Where Covid-19, public health, climate change and the environment meet

In this briefing, you will find:

- **The environment, climate, health and Covid-19**: Research showing that a healthier environment with less pollution brings substantial health benefits, and that climate change will magnify risks from other infectious diseases (page 1).

- **Ensuring safe water, sanitation and hygiene in times of Covid-19**: Factsheet on the threat of water stress in developing and least developed countries and policies required to shift from water intensive sectors like fossil fuels (page 3).

- **Food, nature, climate and Covid-19**: Humans are changing ecosystems and the existing balance of nature, leading to emerging infectious diseases (page 5).

The environment, climate, health and Covid-19

- Scientists have warned us about the risks pandemics pose and say climate change will magnify risks from other infectious diseases, making outbreaks less predictable and harder to deal with. Changes in the climate are already making it easier for some diseases to spread, like dengue and malaria.

- Clean air and water can help people battle viruses like Covid-19. Air pollution damages respiratory health, and scientists have shown that air pollution increased mortality during previous respiratory disease outbreaks. A lack of access to water prevents basic sanitation, putting billions of people at higher risk from this novel coronavirus.

- A healthier environment with less pollution brings substantial health benefits. Studies show that in many countries, including major emitters like India and China, the cost of cutting emissions could be completely outweighed by the benefits to people's health.

Air pollution and Covid-19 are a bad combination

People living with high levels of air pollution could be at higher risk from Covid-19, according to experts at the European Public Health Alliance and the Indian Doctors For Clean Air. The pandemic puts people suffering from respiratory conditions that are worsened by air pollution, like asthma and Chronic Obstructive Pulmonary Disease (COPD), at increased risk of death and complications.

Nine out of 10 people breathe air the World Health Organization (WHO) deems too polluted,[1] causing an estimated 4.2 million premature deaths every year. Over half a million of those are in Europe, but by far the largest proportion occur in China (33-37% of global excess deaths) and India (24-37%). In India,[2] 74% of low-income city workers are exposed to dangerously high levels of air pollution.[3] In the US, minorities bear an unequal burden of pollution.

It is too early to say whether there will be a link between Covid-19 mortality and air pollution. But because air pollution exposure reduces organ function and makes people more vulnerable to infections and diseases, people living in more polluted areas may face more complications from Covid-19, according to the Doctors For Clean Air. High air pollution has already been linked to increased hospitalisations from pneumonia in older patients. People in polluted areas are more susceptible to acquiring pneumonia in the first place and could be at higher risk from Covid-19, as severe cases can lead to pneumonia.

Scientists have shown that polluted air was associated with increased mortality during the 2002 Severe Acute Respiratory Syndrome (SARS) pandemic, another strain of coronavirus that killed 774 people and infected

1 Globally 29% of all deaths and disease from lung cancer is caused by air pollution, as well as 43% from COPD and 24% from stroke. Inside homes 3.8 million people die from exposure to dirty cookstoves and fuels, accounting for 7.7% of global mortality, statistics as of 2017.

2 India is home to 6 out of 10 of the world's most polluted cities - though the report does not cover all regions due to lack of data and monitoring.

3 Compared to 58% for high and middle income workers in Indian cities.

8,890. A person living in an area with high air pollution was more than twice as likely to die from SARS, according to research published in 2003. In Chinese cities with high or moderate air pollution the death rate was 8.9% and 7.49% respectively, compared to areas with low air pollution where it was 4%.[4]

Reductions in air pollution from cutting the burning of fossil fuels and use of wood cooking stoves can significantly improve public health. Phasing out fossil fuels could avoid 3.6 million premature deaths each year from outdoor air pollution alone, increasing to 5.6 million if pollution from agriculture and households is included.

Water scarcity undermines resilience to infectious diseases

A lack of access to water and sanitation will put billions of people at higher risk from Covid-19. Those without water for handwashing and personal hygiene will struggle to practice even basic safety measures. Around 3 billion people lack access to basic hand washing facilities. In the world's least developed countries 22% of health care facilities have no water service, 21% no sanitation service, and 22% no waste management.

Securing access to water means dealing with a series of interconnected environmental challenges. Not least is climate change, a threat multiplier that will increase pressure on water resources, as higher temperatures lead to increased droughts and desertification and retreating mountain glaciers, which are important stores of freshwater.

Addressing climate change by cleaning up polluting industries may also bring secondary benefits to water supply. For example, as of 2013, total water consumption by the coal industry was estimated at 22.7 billion cubic metres per year, enough to meet the most basic water needs for 1.2 billion people. Transitioning to power sources that need little water, like wind and solar, and applying energy efficiency would help limit climate change and water stress.

Other infectious disease may be worsened by climate change

Looking beyond the current crisis, climate change is also creating new risks from many infectious diseases, changing their geographic distribution and seasonal behaviour. As a result, our ability to predict and prepare for new infectious disease outbreaks may be weakened.

Infectious diseases are spread in many ways, but two major ones are from human-to-human, like Covid-19, and 'vector diseases' spread by other animals, like mosquitoes and fleas. By changing weather patterns and extreme weather events, climate change will have an impact on vector diseases, altering the population, reach and survival of the animals which carry the disease.

Among the most important examples are dengue fever and malaria, which are both spread by mosquitoes. Both are huge public health challenges, and transmission of both is affected by climate factors including temperature, humidity and precipitation. Malaria killed over 400,000 people in 2018, 67% of them children under the age of five. About half of the world's population is at risk of dengue fever, with an estimated 100-400 million infections each year. Though symptoms are mostly mild it can develop into a serious condition, which requires medical attention and is a leading cause of hospitalisation and death in Asia and Latin America.

Climate change is making conditions more favourable for both. Data stretching back to the 1950s show that nine of the 10 most suitable years for transmission of dengue fever have occurred since 2000. Climate suitability for transmission of malaria in the African highlands for the years 2012-2107 was 30% higher than a 1950s baseline. Future climate change may make conditions even more suitable for malaria, although such predictions are complicated to make, given all of the complexity.

For human-to-human transmitted diseases, like Covid-19, the picture is more complicated. Climate change does not shift the geographic reach of humans as clearly as it does for animals and insects. But climate change could play a role in some cases. In the US, for example, research suggests that warmer winters caused by climate change could bring more severe flu seasons, with a risk that warmer weather could promote sustained transmission, leading to the flu 'season' lasting all year.

4 The study was only conducted when 5327 cases were registered with 349 deaths, published in 2003.

At this early stage in our understanding of Covid-19, the question of whether climate change changed the risk of the current crisis is impossible to answer.

Better health and greater resilience to future pandemics

Climate change will undermine healthcare systems, making them less resilient to emergencies like pandemics. Being more prepared for public health emergencies leads to better outcomes. 2010-2017 saw a 31% drop in vulnerability to mosquito-borne pathogens because of investment in public health. In China, upfront investments in public health[5] has seen a substantial decrease in child mortality and infectious diseases like diarrhoea, which was the 20th most common cause of death in 1990[6], but by 2017 it was 78th.

Globally, nearly a quarter of all deaths can be attributed to environmental factors. The direct health damages alone from climate change[7] could reach between $2 and 4 billion each year by 2030, not counting indirect costs from other sectors, and climate change could cause some 250,000 additional deaths per year between 2030 and 2050, according to the WHO. Limiting temperature rise through deep and speedy emissions cuts will dramatically reduce future health risks. In many cases, doing so will have no net cost - medical experts at the Lancet Planetary Health found the health benefits of reducing emissions substantially offset the costs involved, and in countries like India and China, there are substantial net economic benefits in avoiding damage to health, making reducing emissions in those countries zero-cost on health grounds alone.

It is clear that health system adaptation is needed alongside mitigation, strengthening resilience to the impacts of climate change. Fragile health systems become overwhelmed in times of crisis. In India only a tenth of the poorest 20% have access to health insurance and the country has a serious lack of equipment to deal with respiratory diseases,[8] which is already leading to a preventable tuberculosis epidemic killing 1400 people each day. The lack of health system resilience is making India extremely vulnerable to covid-19.

Creating a safer environment by taking rapid action on climate will help reduce future public health challenges and building health system resilience globally will be crucial for dealing with future pandemics.

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Ensuring safe water, sanitation and hygiene in times of Covid-19

Key stats: people are under threat due to water supply shortages

- As of 2019, 17 countries worldwide face extremely high water stress, with 12 of these countries in the Middle East and Africa, accounting for one-quarter of the world's population. India ranked 13th, but has three times the population of the other extremely water stressed countries.

- Covid-19 cases continue to rise rapidly and have caused over 10,000 deaths. These cases have mostly been concentrated in Europe and China, but the virus has started to spread to water-stressed countries. As of March 19, 18,407 cases have been registered in Iran (the fourth most water-stressed country), 529 in Israel (the second) and 173 in India (13th).

- 80% of the world's population is already experiencing some level of water scarcity, making them extremely vulnerable to Covid-19, as they will struggle to practice basic safety measures.

- Communities struggling to access water for hand washing, especially in informal settlements, have been reported in India, Brazil, the Philippines, South Africa, Kenya and elsewhere in Africa. UN agencies and humanitarian organisations are particularly concerned about refugees and internally displaced people.

- Around 3 billion people lack access to basic hand washing facilities, 2.2 billion do not have access to water, and 4.2 billion cannot access sanitation services.

5 health expenditure quadrupled from 2008 to 2017

6Ranked by deaths per 100,000 people

7excluding costs in health-determining sectors such as agriculture and water and sanitation.

8 For example in the state of Maharashtra there are currently only 450 ventilators to serve the needs of 126 million people.

- 785 million people lack access to even basic drinking-water services and 2 million people drink water contaminated by faeces.

- By 2025, about half of the world's population will be living in water stressed-areas. While the global demand for water is increasing at a rate of about 1% per year since the 1980s, increasing by 20% to 30% above the current level of water use by 2050.

- A person needs 7.5 to 17 litres of water each day to cover his or her basic needs for drinking, cooking and sanitation, according to the WHO. But the needs will shift in times of emergency, as water is essential to many services, particularly to health care. The added pressure of Covid-19 could exacerbate the water stress for people who are already vulnerable, at the same time the lack of access to water and sanitation puts billions of people at risk of Covid-19.

- Already, in the world's least developed countries 22% of health care facilities have no water service, 21% no sanitation service and 22% no waste management service.

Key Stats: fossil fuel industry is contributing to water crisis

- The volume of water used directly in the energy sector represented about 15% of global freshwater withdrawals in 2010. Transitioning quickly from water intensive coal power plants to renewables that need little water, and applying energy efficiency measures, will reduce the water stress and help keep the temperature rise to under 2 degrees Celsius.

- A recent study on the water use from electricity technologies shows that fossil fuel production consumes large amounts of water for each megawatt–hour of electricity produced. Oil from shale and oil sands and shale gas are the largest consumers of water at more than 890 to 1,600 litres per MWh, while coal comes in third at more than 230 litres per MWh. On the other hand, solar PV and wind have minimal water needs.

- As of 2013, the total water consumption by the coal industry was estimated at 22.7 billion cubic metres, enough to meet the most basic water needs for 1.2 billion people.

- In the water–stressed regions of India, coal power plants consume millions of cubic metres of water. During the dry summer months, this can create water sharing conflict between small farmers and coal power plants. About 40% of India's thermal power plants (which generate electricity from fossil fuels, biomass, nuclear or concentrated solar) are situated in highly water-stressed areas.

- In heavily coal dependent South Africa, coal mining and power generation have caused serious water quality issues and air pollution, and exacerbated the water scarcity faced by communities.

- The world's driest continent, Australia, is facing a looming water crisis, but allows the coal industry to continue depleting its supply in the meantime.

- The fossil fuel industry not only uses more water but also contributes to global warming. Warming has impacted the monsoon patterns and affected the water regime with more droughts, floods and cyclones.

Info: water risks will rise in the future due to climate change

Climate change will continue to exacerbate the pressure on water resources as climbing temperatures lead to **increased droughts**, causes **desertification** and **melts our frozen regions** which are important stores of freshwater. This will further reduce our resilience to deal with disease outbreaks, like Covid-19.

- Climate change will reduce water supplies overall and lead to changes in predictability, impacting water security, and agriculture.

- Mountains store fresh water as ice and snow, releasing it as they thaw, and providing water for people in and beyond mountainous regions. As the world warms, glaciers are melting, and glacial water supplies are expected to decline during the 21st century in Asia, Europe, South America and North America.

- In South Asia's Hindu Kush Himalaya region, glaciers are a crucial water supply for 240 million people, including 86 million Indians. If emissions do not fall, glaciers in the Hindu Kush Himalaya would decline by two-thirds, further impacting water security. A recent study covering 13 towns across Bangladesh, India, Nepal and Pakistan in the Hindu Kush Himalayan region shows they face increased water risk due to inadequate urban planning and rapid climate change.

- Desertification has multiple causes including human activity and climate change and in turn exacerbates climate change, particularly impacting countries in Africa and Asia, the Mediterranean regions and Latin America and the Caribbean.

- It is estimated that desertification is directly affecting 250 million people, 1 billion people indirectly and 3 billion hectares in drylands are undergoing degradation. Though keeping global temperature increase below 1.5 degrees could limit the emergence of aridification.

- By the end of the century, up to 700 million people are projected to live in arid regions. The largest populations to experience extreme drying are projected to be in Asia and Africa. For Africa, the UN panel of climate change scientists (the IPCC) states with high confidence that climate change will amplify existing stress on water availability and on agricultural systems leading to food shortages.

- Impacts of drought are already being seen. For example, in 2018 Cape Town experienced a record breaking drought, threatening the water-supply of over 4 million people.

- Climate change has already led to a massive loss of our frozen regions, negatively impacting food security and water resources. As these areas continue to melt, water supplies will be reduced overall. Melting glaciers will also decrease water quality, by accelerating the release of anthropogenic pollutants and could bring toxic heavy metals into water supplies.

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Food, nature, climate and Covid-19

- Human activity now affects 75% of Earth's land surface. In the past 50 years, the human population has doubled and the global economy and trade have grown nearly fourfold and tenfold, respectively. Global tourism has had a 56-fold increase since 1950. Land-use changes[9] have had the largest relative negative impact on nature since 1970, via the expansion of agricultural and urban areas. Nearly 1 million species are facing extinction and over 85% of wetlands were lost.

- **Agriculture for crops and livestock, and mining, are disrupting nature the most,** followed by **harvesting, logging, hunting and fishing.** Mining uses under 1% of global land but its negative impact on biodiversity, availability and quality of water and human health may be larger than agriculture (p.14), particularly, gold mining. Agriculture covers over a third of the world's land surface. About 25% of greenhouse gas emissions come from land clearing, crop production and fertilisation, with livestock production accounting for 75%.

- **All these activities are encroaching natural ecosystems, facilitating the emergence of infectious diseases from animals**. These are known as **zoonotic diseases**, or zoonoses. These diseases can be transmitted by direct contact with infected wild or domestic animals; indirect contact (such as

[9]See here the definition of land-use change. These activities include deforestation, rangeland expansion, urbanization/suburbanization, infrastructure development (railroad, road, power lines), hydrological alteration (dams, irrigation, canal construction), agricultural development (crops, livestock), and natural resource extraction/depletion (mining, logging, hunting)

contact with areas where animals live and roam); bites from a tick or insect or eating and drinking contaminated food/water. Deforestation, for example, modifies the structure of habitats and decreases the area available for wildlife, increasing the human–wildlife interaction. It can also fragment habitats into smaller patches of agricultural land or human settlements ("edge effect") that can further promote interaction pathogens,[10] vectors[11] and animal hosts. This contributes to the emergence of zoonoses such as Lyme disease and malaria.

- **More than 60% of new infectious diseases (and almost all recent pandemics) originate in animals; most coming from wildlife (71.8%),** such as Ebola, Middle East Respiratory Syndrome (MERS), SARS and HIV.[12] These diseases spread from animals to humans in different ways. They often emerge in tropical forested regions, in areas with high mammal biodiversity, and experiencing land-use changes caused by agriculture. A recent literature review going back to 1940 found out that **agricultural drivers[13] were associated with less than 25% of all — and less than 50% of zoonotic — infectious diseases that emerged in humans,** proportions that will likely increase as agriculture expands and intensifies.

- Zoonotic diseases are a significant threat to global health as research shows that they are increasing in recent years and affecting all areas of the world. **Coupled with increasing urbanisation, population and travel,[14] these diseases can spread quickly and become pandemics**, such as the recent Covid-19. Together with other drivers, climate change could make these outbreaks more frequent.

But the link between human activity and zoonotic diseases is complex and context-dependent.[15]

- Zoonotic diseases are hard to predict and many ecological and evolutionary factors play a role. Nevertheless, scientists agree that **human-induced land-use changes and wildlife hunting/trade are key drivers.**[16] The clearance of forests for crops and livestock (including but not limited to industrialised production) and extractive industry actions (mining and logging) can negatively impact the environment, creating a cascade of factors that facilitates the emergence and spread of diseases. For example, changes in agricultural practices have contributed to the emergence of Nipah virus (fruit bats to pigs) and MERS-CoV (originally found in camels). In industrialised livestock production systems, numerous animals are kept in small spaces, facilitating the spread of diseases including the bird and swine flues. Human contact with wild animals during hunting, trading, slaughtering, and consumption has been directly linked to the emergence of HIV/AIDS (chimpanzees) and Ebola (great apes and/or other wild animals).

- **Human alterations do not always have negative health impacts.** Forest land-use changes can lead to the emergence of zoonotic diseases and vector-borne diseases, but not always. For example, deforestation combined with factors[17] such as hunting for bushmeat and converting deforested lands into human settlements contributed to the emergence of Ebola and Nipah viruses, respectively.

- **Biodiversity loss frequently increases disease transmission and areas of naturally high biodiversity** host many species that **may serve as a source pool for new pathogens that can spill over to humans.** Overall, the link between biodiversity and diseases is variable[18] and dependent on

10 Micro-organisms that can cause diseases, such as virus, bacteria.

11 **Vectors** are small organisms such as mosquitoes or ticks that can carry pathogens from person to person and place to place.

12 https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1247383/; https://link.springer.com/article/10.1007/s10393-014-0941-z#citeas; https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(12)61678-X/fulltext; https://www.nature.com/articles/nature08182

13 Researchers classified 13 drivers and classified "Agricultural industry changes", "Food industry changes", and "Land use changes" as agricultural-related drivers. See here the full list.

14 https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4507309/; https://www.sciencedirect.com/science/article/pii/S2590053620300161?via%3Dihub; https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(12)61678-X/fulltext; https://doi.org/10.1146/annurev-animal-030117-014628

15 https://www.annualreviews.org/doi/10.1146/annurev-animal-030117-014628; https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(12)61678-X/fulltext

16 https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4507309/; https://link.springer.com/article/10.1007/s10393-014-0941-z#citeas; https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(12)61678-X/fulltext; https://www.nature.com/articles/s41467-017-00923-8

17 https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5413873/;http://www.fao.org/tempref/docrep/fao/009/a0789e/a0789e03.pdf

18 https://www.nature.com/articles/nature09575;https://conbio.onlinelibrary.wiley.com/doi/abs/10.1046/j.1523-1739.2000.99014.x;https://www.nature.com/articles/srep31314;https://www.pnas.org/content/115/31/7979; https://linkinghub.elsevier.com/retrieve/pii/S1471492216300101

the disease system or local ecology**.** But, despite many remaining questions, that preserving intact ecosystems and their biodiversity should generally reduce the prevalence of infectious diseases.

Recent outbreaks of zoonotic diseases led to significant health impacts and economic costs

- About 1 billion cases of illness and millions of deaths occur every year from zoonoses. Low and middle-income countries are disproportionately affected, with over 2 billion human cases and 2 million deaths per year. The economic losses from six highly fatal zoonotic disease outbreaks[19] between 1997 to 2009 amounted to at least $80 billion. If these outbreaks had been prevented, the benefits of the avoided losses would have averaged $6.7 billion per year. A 2019 estimate of the costs of a severe influenza pandemic could be up to 4.8% of global GDP ($3 trillion). Early estimates of the costs of Covid-19 to the global economy are between $1 to 2 trillion in 2020, but these estimates are growing up daily.

This briefing was compiled by researchers in Europe and the US. For more information or questions, please contact info@mission2020.global, or visit mission2020.global.

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19Nipah Virus (Malaysia), West Nile Fever (USA), SARS (Asia, Canada, other), HPAI (Asia, Europe), BSE (US, UK), Rift Valley Fever (Tanzania, Kenya, Somalia)