

## Review

# Effect of climate change on nature and human health with a special focus on infectious diseases in the Mediterranean region

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### Abstract

**Introduction:** In this short review, the effect of climate change on nature and human health with a special focus on infectious diseases in the Mediterranean region is discussed. This research is a part of the Mediterranean Convention of Human Rights project, which is an organizational work on human rights issues that was established in cooperation with civil society and the national authorities of the Mediterranean Region.

**Methodology:** Previously published data were collected by retrieving published literature from PubMed, Google Scholar, and Web of Science using “climate change”, “the Mediterranean region”, “infections in Mediterranean Region”, “infectious diseases”, “biodiversity”, and “the Mediterranean Sea” as keywords. The collected data were then evaluated and reviewed. The recommendations and guidelines were analysed by the preferred reporting items for systematic reviews and meta-analyses (PRISMA).

**Conclusions:** The Mediterranean region presents a typical example witnessing a dramatic change in climate events and their adverse impact on biodiversity, ecosystems and public health are multiple. This negative impact is in part due to the geographical particularities, and sociocultural and geopolitical conflicts that are progressively worsening the burden of climate change. While most of these changes cannot be totally avoided, many of the health risks related to climate change could be monitored. This can be done by establishing health systems with policies to reduce and prevent the risks of infectious diseases and to recover and support the affected areas, which may identify priority and management of high-risk events.

**Key words:** climate change; Mediterranean; health; infections.

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### Introduction

Climate change is defined as a series of significant variations in the regional or global climate over a long period of time that involves major changes in average and peak temperature, humidity, atmospheric pressure, precipitations, wind patterns and water salinity. It also leads to a reduction in the size of mountains and polar glaciers. These changes are considered a global risk that are threatening various sectors as a complex inter-governmental challenge affecting various elements of the ecological, environmental, socio-political, and socio-economic fields. Observed and anticipated climatic changes, including global warming, have been significantly encountered during the past 65 years on the planet [1-5]. Global warming has affected the diversity of plants and animals, water and food resources, food security and human health [6].

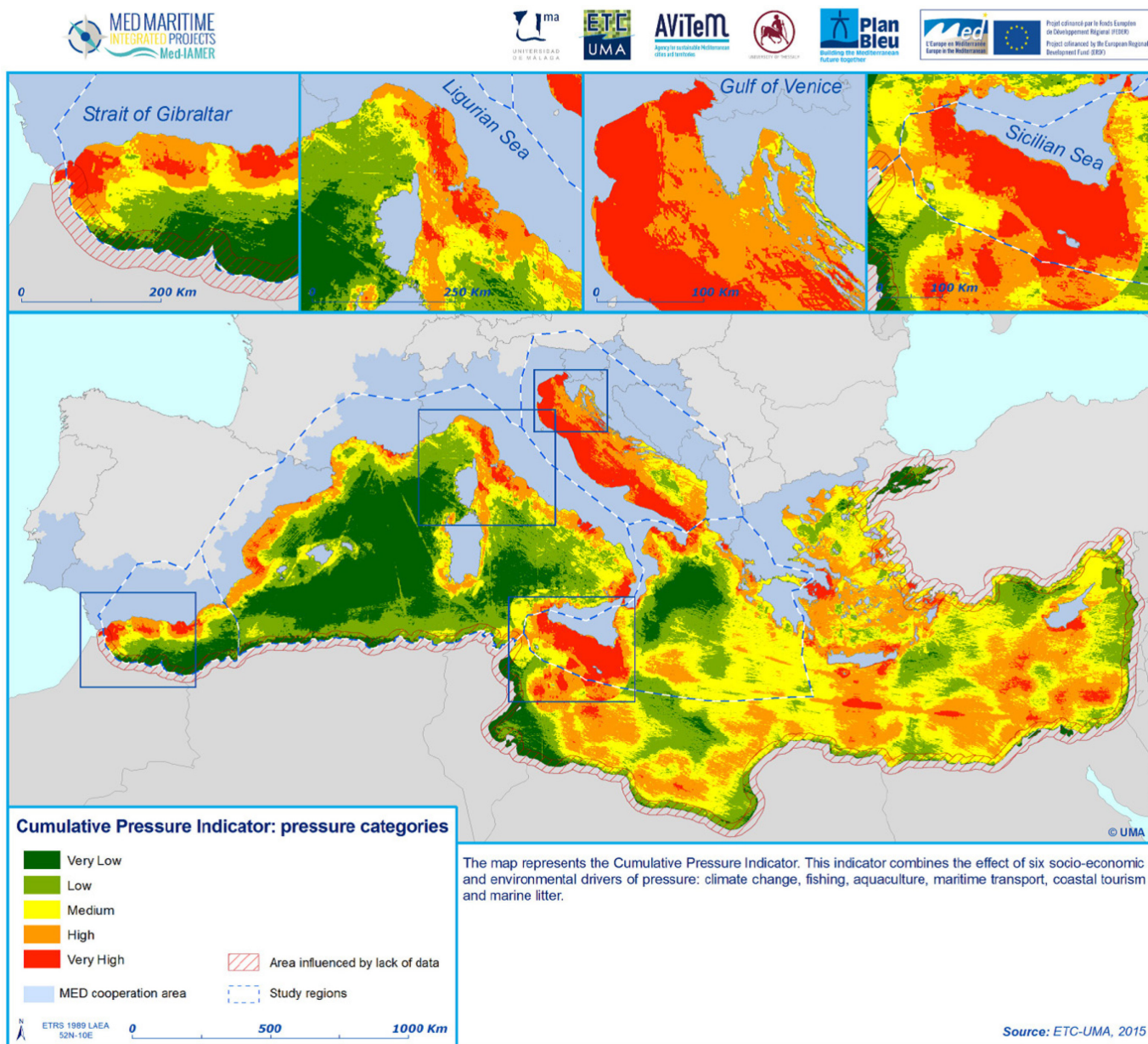
The Mediterranean Sea represents the largest of the semi-enclosed European seas, occupies a basin of almost 2.6 million km<sup>2</sup>, and measures about 3,800 km from east to west and 900 km from north to south at its maximum between France and Algeria [7]. The Mediterranean Sea is surrounded by 23 countries and is located at the crossroads of Africa, Asia, and Europe. The Mediterranean Basin is defined as the region that stretches from Cabo Verde in the west to Jordan and Turkey in the east, and from Italy in the north to Tunisia in the south. It also includes parts of Spain, France, the Balkan States, Greece, Turkey, and the nations of North Africa and the Middle East, as well as 5,000 islands scattered in the Mediterranean Sea [8]. The Mediterranean basin demonstrates a high species endemism with severe threats to the natural ecosystems. Its terrestrial area shelters 20% of the global flowering

plants and fern species, in addition to many wild relatives of agronomic, horticulture, and forestry plants of high economic value. This precious region is an important home to the world's known marine species. The complex history and the highly variable hydro-climatic, morphological, geographical, historical, and social features are pivotal to the exceptional biodiversity of the Mediterranean basin. Many of the Mediterranean countries' economies are largely dependent on natural resources, particularly along the southern rim of the basin [9-12].

The cultural richness and diversity of the Mediterranean region is high, being one of the busiest shipping routes in the world. This region is constantly suffering from human influence such as excessive land and sea exploitation, urbanization, migration, tourism, industrial development, and atmospheric forcing (Figure 1) [13]. In recent years, these influencing factors and climate change impacted the marine and terrestrial biodiversity, and human livelihood [14-18].

In this short review, the effect of climate change on nature and human health with a special focus on

Figure 1. Map of the cumulative pressure indicator at Mediterranean Sea, with details of four areas subject to the greatest pressure.



Reproduced with permission from Med-IAMER project (<https://maritime-spatial-planning.ec.europa.eu/practices/maps-indicators-and-factsheets-mediterranean-sea-region>) [13].

infectious diseases in the Mediterranean region is discussed. This review is a part of the Mediterranean Convention of Human Rights project, which is an organizational work on human rights issues that was established in cooperation with civil society and the national authorities of the Mediterranean Region. This is the thought of an international network of organizations that created a consortium to support the human rights of the people living in the Mediterranean Sea area [19].

**Methodology**

Previously published data were collected by retrieving published literature from PubMed, Google Scholar, and Web of Science using “climate change”, “the Mediterranean region”, “infections in Mediterranean Region”, “infectious diseases”, “biodiversity”, and “the Mediterranean Sea” as keywords. The collected data were then evaluated and reviewed. The recommendations and guidelines were analysed by the preferred reporting items for systematic reviews and meta-analyses (PRISMA) [20].

**Effect of global climate change on biodiversity and ecosystems**

The major impacts of climate change are shown in Table 1. The world is warming rapidly mainly due to the increase in carbon dioxide and other gases from the combustion of fossil fuels in the atmosphere. The effects of climate change on our planet have become increasingly frightening, and it was reported that the recorded temperatures during the last 10 years have been the hottest in the world. Accordingly, the Earth's surface temperature has increased by 1.2 °C in 2020 compared to the pre-industrial period (1880–1900), and an increase of 1.5 °C -2 °C is expected by 2100. In the Mediterranean region, average annual temperatures are now approximately 1.5 °C higher than during the preindustrial period and the trend is of 0.03 °C per year, also above global trend considering that it is warming 20% faster than the rest of the world [6-8]. The urban areas in this region are warmer than the surrounding rural areas due to human activities especially at night, and this is defined as the "urban heat island factor", emphasizing the impact of climate change on cities. Rising temperatures have led to reduced snow cover and increased seasonal water runoff from the mountains, melting glaciers, flooding, drought, sea

**Table 1.** The impacts of climate change on biodiversity, ecosystems and health, with special focus on infectious diseases.

Main effects of climate change	Outcomes of climate change
Impacts on environment, biodiversity, and agriculture	Environment <ul style="list-style-type: none"> <li>• Decrease of precipitation</li> <li>• Rise in sea temperature and levels</li> <li>• Acidification of the oceans</li> <li>• Increased frequency and severity of fires</li> </ul>
	Changes in biodiversity <ul style="list-style-type: none"> <li>• Loss of habitat and species</li> <li>• Increased entrance of warm and tropical marine alien species to the Mediterranean Sea</li> <li>• Increased spread of warm marine species</li> <li>• Outbreaks of purple-striped jellyfishes</li> </ul>
	Agriculture <ul style="list-style-type: none"> <li>• Decreased crop yields</li> <li>• Increased irrigation demands</li> </ul>
Direct and secondary impacts on human health	Direct effect on human health caused by extreme weather events <ul style="list-style-type: none"> <li>• Heat waves</li> <li>• Droughts</li> <li>• Cyclones and tropical storms</li> </ul>
	Secondary effect on health <ul style="list-style-type: none"> <li>• Weather related mortality</li> <li>• Respiratory diseases, allergies, and asthma</li> <li>• Cardiovascular diseases</li> <li>• Personal injuries and occupational health</li> <li>• Mental health problems</li> <li>• Decreased water and food resources and safety</li> <li>• Increase of infectious diseases</li> <li>• Vector-associated infections (West Nile virus, zika and chikungunya, dengue fever, yellow fever, Lyme disease, visceral leishmaniasis)</li> <li>• Water and foodborne infections (salmonellosis, shigellosis, <i>Campylobacter spp.</i>, and <i>Escherichia coli</i> diarrhea, yersiniosis, norovirus and rotavirus)</li> <li>• Other emerging viral infections (coronavirus infections, Hendra virus infections)</li> <li>• Fungal infections (<i>Candida auris</i>, <i>Cryptococcus</i>)</li> <li>• Antimicrobial resistance</li> </ul>

level rise, and acidification of seas and oceans. As a result of these changes, aquatic and terrestrial ecosystems have deteriorated [21,22].

#### *Decrease of precipitation, and rise in sea temperature and level*

Studies reported that a 2 °C global atmospheric temperature increase causes a significant reduction in summer precipitation. In the last ten years, 10-15% decrease in precipitation has been observed in Southern France, northwest Spain, and the Balkans, and up to 30% in Turkey. The surface of the Mediterranean has warmed up by 0.4 °C every ten years between 1985 and 2006. Parallely, the Mediterranean Sea level rose by 0.7 mm per year between 1945 and 2000 and by 1.1 mm per year between 1970 and 2006. A sharp rise in sea level has been observed in the last two decades, reaching about 3 mm per year. An important factor in sea level rise is the accelerating ice loss in Greenland and Antarctic. Southern and eastern Mediterranean regions, including Morocco, Algeria, Libya, Egypt, Palestine, and Syria, are at high risk due to coastal influence. The United Nations Educational, Scientific, and Cultural Organization (UNESCO) World Heritage Sites located in this region are at risk of coastal flooding and erosion. All these factors would have an economic impact in the Mediterranean and interconnected risks to sustainable development [23,24].

#### *Acidification of the oceans*

The oceans absorb about 30% of the CO<sub>2</sub> emitted by human activities. The absorbed CO<sub>2</sub> combines with water and produces carbonic acid, which increases the acidity of oceans. The pH of the oceans has decreased by 0.1 pH units since pre-industrial times, unprecedented in 65 million years. It is also reported that pH of the the Mediterranean Sea has decreased between 0.018 to 0.028 pH units in the last ten years [25-26].

#### *The changes in ecosystems*

An increase in warming of 2 °C or more above pre-industrial levels is expected to create unprecedented conditions for many Mediterranean terrestrial ecosystems. Desertification is expected in southern Spain and Portugal, northern parts of Morocco, Algeria, Tunisia, Sicily, southern Turkey, and some parts of Syria. The frequency and severity of wildfires are increasing making western Mediterranean forests more vulnerable. Characterized by its mosaic biodiversity-rich ecosystems, the Mediterranean basin has long been affected by human influence questionably related to

climate change [13,27]. Climate change impacts the integrity of ecosystems by influencing the variation in the relative abundance of species, range shifts, changes in activity timing, and microhabitat use [14,28-30]. The climate change-impacted species extinction is largely reported in the literature, with concerning data on demise prediction until the twenty-first century [15-17,31].

The Mediterranean Sea, which accounts for 0.8% of the global ocean surface is a biodiversity hotspot and it is home to 4-18% of the world's known marine species. Cascading effects induce changes in fluxes of matter and energy in trophic webs. Due to thermal stress, it has been shown that the entrance of warm and tropical marine aliens to the eastern Mediterranean Sea has increased by 150% after 1998. The speed of alien species spreading in response to global warming is apparently much faster than the temperature increase itself, presenting an important warning for the future of Mediterranean Sea biodiversity. The rising temperature has modified the potential thermal habitat available for warm-water marine species and facilitated their spread. Outbreaks of purple-striped jellyfish, which are predators of fish larvae and their zooplankton, have been observed in recent years [32].

#### *Decreased water resources and safety*

The availability of drinking water in the Mediterranean basin may decrease due to factors including decrease in precipitation, increase in temperature, population growth, rise of sea level and mixing of salted water into groundwater. Dam constructions on rivers also cause water loss [26,27].

In the next 20 years, it is estimated that the Mediterranean population that will be classified as “water poor”, that is, less than 1000 m<sup>3</sup> per capita access to water per year, will exceed 250 million. Water availability in Turkey and Greece may fall below 1000 m<sup>3</sup> per capita per year by 2030. In southeastern Spain and the southern coast of the Mediterranean, water availability may drop below 500 m<sup>3</sup> per capita per year soon and water scarcity may occur. It is estimated that Beysehir lake, Turkey's largest Mediterranean lake, will dry up in the 2040s unless the outflow regime is changed [26,27]. The increase in population will lead not only to an increase in water demand but also to a deterioration in water quality, and the frequency of water-related infections will increase.

#### *Food resources and safety*

Ongoing climate changes, environmental and socioeconomic variations are also posing a threat to

food security in the Mediterranean region. An increase in pests and mycotoxins on crops in the fields or during storage is expected. By 2050, it is estimated that there will be a 40% decrease in pulses production in Egypt, 12% decrease in sunflower production in Southern Europe, 14% decrease in the production of tuberous plants in Southern Europe, and a significant decrease in olive, grape and vegetable production. Global warming will also disrupt fisheries and aquaculture. It is estimated that more than 20% of fish and invertebrates in the eastern Mediterranean will become extinct [23].

### Impact of climate change on human health in the Mediterranean region

The pathways by which climate change affects health, and concurrent direct-acting and modifying (conditioning) influences of environmental, social, and health-system factors are described in Figure 2 [31]. Climate change impacts are also reported in mental health, cardio-respiratory diseases, and occupational health, but due to the scope of this mini review we focus on infectious diseases or closely related matters like food and water.

Climate change can impact human health both directly and indirectly (Table 1). The direct effects are related to extreme weather events such as heat waves, droughts, cyclones and tropical storms, for which empirical data are readily available and correlations are easily demonstrable [33]; whereas the secondary effects

are associated with the decline in the ambient air quality, food and water safety, changes of ecosystem diversity and their impacts on infectious disease diffusion relevant to human health [34].

Climate change not only has direct impacts on human health (e.g., through injuries and illness from extreme weather events), but also threatens the capacity of health systems to manage and protect population health (e.g., through the vulnerability and reliability of infrastructure or critical services). Health systems should therefore be increasingly strengthened to be efficient and responsive to improve population health in unstable and changing climate. Therefore, the World Health Organization (WHO) supports countries in increasing the climate-resilience of their health systems by providing direct support through projects on climate change and health, and through the generation of guidance for multiple areas of work that contribute to the overall functioning of health systems [35].

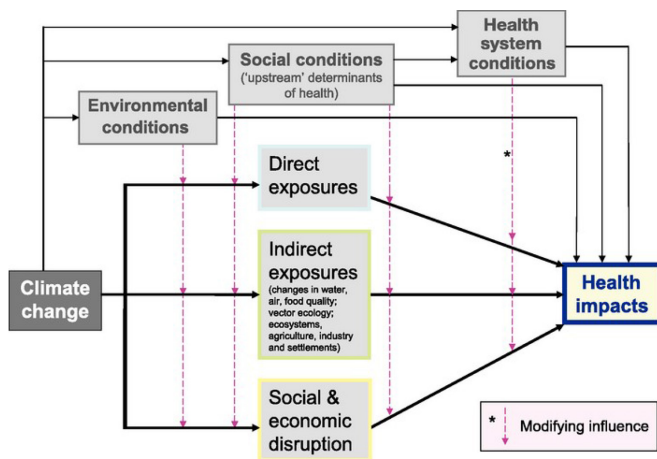
#### The direct effects of temperature increase and air quality on human health

Increasing air temperature can negatively affect human physiology. In this regard, an increase in deaths from respiratory or cardiovascular complications during hot nights was recorded in Barcelona, and in France during the severe heat wave in the summer of 2003, especially among the elderly individuals [36,37]. In a study in Cyprus, Heaviside *et al.* reported that 1 °C increase in the daily maximum temperature would cause 2-fold increase, and a 5 °C increment would cause an almost 8-fold increase in heat-related mortality [38]. Personal injuries, allergies and asthma, mental health problems and exposure to toxic chemicals are also among the direct effects of bad quality of the air due to climate change [34].

#### Increased prevalence of infectious diseases

The effects of climate change on ecosystems and vector populations, depletion and deterioration of water and food availability, human migration, population growth on seacoasts and in endemic areas for infections, waterborne bacteria spread through floods, fungal spread due to temperature increase and drought, increase of temperature at sea surface, and the geographic expansion of the *Vibrio* species due to the increase in water and salinity could change the prevalence of infectious diseases [39,40]. According to a report from WHO, in 2020, 10 major outbreaks occurred in the Eastern Mediterranean countries including poliomyelitis in Afghanistan and Pakistan, chikungunya in Somalia and Sudan, cholera in Somalia

**Figure 2.** Schematic diagram of pathways by which climate change affects health, and concurrent direct-acting and modifying (conditioning) influences of environmental, social and health-system factors.



Reproduced with permission from IPCC Fourth Assessment Report: Climate Change 2007 ([https://archive.ipcc.ch/publications\\_and\\_data/ar4/wg2/en/figure-8-1.html](https://archive.ipcc.ch/publications_and_data/ar4/wg2/en/figure-8-1.html)) [31].

and Yemen, dengue fever in Pakistan and Yemen, diphtheria in Sudan and Yemen, Crimean-Congo, hemorrhagic fever in Afghanistan and Pakistan, chickenpox in Pakistan, Middle East respiratory syndrome (MERS) in Saudi Arabia, and viral hemorrhagic fever in Sudan. More than 430,000 cases and 400 associated deaths were reported from these 10 outbreaks. The WHO declared that these countries must be supported for building capacities to prevent, detect and treat these infections due to the potential global spread [41].

#### *Vector-associated infections*

Climate change has effects on the breeding conditions, behavior, and population of vectors. Small changes in temperature can have large effects on disease dynamics, and global warming has changed the epidemiology of endemic mosquito-borne diseases. Fresh water pools are necessary for the development and continuation of the mosquito's life cycle. An increase in temperature may affect both mosquito density and its bite rate [42]. West Nile Virus (WNV) infections transmitted by *Culex* mosquitoes have been spreading in the United States since 1999 [43]. As a result of climate change, Zika, chikungunya, dengue and yellow fever, which were not observed in the last century, have re-emerged [44,45]. The primary vector for these infections is *Aedes aegypti*. Although this species is distributed along broad tropical and subtropical areas, it has been detected in the Mediterranean Sea area as well. On the other hand, *Aedes albopictus*, one of the vectors for chikungunya, dengue fever, and Zika is spread in a much larger geographical area in the world, including the Mediterranean. This shows that *Aedes* spp. distribution is affected by climate and geographical features [45]. The rapid spread of the West Nile Virus in the United States and Europe and the entry of Zika virus into the Caribbean and Central and South America reflect the speed with which mosquito-borne viruses are settling in new areas [45]. On the other hand, dengue cases have been reported in Croatia, France, Greece, Italy, Malta, Portugal, and Spain. Chikungunya outbreaks were reported during the hot summer of 2017 in France and Italy. It is estimated that the West Nile Virus infections will become widespread in Mediterranean countries [44,45].

It is known that ticks can survive for 2-3 years due to their ability to be protected from high surface temperatures, heavy rains, and long lifespans by entering the soil. Lyme disease is the most common tick-borne disease worldwide, while other tick-borne diseases include anaplasmosis, babesiosis, ehrlichiosis,

Powassan virus disease, and Rocky Mountain spotted fever followed by tick-borne encephalitis and tularemia [46]. In recent years, it was determined that the scapularis tick spread gradually from the United States to Canada, and this situation was associated with an increase in temperature [46].

Visceral leishmaniasis infection is endemic around the countries on the northern rim of the Mediterranean basin like Spain, France, Italy, the Balkan sub-region, and Greece. Generally, leishmaniasis occurs in rural areas and dogs have an important role in the life cycle of vectors. Changes in temperature, rainfall and humidity have strong effects on sandfly vectors and reservoirs of rodent hosts. In a study conducted in Sicily, between 2013 and 2020, 467 human leishmaniasis cases were reported, among which 71% were cutaneous and 29% were visceral cases. The largest number of patients were observed in Agrigento (45.4%) and Palermo (37%). *Phlebotomus perfiliewi* was the dominant sandfly vector species of the disease in Sicily (68.7%). This study emphasized the importance of leishmaniasis control, surveillance, and prevention in the Mediterranean Region [47].

#### *Water and foodborne infections*

The most frequent bacterial infections spread through contaminated food and water are salmonellosis, shigellosis, *Campylobacter*, and *Escherichia coli* diarrhea, yersiniosis and viral infections due to norovirus and rotavirus [49]. These diseases can also be transmitted in humans due to unhygienic practices. In this regard, the frequency of water-borne infection outbreaks has recently increased because of climate warming and the contamination of water resources with animal wastes due to floods [49]. During 2019, 457 norovirus associated foodborne outbreaks and 11,125 related illnesses were observed in the European Union (EU). During the same period, 51 outbreaks associated with the consumption of food from non-animal origin including leafy green vegetables, olives, tomatoes, cucumbers and radish sprouts were reported. The most common causes of these infections were norovirus (14 outbreaks) and *Salmonella* (12 outbreaks) [49].

#### *Other emerging viral infections*

Climate change has changed the geographical distribution of animal and human populations, and habitats. It has changed the genetics of animal pathogens with the driving force of ecological and evolutionary pressures [39]. In the last 20 years, the spread of an animal coronavirus to humans has been observed three times. Humans have been faced with

severe acute respiratory syndrome coronavirus 1 (SARS-CoV) from civet cats, Middle East respiratory syndrome coronavirus (MERS-CoV) from camels, and the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) pandemic from a bat species, possibly transmitted through an intermediate mammalian host [39]. Hendra virus, which is also caused by bats, can spread to horses, and can infect humans, with a mortality rate of 50-75 % in humans. Epidemiological models have predicted that the geographic spread of Hendra virus will expand under the pressures of climate change [50].

#### *Increased prevalence of fungal infections*

*Candida auris* is a yeast that first existed in the environment. It was first isolated in 2009 in a human ear. Since then, this fungal agent exhibiting non-susceptibility to antifungal agents emerged independently in three continents simultaneously and led to human disease in many countries [51]. The global warming emergence hypothesis suggested that *C. auris* became pathogenic in humans because of thermal adaptation in response to climate change. The studies about the impact of heat stress on fungi reported that higher temperatures have led to rapid genetic changes in *Cryptococcus* species and are responsible for the increased prevalence of its infections [51].

#### *Antimicrobial resistance*

Recent evidence suggests that global temperature changes are also associated with antimicrobial resistance. Interestingly, the increase in temperatures directly affects bacterial growth, survival, and adaptation. Mac Fadden *et al.* explored the role of climate (temperature) and additional factors on the distribution of antibiotic resistance across the United States. They developed a large database of antibiotic resistance patterns across different geographic regions using antibiotic resistance indices generated from information sourced from hospitals, laboratories, and surveillance units for the years between 2013 and 2015. They indicated that increasing local temperature as well as population density were associated with increasing antibiotic resistance in common pathogens. They have also demonstrated that an increase in temperature of 10 °C across regions was associated with increases in antibiotic resistance of 4.2% for *Escherichia coli*, of 2.2% for *Klebsiella pneumoniae*, and 2.7 % for *Staphylococcus aureus* [52].

## Conclusions

Climate change events such as heat waves, drought, floods, and cyclones are major problems that threaten the populations worldwide. The Mediterranean region presents a typical example witnessing a dramatic change in climate events and their adverse impact on biodiversity, ecosystems and public health are multiple. This negative impact is in part due to the geographical particularities, and sociocultural and geopolitical conflicts that are progressively worsening the burden of climate change. Indeed, these changes led to rise in sea level and temperature, acidification of oceans, changes in marine and terrestrial ecosystems, forests wildfires, reduction of food and water resources and deterioration of security in areas of conflict. In addition to the direct effects of climate change, human migrations due to wars, economic crises, drought, flood, and storm damage may raise the incidence of infectious diseases, increase the incidence of vector-borne, waterborne, and foodborne infections, fungal infections, and antibiotic resistance.

While most of these changes cannot be totally avoided, many of the health risks related to climate change could be monitored. This can be done by establishing health systems with policies to reduce and prevent the risks of infectious diseases and to recover and support the affected areas, which may identify priority and management of high-risk events. In this regard, the role of experts in monitoring and identifying changes in the epidemiology of infectious diseases is crucial. Most importantly, state authorities, international institutions, and governmental and non-governmental organizations may play an important role in acting towards climate change mitigation.

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## Annex – Supplementary Items

### Supplementary File 1. Signatories of the Mediterranean Convention of Human Rights at Palermo (Italy): 19<sup>th</sup> March, 2022.

Kheit Abdelhafid - Comunità islamiche di Sicilia (Algeria); Emiliano Abramo - Comunità di Sant'Egidio (Italy); Farid Adly - Associazione Culturale Mediterraneo (Italy); Fabio Alberti - Comitato Nazionale “Un ponte per” (Italy); Souad Alwahidi - Observatory on gender in crisis (Libia); Roberto Ammatuna - Sindaco di Pozzallo (Italy); Giacomo Anastasi - Centro Mediterraneo La Pira (Italy); Ibrahim Anber Wissam - Organization for Human Development (Iraq); Foad Aodi - Uniti per Unire – AMSI - UMEM (Italy); Kareem Batool – Università Al-Mustansiriya (Iraq); Mario Boffo - Ambasciatore (Italy); Rafik Boujdaria - Univ. Al Manara (Tunisia); Valentina Brochi – Associazione Rondine Cittadella della Pace (Italy); Francesco Cacciatore - Sindaco di Santo Stefano Quisquina (AG) ALI – Lega Autonomie Italiane (Italy); Salvatore Cacciola - Rete Fattorie Sociali Sicilia (Italy); Salvatore Cherchi – ISPROM – Istituto di studi e programmi per il Mediterraneo (Italy); Claudio Conti - Associazione culturale Humaniora (Italy); Salvatore Corveddu - Sindicalista (Italy); Flavia Cultrera - Società Cooperativa Sociale Onlus “Foco” (Italy); Tuba Dal - Scuola di Medicina Università di Ankara (Turkey); Vincenzo Di Dato - Xerdan Ltd. (Malta); Antonio Diana - Sindaco di Stintino (Italy); Karam Faiyad - Fede e Luce (Siria); Alessandro Fishman Rotmensz – Militante pacifista (Italy); Marilina Fogarizzu - ASD IOLAUS (Italy); Alfio Foti - Coordinatore del Progetto “Convenzione dei Diritti nel Mediterraneo” (Italy); Javier Garaizar -Univ. dei Paesi Baschi (Spain); Liliane Ghanem - Bada'el - Association Ecologia (Libano); Michelangelo Giansiracusa - Sindaco di Ferla (Italy); Concetta Giaquinta - Vicesindaco di Monterosso Almo (Italy); Gaetano Giunta- Fondazione di Comunità di Messina onlus (Italy); Malek Grari - Haouaria - Governatorato di Nabeul (Tunisi); Mamdouh Habashi - Arab & African Research Center del Cairo (Egitto); Karim Hannachi - Università Kore – Enna (Italy); Ekram Hassouna - Comune di Mahdia (Tunis); Maria Iozia Edgardo - Associazione Melitea (Turkey); Mohammed Isayed - Comune di Gerico (Palestina); Francesco Italia - Sindaco di Siracusa (Italy); Jawad Kobeissi – Scrittore (Francia); Enrico La Rosa - Associazione Culturale OMeGA (Lebanon); Antonio Liotta - Medinova - (Italy); Gianni Liviano – Associazione Sentinelle – Taranto (Italy); Lavinia Lo Faro - Associazione Trucioli - Ecomuseo del Castagno (Italy); Habib Maalouf - Associazione Libanese per l'Ambiente e Sviluppo (Lebanon); Hassan Maamri - Circolo Arci Amari – Caltagirone (Italy, Morocco); Gerolama Maddau - Associazione Il Tempo della Memoria – Stintino - (Italy); Filippo Maritato - Movimento di Volontariato Italiano - Federazione Provinciale – Caltanissetta (Italy); David Mascali - Presidio Partecipativo del Patto di Fiume Simeto (Italy); Attilio Mastino - Scuola Archeologica di Cartagine, Storico (Italy); Renato Meli - Fondazione San Giovanni - Ragusa (Italy); Silvana Melli / Giovanni Rossetti - Cantiere di Comunità - Taranto (Italy); Luisa Morgantini - Associazione “Assopace Palestina” (Italy); Guadalupe Murillo – Solidaridad Sin Fronteras (Spain); Rosario Musmeci APS Camperisti Torres (Italy); Marianna Nicolosi - Associazione Cultura è Progresso (Italy); Jerzy Norel - Ordine dei Frati Minori Conventuali - Assisi (Italy); Maria Adelaide Novembre - In Sardegna: Sport, Cultura e Territorio (Italy); Yilmaz Orkan - Comunità Kurda in Italia – UIKI ONLUS (Kurdistan); Leoluca Orlando - Comune e Città metropolitana di Palermo Anci Sicilia (Italy); Salvatore Pagano - Sindaco di Monterosso Almo (Italy); Antonio Palumbo - Sindaco di Favara (Italy); Tonino Perna - Vicesindaco di Reggio Calabria (Italy); Riccardo Petrella - Agorà degli abitanti della Terra (Italy); Franco Piro - Associazione “Rivediamoietermini” – Termini Imerese (Italy); Pietro Piro – Fondazione Don Calabria (Italy); Azis Pollozhani - Mather Teresa University - Skopje (North Macedonia); Salvatore Quinci - Sindaco di Mazara del Vallo (Italy); Don Carmelo Raspa - Biblista Diocesi di Acireale (Italy); Mimmo Rizzuti - Forum italo-tunisino per la cittadinanza mediterranea (Italy); Fabio Rocuzzo - Sindaco di Caltagirone (Italy); Lavinia Rosa - Associazione “Ponti Non Muri” (Italy); Claudio Rossi – Università La Sapienza-Roma (Italy); Salvatore Rubino - Centro Studi sulla Civiltà del Mare (Italy); Fabio Ruvolo - Coop Sociale Etnos (Italy); Sebastiano Scaglione - Passwork - Impresa sociale scs onlus - (Italy); Giovannella Scifo - Casa delle culture – Scicli (Italy); Benedetto Sechi - FLAG Nord Sardegna (Italy); Riccardo Sirri / Yousef Hamdouna – Educaid (Italy); Hamouda Soubhi - Forum marocain des alternatives sud (Morocco); Ibrahim Spahic - International peace centre/Sarajevo winter (Bosnia Erzegovina); Suor Arta Suli - Istituto Superiore Lezha (Albania); Manuela Tedesco - Casa della Comunità Speranza – Mazara del Vallo (Italy); Vittorio Teresi - Centro studi Paolo e Rita Borsellino, Palermo (Italy); Alexandros Touloumtzidis - Rete (iED) - Larissa (Greece); Hannah Treves Shulamit – Militante pacifista (Italy); Esmeralda Ughi - Museo della Tonnara di Stintino (Italy)- Antonella Valmorbida - European Association for Local Democracy) – ALDA (France); Fabio Venezia - Sindaco di Troina (Italy); Emanuele Villa – Associazione Un'altra storia (Italy); Karsten Xuereb - Inizjamed - Associazione Culturale del Mediterraneo (Malta); Abdulbadia Yaseen Mahmoud - Iraqi Social Forum (Iraq); Amir Younes – Popoli News (Egitto); Jamal Zakout - Centro di ricerca e studio Al-ARD (Palestina); Ambra Zambenardi - Università di Torino (Italy); Naila Zaqout - Women and human rights Activists (Palestine); Mihallaq Zilexhiu – Università di Tirana (Albania).