* COUNTDOWN

The *Lancet* Countdown: Tracking Progress on Health and Climate Change exists to monitor the links between public health and climate change, and the transition from health threat to opportunity. We are a global collaboration of over 300 leading experts from academic institutions and UN agencies across the globe, bringing together climate scientists, engineers, energy specialists, economists, political scientists, public health professionals and doctors.

Each year our findings are published annually in medical journal The Lancet ahead of the UN climate change negotiations. Our data makes clear how climate change is affecting our health, the consequences of delayed action and the health benefits of a robust response.

MÉDECINS SANS FRONTIÈRES/DOCTORS WITHOUT BORDERS (MSF)

MSF is an international, independent, medical humanitarian organization working to alleviate suffering and to provide medical assistance to people affected by conflict, epidemics, disasters, or exclusion from healthcare in over 70 countries today. Climate change, a human-induced reality, is also of great concern to MSF, as it may well alter the dynamics of conflict and the incidence of disease, impacting communities already at risk. On the basis of scientific reports outlining what can be expected in the future, the organization recognizes how vital it is to prepare to assist the people most affected. At the same time, MSF is assessing its own carbon footprint and taking steps to incorporate environmentally responsible working methods, products and equipment into its projects. Adapting the way MSF operates could greatly impact the communities it serves, and as such it is working urgently to define and adopt a strategy