



ARTÍCULO DE REFLEXIÓN

Climate change and its impact on human health

Cambio climático y su impacto sobre la salud humana

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The Intergovernmental Panel on Climate Change (IPCC) of the United Nations, the maximum world scientific organism on the topic, published IPCC, 2018: Global Warming of 1.5 °C¹. More of 90 scientists from 40 countries who reviewed 6,000 studies prepared the IPCC report in response to a climate agreement request in Paris in 2015.

Its purpose was to discriminate between the effects of the global heating at 1.5 °C (2.7 °F) versus 2.0 °C (3.6 °F). The agreement from Paris required keep the heating below 2.0 °C while efforts are performed for limit it to 1.5 °C. In this way, if the temperatures increase in 1.5 °C, it was reported that out of the 105,000 species studied, 4% of the vertebrates, 6% of the insects and 8% of the plants would lose half of its geographical rank determined by the weather. With increase of 2.0 °C, these percentages would double and even triple in some cases. With an increase of 1.5 °C, we

would lose between 70% and 90% of coral reefs, while at 2.0 °C the loss would be 99%.

According to these reports, the earth has warmed 1 °C since preindustrial era, and two thirds from this increase has been produced since 1986. The 20's warmest years on record, it has been produced in the last 22 years, mainly due to the increase of the temperature from the oceans, that were surprisingly warm in 2017. Overcame to 2015, the second year of temperature of the ocean warmer by 1.51×10^{22} joules, that is the amount of electrical energy that produces annually China. Among these results of the heating of the ocean, there is the acidification, particularly troublesome for the phytoplankton that produces half the oxygen we breathe.

As for the cause of global warming, or the relationship almost linear relationship between the emissions of gases of greenhouse effect and atmospheric warming, more than 42,000 million

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tons pollution of greenhouse effect have been poured in the atmosphere every year in the world, quantity that continues to increase. According to the Global Carbon Project, it is expected that the emissions will increase 2.7% annually, in part due to increases in oil consumption.

Warmer air holds more water and higher temperatures cause greater evaporation from the surface; in turn, this increases the number and the intensity of the events from rain, now called rain bombs, what provokes the intensity, frequency and duration of the hurricanes. The devastation caused by the Hurricane Harvey, was in part the result of Gulf of Mexico surface temperatures that for the first time did not fall below 23 °C. Hurricane Maria, in 2017, caused almost 3,000 deaths in a decimated Puerto Rico². Economically, Harvey, Irma, and Maria together, caused more than \$ 300 billion in damages. In a recent research published in *Nature*, it was concluded that global warming will cause hurricanes become even more deadly as precipitation intensifies by up to 10% and wind speeds at 40 km/hour³.

Beyond the increasing gravity of the hurricanes, global warming means that the current rate of increase in sea level is greater than at any other time in history. As an example, if the ice sheets of Greenland would thaw, it will increase 6 meters the height of all seas, while melting of the upper layer of Western Antarctica would add others 3 meters⁴. To put it in perspective, at 6 meters, most of Florida and a third of New York City would be under water. It should be considered that 145 million people worldwide live one meter or less above sea level and that 10% of the world's population, almost 800 million, live less than 30 feet from current sea level⁵. Eleven of the 16 megacities, considered as such those with more than 15 million inhabitants are built on the coasts; among them are Jakarta, Los Angeles, Manila, Mumbai, Osaka, Shanghai and Tokyo.

The rising seas and the floods compromise the drinking water, the treatment of the human sewage and elimination of the rainwater, which

in turn increases the risk of communicable diseases caused by pathogens (bacteria, viruses and protozoa). Between 1948 and 1994, 68% of the sprouts in the United States were from diseases transmitted through the water⁶. Severe storms also mean more pollution of food by increasing the transport of pathogens such as salmonella. Therefore, global warming influences destination, transport, transmission, and multiplication rate of pathogens in the food chain.

Heat and drought increase the prevalence, intensity and duration of forest fires. Recent California fires, the deadliest of that state's history, partly were the outcome of having experienced five years in a row of unprecedented heat, rains in 2018 above 20% of the historical record and the worst drought in a millennium⁷. The amount of carbon that can emit these fires can be massive, which further exacerbates general trends of climate change. It is estimated that the forest and peat fires in Indonesia during 1997 released more than 40% of total world annual carbon emissions. Such fires also have a long lasting impact in the air quality, with serious health consequences. By 2050, it is anticipated that the forest fires will give a 40% increase in the organic carbon from 20% in the carbon spray concentrations.

Heat, drought and wildfires also contribute to the pollution worsening and increased levels of aeroallergens such as pollen. Combined, these are responsible for tens of thousands of episodes from acute respiratory disease that will lead to premature deaths and hospital admissions. In 2013, the year of the *airpocalypse* in China, the researchers found that, in 74 major Chinese cities, the air pollution was associated approximately with a third of the deaths⁸.

Higher temperatures cause exhaustion due to heat stroke, hyperthermia, and dehydration what in extreme cases may be fatal. Further, it may worsen the medical pre-existing conditions, as high blood pressure, and cardiovascular, respiratory, cerebrovascular, and kidney diseases, and those related to diabetes. It is difficult to calculate the morbidity and mortality due to extreme temperature, as medical records rarely

capture data related to each other. Added to it, the warmer temperatures of the winter and spring mean that the annual start of Lyme disease cases is much earlier. The more elevated temperatures contribute to transmitted diseases by vectors (mosquitoes, fleas, ticks and rodents). The warmer temperatures, for example, accelerate the reproductive cycle of the mosquitoes of cold blood, making the cases of dengue fever double every decade since 1990.

Climate change also causes a long list of mental and behavioral health conditions ranging from anxiety, depression and alcohol and other substance abuse, even post-traumatic stress disorder and suicide. After the hurricane Katrina in 2005, veterans with pre-existing mental illnesses were at almost seven times greater than developing an additional mental disease. Suicide attempts after that hurricane among women who lived in temporary housing increased 15 times compared to regional averages, and the incidence of violent crime, including homicides and violence against women increased substantially.

As long as the world economy is defined as fossilized capitalism, mass extinctions or loss of diversity phylogenetics will continue. Among other things, we will continue seeing considerable losses in world fisheries and the collapse of insect populations⁹. The latter will contribute to a profound negative effect on food production. In fact, 30 countries are experiencing nowadays negative harvests and there is a probability of heat one in twenty, which affects the harvest of corn.

Production aside, it is worth to note that higher concentrations of CO₂ in the air stimulate the production of carbohydrates, starch and sugars, and growth of various widely consumed crops, as barley, potato, rice, and wheat. It will also reduce the level of vegetable protein up to 15%. The increase of atmospheric CO₂ exhausts calcium, copper, iron, magnesium, zinc and other minerals in most plants by more than 10%, because the higher concentrations of CO₂ reduce the demand for water, which in turn makes them to absorb less nutrients from their roots. All these factors could contribute to increase the obesity rates.

There are a number of additional cascade consequences related to the climate change that affect disproportionately to pregnant women, children, the elderly and the disabled, minorities and poor. The vulnerability it is a function of sensitivity to change and the capacity to adapt. The seniors are particularly vulnerable, they are frequently immunocompromised, with prescribed medicines that limit the thermoregulation or block the nervous system, and a significant percentage have a cognitive impairment or are socially isolated. It is no surprising that half of the deaths from Katrina were people over 75, and the African American mortality two to four times greater than that of Caucasians. Must be considered that the US population of 65 years of age or more will almost double from 48 to 88 million between the period from 2015 to 2050.

While health has always been affected by the climate, it is the change in its variability that constitutes a significant threat to human health. The health care industry, the second largest greenhouse gas polluter after the food industry, represents almost 10% of the contamination¹⁰, and supposedly dedicated to prevent and treat diseases caused or exacerbated by global warming, continues being largely indifferent.

At the time of finishing this article, humanity is being under the COVID-19 pandemic produced by a virus called SARS-CoV-2. Respect to its origin it predominantly follows two theories: while one indicates that the virus would come from the bats, having in the pangolin (mammal in peril of extinction) as the intermediate host, and after its ingestion was transmitted to man, being the epicenter a live animal market to human consumption in the city of Wuhan, China, by the end of 2019, the other theory aim to a center of virology located in its vicinity. Whatever is its origin, the reality is that the world not only has been moved from the sanitary point of view, long surpassing the 16.2 million confirmed cases and more of 648,000 people deceased to the day that this article is finalized¹¹, but also causing a huge socio-economic and psychological disruption.

After several months of detecting the first case there are still more questions than answers. While COVID-19 has changed the life of millions of people, it is not going to end the humanity, but one must react as a wake-up call and to reflect on how our actions affect the ecosystem we live in. Surely, this will not be the last pandemic and other diseases will come, but if the lesson is not learned and continue to have the same negative impact in the nature, perhaps in the future the planet will not be as benevolent to our specie as it has been until now.

Compliance with ethical standards

Informed Consent: This article is the result of a literature review, and as such there is no need for informed consent neither approval of the Institutional Ethics Committee.

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