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Chapter · April 2023

DOI: 10.1007/978-3-031-26592-1\_21

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# Climate change and humanitarian responses: a proposal of education for health hazards preparedness

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## Abstract

This contribution consists in an analysis of the recent developments and proposals for changes in humanitarian practices, in order to improve the responses, and in particular education and awareness-raising, to health hazards linked to climate change. The first part explores the existing global context, and the growing need for more sensitization and education to health hazards related to climate change among humanitarian workers and the populations in general. The position of the United Nations and of other specialized international organizations is explained, as well as the proposals recently made by the major humanitarian NGO networks, such as the ALNAP and the Sphere Project. The second part presents examples of health hazards linked to climate change, and the responses given in the field. This way, this intent is to compare the “by the book” recommendations, and the reality in the field. This section of text uses the methodology of the case study analysis, with a focus on climate change and health hazards situations in Bangladesh and in France (both in French Guiana and in metropolitan France). The cases studied, including a rather complete list of climate change caused problems (heatwaves, drought, cyclones and floods) and their consequences on health hazards. Such situations are contrasted and analysed, in order to underline the role that specific preventive and preparedness measures can have to improve the response to health hazards. The conclusions underline the relative lack of wide educational or awareness raising measures, and the need to dedicate more attention to this area, for both professionals and the population in general.

Wherever you go,  
Whether you are consumed by a forest fire,  
I remain high as the ashes

Poem by Amirul Arham

## 1. Introduction

Climate change affects mostly health, leading to several problems including injuries and deaths as a result of extreme events, but also infectious diseases, and food and water insecurity. Global warming, in particular, has many negative effects on human health, such as the inability of the human body to regulate its temperature, provoking heat exhaustion and heat stroke, and even intensifying some diseases like heart and lung diseases. The emission of toxic pollutants is dangerous for human health and can cause asthma, infections such as pneumonia and cancer, leading to about 7 million deaths every year. Extreme weather events such as floods, droughts and wildfires can destroy infrastructures and lead to the inability of the population to access health care facilities, causing deaths and are also affecting, in turn, water security, as people are unable to access clean water for drinking, cooking, and hygiene. In addition, the increasing temperatures and water temperatures are causing a spread of infectious diseases such as Lyme diseases, which affects the skin, heart, and brain of the

population, as well as *Vibrio* which can cause gastrointestinal illness and infections (Ebi et al. 2017).

In sum, climate change is the cause of multiple variants of humanitarian crisis, starting with the health dimension. The United Nations High Commission for Refugees reminds that climate changes are destroying livelihoods, driving displacement of millions of people every year, and increasing conflicts, and that the adverse effects of climate change contribute to the vulnerability and pose increased risk to the human rights of people affected (UNHCR 2022). Furthermore, climate changes as a factor of humanitarian crisis are exacerbating current inequalities, affecting those who are already most vulnerable and usually with less capabilities (Sen 1993). Taking the multiple challenges put on populations, health structures, and social systems by climate changes, this contribution looks, first, at the recommendations of international agencies as concerns education or awareness good practices for preparedness to health hazards linked to climate change. The second part of the article illustrates the specific case studies Bangladesh and France, in order to look at the reality in the field, as the field reality may be different from what international institutions actually advocate.

## **2. The vision of international agencies**

For international agencies linked to humanitarian action, the implementation of awareness and education among humanitarian workers and the population in general is seen as increasingly necessary. The implementation of awareness can bring numerous positive results such as: reducing people's vulnerability and exposure to climate-related hazards, protecting livelihoods by safeguarding the natural resources of the population, improving communities' health and safety by reducing pollution and waste. It can also promote good practices among the communities, such as the fight against deforestation, desertification, wildfire or other forms of pollution. As such, it also educates the local communities in order to be more resilient, biodiversity sensitive; and it also enhances food security, as well as social and economic development (EHA 2019). It is also crucial that the population are informed and educated about the topic, in order to be aware of how to be less exposed to climate-related hazards. Indeed the example of some countries, like Japan, is a paradigmatic one on this question (Pulhin, Inoue & Shaw 2021), but other countries are also developing good examples (*cf.* our case studies). The challenge ahead seems to specify the good practices, taking into account the variety of health hazards; and to generalize and diffuse the best practices among the potentially affected populations.

The World Health Organization (WHO) has been developing a programme on climate change and health, taking on board the impacts of climate change on vulnerable groups, and advocating the implementation of protective measures. In the conference on Health and Climate (WHO 2021), it underlined the importance of reducing the impacts of climate change, meeting the health needs of the population, their resilience and underlining the need to strengthen the health system. The organization has shared some possible interventions, namely: defining adaptation plan based on assessed population vulnerabilities, building response plans in case of new disease outbreak, together with emergency response plans, evacuation procedures and emergency management coordination measures to anticipate and respond to events affecting public health. It also recommends the development and implementation of national all-hazards health emergency and disaster risk management programs, based on risk

and capacity assessments (which account for shorthand long-term climate trends). The WHO promotes the integration of climate risks and management measures in the health curriculum. Lastly, it recommends the implementation of a communication strategy to raise awareness about climate change and health (WHO 2021).

Another United Nations agency has been decisive in the initiatives to promote good practices. It is the Food and Agriculture Organization (FAO), which shares several publications about the impacts of climate change on various food safety hazards. The organization highlights the importance of risk awareness for sustainable agriculture reducing emissions. The focus of its studies is on the important to help farmers to avoid health hazards, and to build climate-resilient systems at national level. To address climate risks, the FAO is “developing climate change impact and vulnerability assessments for crops, livestock, fisheries and forestry” (FAO 2017: 10). More specifically, it promotes an “approach to strengthening resilience and reducing poverty in rural areas through risk-informed and shock-responsive social protection systems” (FAO 2017: 10). Moreover, it recommends the development of disaster risk reduction management capabilities, early warning systems and rapid reaction mechanisms to support the population to adapt and mitigate climate change (FAO 2017).

As regards private international bodies, it is worth mentioning the Sphere network. The Sphere standards are considered a reference tool for international NGOs, volunteers, UN agencies and others. Considering the importance of consequences that climate change have on health hazards, the Sphere movement has taken an important position concerning the quality of the humanitarian response as concerns sustainable development and the mitigation of the impact of climate change. The role of humanitarian workers is not forgotten, as they should also focus their work on reducing the environmental impact of humanitarian activities, otherwise they may also contribute to health hazards for vulnerable populations. On the Sphere thematic sheet “Reducing environmental impact in humanitarian response” based on the 2018 Sphere Handbook, various visions about the positive or negative impacts of the humanitarian response on the environment are underlined. In fact, the degradation of the environment has a really negative impact on the resilience and the capabilities of the population, affecting their wellbeing by reducing their health capacity or their access to education for example. The importance of considering and integrating the environment in every humanitarian response, is seen as necessary in order to increase sustainable development, but also in order to create a solid foundation for conflict resolution and peace-building. But, on top of that, it is also important for the Sphere movement to understand why it is so essential to promote education and awareness on health hazards caused by climate change (Sphere 2022).

For Sphere, the most important is to include the environmental issues at an early stage of a crisis response. Indeed, this methodology will have a sustainable and positive impact for the rest of the response. For example, it will reduce the risk of recurrence, safeguarding the natural resource, and by this way protected livelihood, their health and safety. It will also reduce the risk of local conflict for resources. Through mitigation activities, including education and awareness-raising, it will help to prevent the population and the environment from future health hazard, and contribute to the “[s]lowing or reversing trends that lead to deforestation, desertification and pollution and thereby supporting community resilience, biodiversity, food security

and economic development” (Sphere 2019). This early-stage incorporation of the environment in the management of humanitarian actions is also a key to increase the quality and accountability of humanitarian action.

Concluding on the private international actors, it is important to mention ALNAP (Active Learning Network for Accountability and Performance). ALNAP is a “global network of NGOs, UN agencies, members of the Red Cross/ Crescent Movement, donors, networks, academics and consultants dedicated to learning how to improve response to humanitarian crises” (ALNAP s.d.). ALNAP is aware of the fact that humanitarian actors must be well prepared to deal with the effects of hazards related to climate change. It considers that humanitarian workers and, more generally, humanitarian actors, ought to improve capabilities of communities to plan and implement a full range of resilience measures, including DRRR (Disaster Risk Reduction and Response), to ensure the quickest response possible. It also considers that it is necessary to develop more knowledge among the humanitarian workers as regards the complexity of climate change impact. Most interestingly, ALNAP recommends as an important method that humanitarian actors “co-design climate change programmes with vulnerable people and groups, ensuring that they understand and can discuss climate change, its effects and the potential impact on their lives and livelihoods” (De Geoffroy *et al.* 2021: 33). This aspect is also completed by a recommendation of focusing “support to communities and socio-economic groups that are particularly exposed” (De Geoffroy *et al.* 2021: 51), giving the example of one of the recurrent climate change issue, namely heatwaves. According to ALNAP, partnerships between humanitarian organizations and governments could also help to set up social protection to anticipate the impact of extreme climate phenomena, This can be completed by partnerships between the humanitarian workers and climate-related actors (e.g. Civil Protection), using “joint analysis and common standards” (De Geoffroy *et al.* 2021: 32).

### **3. Case study on Bangladesh**

Bangladesh, a South Asian country located beside the Bay of Bengal with a coastline of 580 km. The country is one of the utmost susceptible countries in the world to climate change due to its unique flat and low-lying topography and geographical location. The population density, extreme poverty, lack of institutional proficiency and the livelihoods dependence of climate sensitive sectors, such as agriculture and fisheries, make Bangladesh as one of the most vulnerable countries in the world to climate change (Huq 2001; Huq *et al.* 2004; Huq & Ayers 2007). The sixth report of The Intergovernmental Panel on Climate Change (IPCC)<sup>1</sup> stated that “the low elevation, high population and weak infrastructure make Bangladesh highly vulnerable to climate change”. According to the Global Climate Risk Index 2021 Bangladesh ranked 7<sup>th</sup> most vulnerable country among the 180 countries in the world, and from 2000 to 2019 the country faced 185 extreme weather events due to climate

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<sup>1</sup> The Intergovernmental Panel on Climate Change (IPCC) was created in 1988 by the United Nations, and is a clustering of 195 States. It works on the causes and consequences of climate change by assessing scientists, technical, economic, and social knowledge.

change. Increasing temperatures, rising sea levels, floods, drought and cyclones are the important climate change impacts suffered by Bangladesh.

The changing climate has not only an impact on the environment but also impact on the human life. All the climatic disasters degrade the human activities and ultimately forced populations to migrate from one place to another place. Such migrations tend to reduce the quality of life, especially in rural areas due to the lack of social support, standard household shelters, standard employment, poor healthcare systems, mental problems deriving from the generalized uncertainty about the future (Naheed & Hort 2015). To overcome these situations, three (humanitarian) approaches have been traditionally used, namely: resilience, disaster risk reduction, and early warning systems (Marin & Naess 2017). They can be useful to define the targets for the adaptation to climate change. Yet, to analyse the adaptation to climate change from the standpoint of health hazards implies a dynamic approach, due to the complexity of climate related problems existing in Bangladesh. In particular, it requires to identify the different types of disasters and the different types of problems they create, both in nature and in human activities.

### **3.1. Cyclones**

Cyclones are tropical storms, which formed over the South Pacific and Indian Ocean. In the last two-three decades the frequency and intensity of the tropical cyclone/hurricane/tornado has been increased worldwide due to the global climate change. Increasing sea surface temperature is one of the most favourable criteria for the genesis of cyclone along with other climatic criteria (Nasher *et al.* 2022). The intensity and frequency of tropical cyclone has been increased due to the geographical location and funnel-shaped coastline of Bangladesh. Every year about 5% of global tropical cyclones are formed over the Bay of Bengal, and the cyclones caused 53% of the world death and 80% of the casualties (Rahman *et al.* 2022; Fakhruddin *et al.* 2022).

In Bangladesh, most affected and high risk zones by tropical cyclone associated phenomena (wind, storm surge) are Barguna, Patuakhali and Bhola districts (southern part), Cox's Bazar and Chittagong districts (the eastern part), and Satkhira, Khulna and Bagerhat districts (south western part) (Hoque *et al.* 2018) [Fig. 1 (A)]. Since the independence of Bangladesh (1971), a number of cyclones have hit all over the country. For example, in November 1970 (Bhola Cyclone), in November 1971, in November 1974, in May 1975, in May 1977, in November 1983, in May 1984, in November 1988, in December 1990, in April 1991, in May 1997, in September 1997, in May 1998, in November 2007 (cyclone Sidr), in October 2008 (cyclone Rashmi), in May 2009 (cyclone Aila), in May 2013 (cyclone Mahasen), in July 2015 (cyclone Komen), in May 2016 (cyclone Roanu), in May 2017 (Cyclone Mora), in May 2019 (cyclone Fani), in November 2019 (Cyclones Matmo and Bulbul), in May 2020 (cyclone Amphan), and lastly the cyclone Yaas in 2021.

The coastal areas of Bangladesh suffer as a consequence of strong wind, heavy rain, large storm surges near landfall. Agricultural land and livestock are damaged due to inundation, salt-water intrusion, among other effects. Due to these extreme events the human settlements face severe casualties, leading to migration movements after large

portions of the local populations lose their shelters, agricultural lands, livestock and also due to the shortage of fresh water. For example, large proportions of the population affected changed their occupation and moved other cities after the cyclone Sidr (2007) and the cyclone Aila (2009). Approximately 350,000 people were displaced and not able to return their previous home, according to the United Nations (UN) Office for the Coordination of Humanitarian Affairs report (Rahman *et al.* 2022). The cyclone Aila affected people obliged to migrate to the nearby places or other big cities because of their loss of houses and physical properties, and damage of agricultural lands due to salinity. As a result, what was observed was an increase in the unemployment problem, an increase in the financial and life insecurity, and most specifically health impacts due to the lack of proper medication, lack of transport access to the local public services, and scarcity of drinkable water (Islam & Hasan 2016). The educational system is also damaged along the affected area after the strike of each cyclone. A study revealed that 90% of the schools were severely impaired due to Cyclone Aila in Shyamnagar Upazila (sub-district), Satkhira District (Parvin *et al.* 2022).

A case study was conducted on the effect of cyclone displacement by the Department of Environmental Science and Disaster Management, at Daffodil International University (Bangladesh), at the end of 2020, just after the attack of the cyclone Amphan. In reality a “super cyclone”, Amphan made landfall on 20th May 2020 on Jammu Island, in West Bengal (India), and crossed Bangladesh on the same day with a wind speed of 60-90 kph. The super cyclone caused huge destructions to the southern part of Bangladesh, including houses and public infrastructures. The effects of the occurrence of this super cyclone became severe during the COVID-19 pandemic. Due to the pandemic, rather than the infrastructure damage as such, the health sector became highly vulnerable and unstable. The local community suffered a lot due to the lack of social distancing, lack of health professionals, shortage of medications, and problems linked to the supply of pure water and sanitation facility (Islam *et al.* 2021). Compared to the pre-cyclonic period (19 May 2020), the number of COVID-19 cases increased by approximately 70% in the post-cyclonic period (29 May 2020) (Kumar, Lal, and Kumar 2021).

It was a huge challenge for the authorities to move large parts of the population in shelter house and maintain proper hygiene and health safety during the pandemic time. Despite of the pandemic, a number of government and non-government organizations and volunteers were involved to support the local community before, during and after the havoc. Over one million people were inundated, approximately 220,000 houses have been partially or fully damaged, and at least 26 people died in the country during the super cyclone Amphan in Khulna, Satkhira, Jashore, Barguna, Bagerhat, Patuakhali, Bhola and Pirojpur districts (Tauhid Zaman *et al.* 2020). The super cyclone Amphan also caused another “collateral” health hazard: the persons displaced were bit living in the shelters that were adequate to maintain necessary social distancing during the pandemic. The study also highlighted that the “provisional” shelter house were in fact durable solutions. Indeed, The family houses had been partially or permanently damaged, and the perspectives of return to normality were low, which also elevated mental pressure and stress as a new health problem. Food scarcity and the almost total destruction of the sanitation system also added to the health crisis and social insecurity, especially for women and children.

### 3.2. Drought

Drought is a most widespread natural hazard today. It develops slowly and can remain for prolonged duration. It is affecting around 55 million people worldwide in every year (Mishra *et al.* 2022). Bangladesh is a drought-prone country with an index score of 3 out of 5 according to Global Drought Risk Index 2020 (Eckstein *et al.* 2019). In last few decades, Bangladesh suffered by several climate change related incidents, such as increasing temperature, prolonged Summer season, high variability in rainfall, low annual and seasonal rainfall, among other problems. The high population density and poverty rates, the high reliance on agricultural production, the low adaptive capacity and the lack of awareness greatly influence the impact of droughts in Bangladesh. Even though the pre-monsoon drought intensity has been reduced through sufficient irrigation practices in many areas of the country, the problem is recurrent (Brammer 1987; Sarker *et al.* 2020).

In terms of severity and occurrence, the North and North-Western, Western, South-western and Central parts of Bangladesh were and are still the most drought-prone areas (Habiba *et al.* 2012; Rahman & Lateh 2016) [Fig. (B)]. A number of studies illustrate the recurrent severity of drought along the years (Rahman & Lateh 2016; Rahman *et al.* 2022). Drought may sometimes turned into famine and cause adverse effects on hydrology (surface water and ground water), affecting both human health and biodiversity. Aspects such as food security are impacted, and so is livestock and livelihood, the soil and water pollution, but also the hydroelectric power generation. Here again, the lack of health conditions, and the risk or reality of human diseases may lead to forced migration (Miyani 2015; Rahman & Lateh 2016). Building proper awareness, developing early awareness system, acquiring more capacity for a correct monitorisation and prediction, may be the most urgent response. However, other solutions may be more sustainable, such as to introduce drought resistant crop variety, the conservation of rain water and the adoption of drought-tolerant crop varieties, in order to reduce the actual impacts of the drought (Miyani 2015; Rahman *et al.* 2022; Xenarios *et al.* 2016). The populations of the drought prone areas should be informed, and trained, in order to have a growing their awareness and know what precautions to adopt in case of drought.

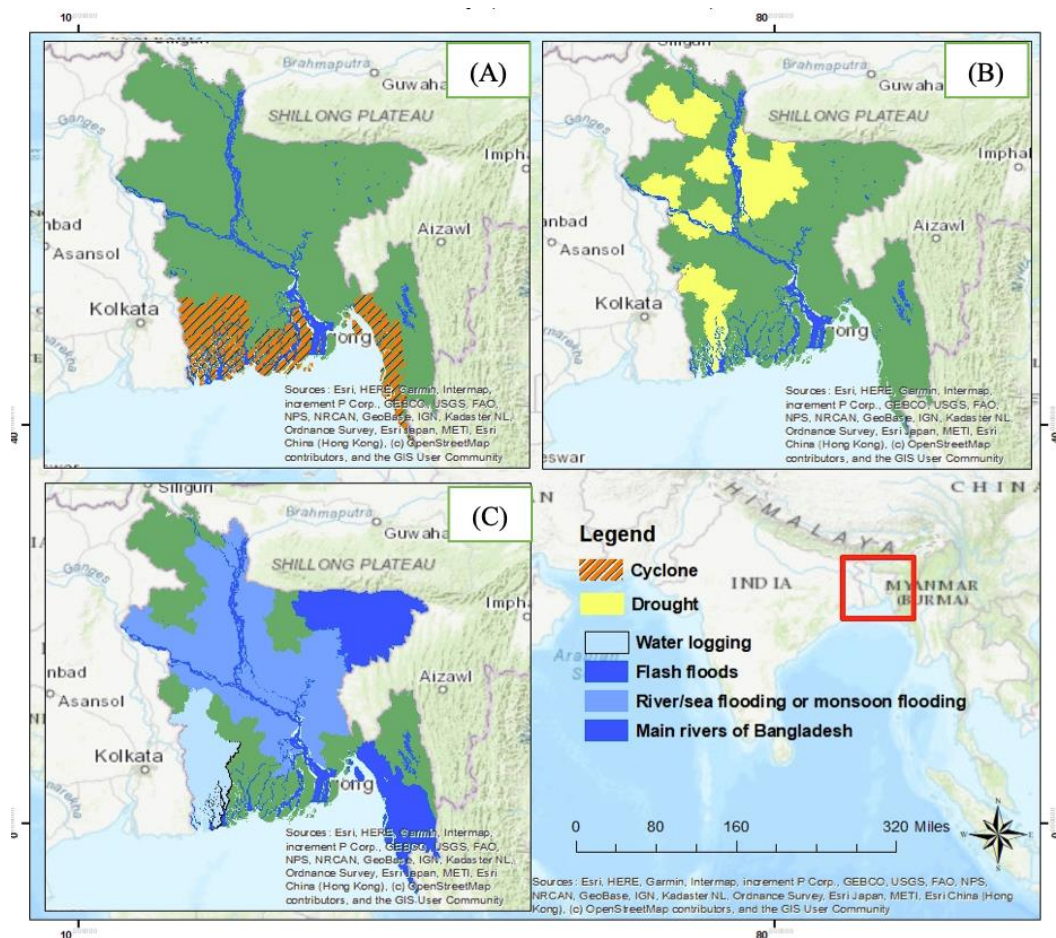
### 3.3. Floods

The geographical location of Bangladesh makes the country one of the most flood-prone areas in the world. Historical records show that at least five major floods occurred in the 20th century in 1955, 1974, 1987, 1988, 1998, 2004, 2007 and 2010. All of these floods affected at least one-third of the country, and initiated enormous physical damage and fatalities. In the history of Bangladesh, the most severe flood happened in 1998, when it inundated approximately two-thirds of the country as well as the agricultural sectors, fisheries sectors, livestock sectors and damaged severely rural infrastructures (Khandker 2007).

In Bangladesh, floods are usually classified as flash floods, water logging and river/sea flooding or monsoon flooding. Flash floods commonly occur from April to July and from September to October, and the most affected areas are Sylhet, Sunamganj, Moulvibazar, Habiganj, and Netrakona Districts, Chittagong, Cox's



Bazar and Bandarban Districts [Fig.1(C)]. The southwest coastal belt areas, namely Satkhira, Jessore, Jhenaidah and Khulna Districts, are examples areas of water logging [Fig.1(C)].



**Figure 1:** Map of Disaster prone areas in Bangladesh Cyclone (A), Drought (B) and Flood (C).

The government of Bangladesh developed and introduced several processes over the years that helped the population to handle these disasters better. For example, it improved forecasting and warning systems, introduced improved policy for the distribution and handling of disaster relief, created special emergency funds, introduced flood insurance, among other measures. Some lessons can be extracted for such initiatives. A study shows that an insurance scheme can be designed on the basis of the socio-economic conditions. Another aspect evidenced is the risk perceptions of the flood by affected populations, and the fact that their attitudes should be considered carefully to adapt better the educational response and the training practices (Hossain *et al.* 2022).

#### 4. Case study on French Guiana

Since the beginning of the 21st century, the Intergovernmental Panel on Climate Change (IPCC) has been warning about the tipping point of the entire ecosystem that is supposed to regulate climate change. The tipping point is when these ecosystems: The Amazonian Forest, the coral reef, the Siberian permafrost, and the ice cap become also victims of climate change and are not fulfilling their role. The

Amazonian Forest also recognized and called the carbon sink and with a role in absorbing CO<sub>2</sub> from human activity, is nowadays on the tipping point, mainly due to deforestation becoming a close future gas emitter as well. It is also essential to underline that the Amazonian Forest is producing a part of the rain in the region, rain that is pushed by the wind in the rest of Southern America. In case of destruction of the forest due to human activity, this weathering activity will be considerably reduced and will risk creating dewatering of the Southern American countries. In order to reduce the risk, the IPCC made Brazil and other Amazonian countries promise to stop deforestation by 2030. This is the first step, but the question is what will happen during all those years. Experts estimated that before 2030, the Northern part of the Amazonian Forest will become savannah and will be more sensitive to fire and destruction of the rest of the forest (Lama 2021).

One of the countries of the Amazonian region is the French Guiana, an overseas department of France. The country is covered by 90% of the less impacted tropical forest in the world: The Amazonian Forest. Only 3% of the whole territory is protected (Stier *et al.* 2020) and the country hosts many endemic species that need protection.

The country is known for its European aero spatial activity where we can find different actors like the European Spatial Agency (ESA), the Ariane Space Group, the Italian group Advances Vision Into Orbit (AVIO), but also the National Space Study Centre (CNES) and around forty entities that collaborate for the launch of rockets (Centre Spatial Guyanais 2022). The aero spatial activity implies a pollution created by all the products used for the rocket. In the case of the Guiana Space Center (GSP), it is in a 700km<sup>2</sup> of littoral savannah where about fifty terrestrial species, over 400 bird species and over hundred fishes are living. But we can also find endemic species such as the giant taboo, the jaguar, the great anteater, the ocelot, the broad-billed grebe, the popsicle and the red ibis (Joussen 2017). The GSP is aware of the risk on the wildlife population due to the pollution, and is doing research about rocket rejection and the possibilities of contamination. For example, rockets are releasing paraffin, liquid oxygen, some rockets like the Ariane 5 may release chloridric acid and alumina in very small quantities (Joussen 2017). But the measure reveals that the risk is at maximum around 1 km around the launching zone; the perimeter around it is actually burned due to the warm gas from launching (Joussen 2017).

To be sure the pollution doesn't disturb the wildlife population, some research is on going on the animals behaviours with the National Office of the Hunting and Wildlife Authorities (ONCFS). The first study has been with a jaguar and did not reveal any abnormal behaviour either within 2 to 10 km of the launch area; and the results have been the same with the peccary, a small mammalian (Joussen 2017). Another initiative to mention is the one of the association Kwata, which works on marine species and especially with marine's turtles. Here again, the result of the studies did not show any disturbance. The ornithologist Olivier Tostain and the ECOBIOS association have also been studying the long-term consequences on bird shells, however after only four years of observation it is too early to give an opinion. Lastly, the Hydreco laboratory is also doing research on the fish and aquatic wildlife, without any result for the moment. (Joussen 2017). Even if the place is a protected area with hunting restriction and a reintroducing species area, there are still some issues because they needed to clear a new space for the Ariane 6 rocket launch, where there was a

protected fern species. But in order to preserve the environment after each clearing, the CGS must give back land with an ecological value equivalent to that lost (Joussen 2017).

Another aspect that has been affected by climate change is the fishing industry and the conservation of the mangroves, that represent 55.000 hectares overall. About 60% of the French mangroves ecosystem is in French Guiana. The surface water weather increased by +1°C in 30 years and is affecting the shrimp fishing industry, which has been decreasing drastically in the last 10 years (Guyaweb 2019). As concerns the mangrove, it decreased from 1% to 2% per year, while they were representing three quarters of the French Guiana coastline. In the last 50 years, they have been decreasing from 20% to 35%. The biggest challenges are the pollution created by the urbanisation of the coast, the land-use conversion to agriculture but also the aquaculture farms that are too intensive and not sustainable (Scemama *et al.* 2022).

In addition, other specific aspect is dangerous for the environment of the Amazonian Forest: it is the gold mining in French Guiana. There is an estimated over 15.000 *Garimpeiros* (Brazilian landowners) that are mining in over 1.000 clandestine mines. In addition to clearing areas of forest, creating an increased risk of forest fires, illegal mining creates risks for rivers, due to the mercury used to separate the gold. The French authorities cannot do anything to stop it, and limits itself to send the minors back to Brazil before they came again (Bellos 2007).

The consciousness about the issues referred above is rising, but it seems still difficult to show, in the immediate, the effects on health of climate change. This, in a way, is a result of the fact that France and French Guiana are developed territories, where natural disasters are compensated by social and effective emergency measures already. The vice-president of the association Citizen for Climate Guiana, Eric Bourdin, emphasizes that French Guiana is “one of the departments most affected by global warming because the increase in temperature in a climate with a hydrometry of over 80° would make it difficult to evacuate our body temperature from 35° and we are almost there, we are at 34° (...)” (Lama 2021). Things can get worse and worse, over time. He explained that, indeed, in the worse case scenario, in 2050 the country will be uninhabitable, in a context where there has been an increase of +1.36°C in the last 50 years. During the G26 meeting, the Amazonian region was focused, pinpointing the progressive drying and rising temperatures in this area of over 5 million km (Lama 2021).

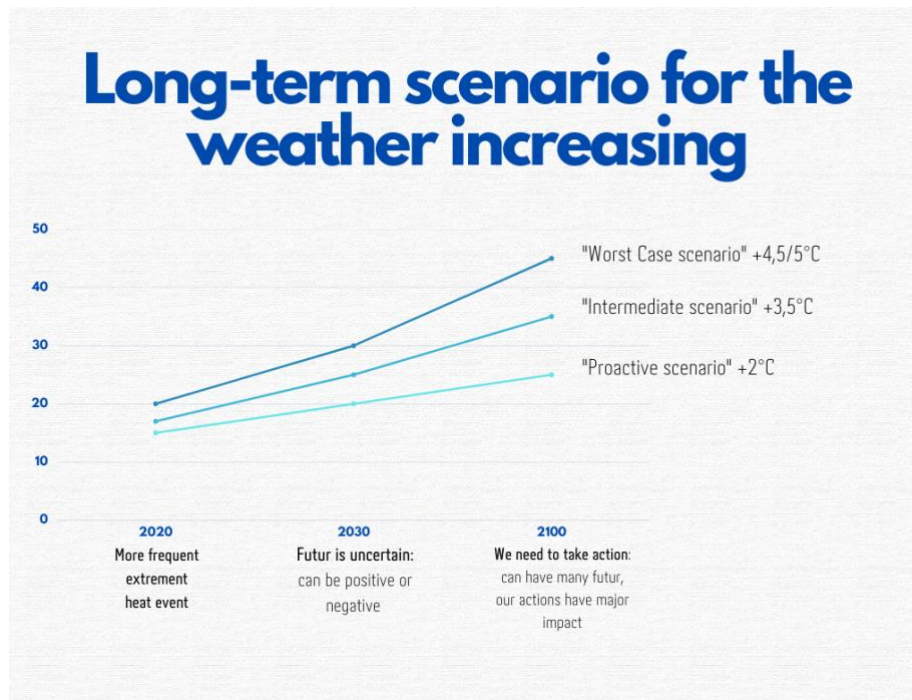
The Amazonian region, including the French Guiana, is currently facing the ENSO cycle, which created important inter-annual rainfall, due to El Niño weather pattern, which created a rainfall deficit and La Niña, which created periods of excessive rainfall (Lama 2021). The last climatic study of 2015 already showed risks linked to climate change, like longest and harsh dry seasons and excessively long rainfall seasons. But there are also important risks of vegetation fire, floods because of the increasing of 3.5 mm per year of the ocean that caused marine submersion and lack of rainfall evacuation, and also the spontaneous urbanisation of the savannah and of the forest (Lama 2021). The governments, both local and central (metropolitan), are attempting to protect the population by encouraging good practices at their level, like waste recycling, changing food practices by consuming more locally, energy saving, developing and using renewable energies (Lama 2021). But it remains to be seen if this is enough. In fact, France, as some other countries in the world, are facing a

greater challenge and greater responsibility: to prevent health hazards caused by climate change in both specific locations like the Amazonian area, but also in Europe.

## **5. Case study on metropolitan France**

Heatwaves, floods, desertification, and extreme cold weather are all consequences of climate change, and have affected strongly the European continent. Focusing on the case of metropolitan France, it is relevant to state that climate change was being discussed all around the country as being one of the most important points for the Presidential election of March 2022, as well as in parallel in other forums, such as the Intergovernmental Panel on Climate Change, which has been trying to alert the French population by using interactive posters in the street with a QR code linked to its last report (Mendy, 2022; IPCC 2022). The new government was assumed to be ready to answer and to take action against environmental issues to reduce the consequences of the climate change in the country first and in the rest of the world *also*.

More specifically, one health hazard has been recurrent in metropolitan France in the last years: heatwaves. It is important to remember that a heatwave is defined by a period between the month of June and September while the weather during daytime and nighttime is higher than the department threshold for at least three days (Adélaïde, Chanel & Pascal 2022). Connected to this problem, the City of Paris, in the report *Paris in the face of climate change* gives a definition of the term “climate hazard”, stating: “How likely is it that a natural phenomenon will occur? How intense will it be? Where will it occur? Is it foreseeable? The diagnosis highlights climate hazard trends, with regard to the average rainfall, for example, severe climate hazards such as heatwaves (...)” (Roussel 2021: 5). In the report, the City of Paris indicates that it is facing different difficulties that occur in the capital as heatwaves, also floods, and risks to citizens’ health. It used figures to show the different evolution of the climate hazard within a period of one hundred years. Using the data of the IPCC, it shows a proactive scenario where the weather gain +2°C, the intermediate scenario with +3,5°C, and the worst-case scenario with an augmentation of +4,5/+5°C in the year 2100 (Roussel 2021).



**Figure 2:** Long-term scenario for the weather increasing. Based on Roussel, 2021.

The City of Paris report shows clearly the expected increase of days under heatwaves – from 7,2 days over 30°C and 0,2 tropical nights over 20°C in 2010 to 13,6 days and 5 tropical nights. It also gives an approximation of what it would be the future. In 2030, metropolitan France should have almost 20 days of heatwaves, almost 22 days in 2050 and we will have more than 34 days of heatwaves in 2085. For the tropical night, it should rise to almost 18 nights in 2030, more than 20 nights in 2050, and almost 35 tropical nights in 2085. We can see that we will have more tropical nights than a heatwave in 2085. If compared with the result of 2010, it is observed that in 75 years, there will be 20 more days of heatwaves and 30 more tropical nights (Roussel 2021).

These increases of extreme weather will have a considerable bad effect on human health. In their article: *Des impacts sanitaires du changement climatique déjà bien visibles : l'exemple des canicules* (Adélaïde, Chanel & Pascal 2022) the authors refer various health impacts due to climate change that already appears in the population, in metropolitan France. One of the most important for them is the loss of well-being. In fact, they considered this loss to be the restriction of the practice of activities that could create important symptoms. These symptoms include tiredness, fainting, cramps, decreased alertness, and problems with cognitive functions (Adélaïde, Chanel & Pascal 2022).

To overview the victims of the heatwave, a comparative study based in the Greater City of Lyon indicates that the most vulnerable persons during heatwaves are children under 10 and the adults over 75 years old (Alonso & Renard 2020). Yet, the previous health condition must be taken into consideration, as this could change the results of studies. This study shows that the psychiatric status of a person can also affect the capacity to face heatwaves. Additional factors also include gender, and show that

women are more affected by higher temperatures (Alonso & Renard 2020). The study shows the percentage of death by age in France: “At the national level, in France, excess mortality [due to heatwaves] was estimated at 20% for the 45-74-year-olds, 70% for the 75-94-year-old age group, and 120% for people over 94 years old” (Alonso & Renard 2020). The heatwave of 2003 caused 19,490 deaths, the one of 2006 caused 1388 deaths, and the one of 2015 caused 3275 deaths (Alonso & Renard 2020). For Chanel and Pascal, since 1970 France counts more than 37 000 deaths caused by extreme weather, and the most important one was the heatwave of 2003, with more than 15 000 deaths in less than two weeks (Adélaïde, Chanel & Pascal 2022).

The latter study, in Lyon, connects with the study of the City of Paris, demonstrating that even in developed countries the public health system’s vulnerability as far as healthcare resources are concerned, when health hazards occur as a result of climate changes. In fact, the existing risk for the healthcare system is almost always increasing. It is foreseeable that in the next decades metropolitan France will face less extreme cold, less snow, and less freezing rain, that are important for the ecosystem. Resources like water, biodiversity, energy, air, and food will be affected. Such resources are important for the public health system itself. One of the biggest challenges of the City of Paris, for example, is to be able to provide drinkable water all around the city, both in public and private places.

Studies estimate that drinking water will be certain and accessible until 2050. However, due to the increase in the weather and the heatwaves, the population will need more water to stay hydrated, and it is estimated that the consumption of water will increase by 2% every year from 2030. In Paris, the highest level of evaporation of the river Seine is already visible, and the increase of the temperature of 2 or 3°C by 2100 will lead to issues on the biological and chemical quality of water. Those changes will lead to challenges to access to drinkable water in the city and create risks of disease due to the change in the water quality (Roussel 2021). Moreover, the quality of air in Paris is already one of the biggest issues as regards the health of the resident population, and the climate change with for example the ozone depletion and fine particles contribute to the decrease of the air quality, and will impact more people’s health. Cardiovascular or respiratory diseases are causing premature death, and with pandemics like COVID-19, the population’s health is getting worsen (Roussel 2021).

As it is possible to observe, heatwaves are not the only hazard of climate change in metropolitan France. Flood is also going to be more common phenomenon, and will lead to health issues. The report of the City of Paris shows that the decennial flood flows should increase from 20% and should be at over 40% in a hundred years. Colombe Brossel, Deputy Mayor of Paris in charge of the cleanliness of public spaces, sorting and reducing waste, recycling and reuse (Ville de Paris s.d), suggests an interesting alternative, indicating that: “[i]n the face of climate change and in anticipation of violent rainfall events, we have initiated the ParisPluie Plan, which is designed to make use of rainwater for cooling the city and greening projects and limiting risks of spillage into the Seine and flooding.” (Roussel 2021: 14). This way, it seems possible to plan an anticipation of the climate hazard, turning them an opportunity for sustainable and greener development. One of the key issues is to identify the institutions with major risks of being affected by the climate change. Here

again, the City of Paris plans a Flood Risk Prevention Plan (PPRI) for hospitals of the city. Over forty health facilities and hospitals have been identified, that are in floodplain areas. Another complementary point is to plan, and educate for, drastic conditions linked to the impact of driving during a flood. Alternative ways must be planned, as the lack of mobility could also slow emergency health operations (Roussel 2021).

In addition to the flood affecting hospitals, another issue is that “each hospital bed 'consumes' an average of 750 litres of water a day, roughly the equivalent of the daily quantity consumed by six Parisians” (Roussel 2021: 20). Every hospital will need to reduce its water consumption in order to cope with shortage. In fact, parallel to what was observed with the COVID-19 crisis, which has obliged to shift to emergency development mode in many settings, the health work will have to be reprogrammed in order to respond to the reduction of resources (as well as to the public health needs) as a result to climate change.

## **6. Conclusions**

Since 2020, the Covid-19 pandemic demonstrated in a drastic manner the way the earth is suffering from the impact of human activity. Due to the fact that most economic and social exchanges stopped during several months, especially from March 2020 to the late months of that same year, humanity as a whole has empirically observed how the various natural elements have improved (e.g. the quality of the air, just to mention this aspect). At the same time, it is now clear that climate change impacts health hazards.

Both in developing countries and in developed countries, as the case studies illustrate, there is a growing need for a better understanding of the way human communities can prepare better for health hazards resulting from climate change. In Bangladesh, disasters force people to switch their occupations and adapt to a life with less earnings, and also to drastically changing the lifestyle and reduce many aspects of the daily consumptions to adapt to the situation. The issue of forced internal migrations is a recurrent one, causing instability and turning the health standards more difficult to implement in such a unstable context. Despite the help coming from the Governmental and the Non-Governmental Organizations, the fates are not changing much, although the effects of disasters also depend on the disaster type. So, it is high time to focus on the humanitarian actions before/during/after the disasters focusing on disaster types.

In France too, both in French Guiana and in metropolitan France, the severe impact of climate change on highly organized public health systems is already visible. For example, despite the attempts and the alerts of NGOs and international bodies to stop deforestation in the Amazonian Forest by 2030, it is likely that well before 2030 the northern part of the Amazonian Forest will become savannah, and will be more sensitive to fire and destruction. In metropolitan France, also, the challenges resulting from recurrent heatwaves have to be combined with the growing need to reduce water consumption. In a way, the fact that developed and modern equipment already exist to respond to humanitarian crisis, as well as social aid support, does not mean that measures should not be taken more intensively. The lack of hygiene in big cities, illustrated by the case of the capital Paris, is illustrative of this. The degradation of environments in complex urban metropolis or city centre, resulting from a combination of bureaucratic, social and cultural phenomena (e.g. strikes), causes new and unusual health risks in developed countries (e.g. associated to the grows of

homeless persons). Besides, the awareness of populations tends to diminish in the context of developed countries, as most of the population rely on public services, and the impact of health hazards can be much higher than it should actually be.

As a result, the analysis done above concludes to the need of more education for health hazards preparedness resulting of new health risks potentiated by climate changes, as an essential issue, both for workers in the field of humanitarian action and for populations in general.

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