What does the AR6 WGII on Impacts, Adaptation and Vulnerability report tell us about topics addressed in ENBEL? A brief excerpt

By Kristin Aunan, Research Director, CICERO Center for International Climate Research

The recently published report from Working Group II of the IPCC's 6th Assessment Report (AR6) paints a gloomy picture of what the future may hold regarding impacts of climate change and how climate change is already affecting societies and nature across the globe. According to the report there are very few examples of beneficial outcomes from climate change at any scale.

Regarding health effects, the report concludes – with very high confidence - that climate change is already harming physical and mental health. The report addresses the fact that climate change often acts as a risk multiplier, interacting with other societal risk factors that increases the vulnerability of people, such as the Covid19 pandemic, war and conflicts, and, more generally, lack of financial resources and strong governance institutions.

Compared to previous IPCC assessments, the 2022 report emphasises more strongly the interdependence of climate, ecosystems, biodiversity, and human societies. It also makes it clear that the underlying drivers of vulnerability, including social injustice, need to be addressed to enhance resilience and close the adaptation gap[1] and that fulfilling the Sustainable Developments Goals will be important to succeed in this endeavour.

We have looked at some of the main findings regarding the core topics of the ENBEL project – health impacts related to environmental and occupational heat, air pollution (including from wildfires), and infectious diseases. This excerpt is mainly based on Chapter 7 in WGII on Health, wellbeing and the changing structure of communities. Regarding adaptation options addressing these risks and other climate risks the report pinpoints the fact that adaptation measures in some cases can have unintended effects that counteracts the original purpose, referred to as maladaptation. While maladaptation increases the risks, well-designed adaptation policies, based on inclusive planning and with a cross-sectorial perspective, will contribute to building resilience. To support efficient and fair adaptation and improve risk management, monitoring and evaluation of adaptation efforts is needed. While there is a growing literature on adaptation plans and implementation worldwide, information about the effectiveness of such efforts remains scarce, according to the report.

Environmental and occupational heat

The AR6 WGI report, released in 2021, which assessed the current state of the climate and possible future directions regarding climate change, described it as virtually certain that hot extremes have become more frequent and more intense across most land regions since the 1950s. Estimates in the WGII report of how many people are being exposed to extreme heat indicate very high numbers. As

an indication, a recent study estimated that globally and annually 1.28 billion people experience heatwave conditions similar to that of the infamous Chicago 1995 event which led to 730 heat-related deaths in the city. In terms of person-days, exposure to heat wave events is largest in Asia, sub-Saharan Africa, North Africa and the Middle East.

Heat is one of the best-studied climate hazards observed to reduce human health and wellbeing. It is well documented that high temperatures and extreme heat affect the risk of premature death and hospitalisation, particularly for cardiovascular disease (CVD) and respiratory diseases (RD), but also for a range of other health outcomes. Other outcomes include a range of maternal, foetal, and neonatal health outcomes. For instance, evidence suggests a link between environmental heat and higher rates of preterm birth, low birthweight, stillbirth, neonatal stress and general adverse child health.

Recent heatwaves across Europe (2003), Russia (2010), India (2015) and Japan (2018) resulted in significant death tolls and hospitalizations. However, studies show that it is not only the extreme temperatures that are detrimental to health, as mortality increases at both hot and cold temperatures beyond the so-called optimum temperature, or minimum-mortality temperature (MMT, at which the lowest temperature-related excess mortality is observed in a given population). The country-level percentage of deaths attributable to non-optimum temperatures has been found to range from 3.4% to 11%. Globally, the health burden attributable to cold temperatures is higher than the burden attributable to hot temperatures, but in hot regions the opposite is the case, particularly in sub-Saharan Africa and south Asia. Global warming is expected to lead to fewer cold-related deaths and more heat-related deaths in the future. A recent study found that already today an estimated 37% of warm-season heat-related deaths can be attributed to climate change. The report notes that compared to the previous assessments, impacts can now increasingly be detected and attributed to a changing climate.

Regarding adaptation to heat stress, there are, according to the report, several lines of evidence pointing to a possible decrease in population sensitivity to heat for high-income countries. For instance, a general decrease in the impact of heat on daily mortality has been observed, as well as an increase in the MMT. This could be due to the heat warning systems and heat action plans been implemented, increased awareness and a general increased quality of life and health status among people. Air conditioning (AC) is shown to reduce the sensitivity to heat on a population basis, but only to a certain degree. A recent assessment referred to in the report found that increased AC could explain maximum 20% of the observed reduction in heat sensitivity in the countries studied. Whether adaptation is included in the analyses or not, the regions projected to be most affected by climate change related increases in heat-related mortality in the future are Central and South America, Southern Europe, Southern and Southeast Asia and Africa.

Working in hot environments, outdoors or indoors, is associated with a broad range of health, safety, and productivity consequences. Occupational heat strain

manifests, e.g., as dehydration, mild reduction in kidney function, fatigue, dizziness, confusion, reduced brain function, loss of concentration and discomfort. Some regions are already experiencing heat stress conditions approaching the upper limits of labour productivity and human survivability. These include the Persian Gulf and adjacent land areas, parts of the Indus River Valley, eastern coastal India, Pakistan, north-western India, the shores of the Red Sea, the Gulf of California, the southern Gulf of Mexico, and coastal Venezuela and Guyana. Projections of adverse impacts of heat on occupational health and worker productivity into the future point to the same regions as those most affected by heat-related mortality in the general population.

Air pollution and wildfires

The report notes that there are complex interactions between weather, air pollution and health outcomes. Climate change may enhance ambient concentrations of health damaging air pollutants through various mechanisms, often referred to as the climate penalty. According to the WGII report, global air pollution-related mortality attributable to climate change is likely to increase and partially counteract any benefits achieved through emission reductions. Worldwide, rates of adverse health impacts associated with small particulate matter exposure have decreased steadily due to decreasing emissions, while rates of adverse health impacts from exposure to ozone air pollution (which is formed by photochemical reactions sensitive to temperature) have increased.

Wildfires cause intense air pollution, and the risk of wildfires is linked to so-called fire weather, which is characterised by hot and dry conditions. According to the AR6 WGI report, human influence has likely increased the occurrence of fire weather since the 1950s in regions of all inhabited continents. The WGII report shows that exposure to wildland fires and associated smoke has increased in several regions and climate change is projected to increase the number and severity of wildfires.

The evidence for wildfire smoke-related cardiovascular disease (CVD) morbidity and mortality is suggestive of increased CVD morbidity and mortality risk including significant increases in certain cardiovascular outcomes (e.g., cardiac arrests). CVD risks to highly exposed populations, such as fire firefighters, are clearer and could increase with additional exposure driven by climate change.

Diarrheal and other infectious diseases

The risk of infectious diseases, including vector-borne diseases and water- and food borne diseases, is a function of a multitude of interacting drivers, which can be categorized into three groups: globalisation and environmental factors (of which climate change is one and others include global trade and travel & tourism), sociodemographic factors, and failure of public health systems. It is well established that many infectious agents and their vectors are sensitive to climatic conditions, and increasing temperatures are widening the geographic areas suitable for transmission. This applies to, for instance, mosquito borne diseases such as dengue fever and malaria. A changing climate is also facilitating the spread

of chikungunya virus, Zika, Japanese encephalitis and Rift Valley Fever, for instance in Asia, Latin America, North America and Europe. Moreover, climate change has contributed to the spread of ticks that can act as vector organism for Lyme disease (borreliosis) and tick-borne encephalitis, with corresponding increases in cases. For instance, ticks that carry the virus causing tick-borne encephalitis have moved into subarctic regions of Europe and Asia.

Higher temperatures, heavy rainfall events and flooding are associated with increased water-borne diseases, particularly diarrheal diseases, including cholera and other gastrointestinal infections in high-, middle-, and low-income countries. Water insecurity and inadequate water, sanitation and hygiene increase disease risk. Diarrhoea mortality has declined substantially since 1990, in line with vaccination coverage of, e.g., polio and cholera, poverty reduction and improved sanitation and hygiene. Climate change could reverse this trend in certain vulnerable regions.

Global deaths caused by climate sensitive diseases

According to the previous report from the IPCC, the AR5 report from 2014, and reiterated in AR6, the baseline climate-related disease burden of a population is often the best single indicator of vulnerability to climate change. Doubling the risk of disease in a population where the burden is already high has much larger absolute impact than a corresponding risk increase in a population less affected by climate-related diseases. Today approximately 40 million deaths (close to 70% of total annual deaths) are caused by climate-sensitive diseases. Regarding the geographical distribution, Asia and Africa emerge as the regions most vulnerable to increased health risks from climate change.

Since the AR5 report two global projections of the mortality burden related to climate change have been published. The first estimated that climate change by 2050 could result in around 250,000 excess deaths, primarily due to heat exposure, childhood undernutrition, malaria, and diarrheal diseases. More than half of these deaths were estimated to take place in Africa. The second study looked further into the future. Under a high emission scenario, taking into account population growth, economic growth, and adaptation, an estimated 9.25 millions deaths annually was projected for the end of the century. Without adaptation and economic growth the estimated annual deaths was 24 million.

Follow updates from the ENBEL project on:
www.enbel-project.eu
@ENBEL_H2020

The ENBEL project received funding from the European Union's Framework Program for research and innovation Horizon 2020 under grant agreement number 789723974.