Climate Change in the Mediterranean

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Due to its geographical location, the Mediterranean region is one of the areas in the world that is most vulnerable to climate change. A 2°C rise in global temperature will most likely bring about a warmer, more variable climate in the Mediterranean region, with an increase in water scarcity, particularly in the summer, more forest fires, a decrease in crops, a drop in tourism and the extinction of species.

Climate change is a reality that even the most sceptical would not dare to question. Since the beginning of the 21st century, we have endured extreme climatic events more frequently and with greater intensity. For the first time a hurricane—Hurricane Vince—reached the Mediterranean region and landed on the southwestern coast of Spain. Tropical storm Delta then hit the Canary Islands causing severe damage. A significant trend has been observed in the increase in droughts in the Mediterranean and Sahel. Beyond our borders, the greater frequency and intensity of hurricanes in the Gulf of Mexico—twice as many as there were 30 years ago—has left a trail of destruction and death.

It is thus not an isolated phenomenon but rather the culmination of a trend that has been occurring in recent years and about which scientists have been warning us for more than twenty years.

Climate Change

History of life on Earth goes back approximately 3,800 million years and humanity is a very recent guest, appearing at the end of the last million years. If we were to use a fast camera capable of compressing time since the Earth was formed—some 4,500 million years ago—into a one-year period, we would see that man appears ten minutes before the end of the year and the industrial revolution and our technological era would appear in the last 13 seconds. However, in such a short period of time we have deeply affected the system that sustains us, to the extent that we are even changing the climate.

The alterations we are inflicting upon the Earth in such a short period of time are producing an impact with catastrophic consequences for human populations. Extreme climatic events are increasing in frequency and severity and scientists are warning us that if we do not implement urgent measures we may find ourselves heading down an irreversible path of much more drastic changes with even greater catastrophic consequences, particularly if the increase in the planet's global temperature is more than 2°C above pre-industrial temperatures.

We are releasing enormous amounts of CO_2 into the atmosphere by burning fossil fuels—coal, petrol and gas—for the production and use of energy. CO_2 is the main gas responsible for the greenhouse effect, that is, it "traps" heat in the atmosphere and produces a rise in the planet's global temperature, 0.7°C in the last century, the highest rise in 10,000 years.

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Impact of Climate Change in the Mediterranean

The physiognomy of the Mediterranean region is a combination of its geographical conditions and culture that has adapted to these conditions over centuries for its development. The Mediterranean's resources are inseparably linked to its climatic characteristics. A hot and dry summer climate combined with 45,000 km of coastline has turned the region into a leading tourist destination, attracting 30% of world tourism. Hot summers and mild, rainy winters have enabled agriculture to develop as an integral part of the region's economy. Furthermore, around one hundred million hectares of woodland cover the entire Mediterranean basin, supporting considerable biodiversity.

Today, this natural wealth is under significant pressure—from population and the current development model—that climate change could make even worse. To ascertain the impact of global warming in the Mediterranean, WWF commissioned a study to a team of scientists from the region—Christos Giannakopoulos, Marco Bindi and Tina Tin—with the aim of finding out how the Mediterranean region's climate would change if global temperature rose 2°C over pre-industrial temperatures, and determining the impact on water resources, forest fires and biodiversity, as well as on the region's main economic sectors: agriculture and tourism.

The analysis is based on the global climate model of the Hadley Centre in the United Kingdom and on the A2 and B2 emission scenarios of the Intergovernmental Panel on Climate Change (IPCC). It has also considered climate information based on temperature, precipitation and wind. The study focuses on the period between 2031-2060, when global temperature is expected to reach 2°C above pre-industrial levels. It then goes on to summarise the main impacts that a 2°C rise in global temperature are likely to have on the Mediterranean region.

Heat Waves: With a 2°C rise in global average temperature over pre-industrial levels, the climate in the Mediterranean region will be warmer, drier and more variable. The annual average temperature in the region could increase by 1-2°C over current conditions. However, inland in countries such as Turkey, northern Italy and the Maghreb, far from the moderating effect of the sea, maximum temperatures could rise up to 5°C. Heat waves and extremely hot days are expected to increase, especially in inland areas, but even the north Aegean islands, with their sea breeze, are expected to endure two more weeks of heat waves a year.

Decreased Rainfall: Annual precipitation is likely to decrease up to a fifth in the southern Mediterranean, while summer rainfall in the northern Mediterranean may decrease over 30%. The study suggests that there will be a shift in drought periods and that they will last longer. The number of dry days will increase and rainfall is likely to be concentrated in short periods of time, which may lead to storms in Italy, western Greece, the south of France and the north-western part of the Iberian Peninsula.

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Fires: A 2°C global warming will lead to a greater risk of forest fires practically throughout the year in the southern Mediterranean. In almost the entirety of the rest of the region, the fire risk period is expected to be an additional one to six weeks. Extreme fire risk will probably increase an additional month in the Iberian Peninsula, northern Italy and the Balkans, putting greater pressure on local nature, including various species of animals that are already in danger of extinction.

Agriculture: A hotter and drier climate will also lead to a decrease in agricultural yields, particularly in summer crops that are not irrigated. Beans, soybeans and lentils are among the most affected crops in the region, with an up to 40% drop in yields, depending on the location. The impacts are not evenly distributed: the decrease in yields will be more severe in the south than in the north of the Mediterranean. Throughout the region, agricultural strategies could generate an increase in crop yields that are more resistant to the warmer and drier climate. However, such strategies could require up to 40% more water for irrigation, which may not always be available with a 2°C warming.

Tourism: A greater frequency in heat waves and droughts will probably discourage summer holidays in the Mediterranean region. Tourists may prefer

INTERCONTINENTAL BIOSPHERE RESERVE OF THE MEDITERRANEAN, ANDALUCIA (SPAIN)/MORROCCO

In October 2006, the UNESCO Bureau for the Man and the Biosphere Programme established by unanimous vote the Intercontinental Biosphere Reserve of the Mediterranean on a proposal by the Council for the Environment of the Junta de Andalucia and the Kingdom of Morocco.

UNESCO highlighted that this conservation programme is a pioneering initiative involving two countries located in different continents that have different social and economic conditions. Moreover, this is the first time that a marine transition area is established as a reserve, which comprises a system of reserves that include the Sierra de las Nieves and the Sierra de Grazalema, both already classed as Biosphere Reserves.

With a total area of one million hectares and located on both shores of the Mediterranean, the reserve includes some of the most emblematic natural spaces of the Spanish provinces of Cádiz and Málaga as well as those in four provinces of northern Morocco: Tangier, Tetouan, Larache and Chefchaouene; it is also expected to have an impact on nine other provinces in this country.

The area comprises various Eastern Mediterranean ecosystem types which are of great importance for the conservation of the world's biodiversity and offers great opportunities to carry out tests and some innovative interventions and activities relating to sustainable development. In addition to the natural parks of the Sierra de Grazalema and the Sierra de las Nieves, the Intercontinental Biosphere Reserve of the Mediterranean also comprises two natural parks in the Andalusian territory, four natural spaces, three Natural Monuments, and 11 sites proposed as Community Interest Sites. The sector located in northern Morocco comprises 18 natural spaces: eight continental Sites of Biological and Ecological Interest (SBEI), such as the Talassemtane National Park, and 10 coastal SBEIs.

The project aims to contribute to the conservation of natural resources by aiding the development of the SBEI network in northern Morocco, consolidating the Andalusian Natural Spaces Network (RENPA) and promoting a sustainable use of resources to the benefit of local populations. Moreover, it encourages a shared use of tools for the management and coordination of human and natural resources. The reserve is to bring benefits to both regions as it will ensure conservation and a sustainable use of its shared natural resources by establishing sound management principles and by fostering and supporting participation along with the social and economic development of rural communities.

The new reserve also provides a unique opportunity for cooperation between Andalusia and Morocco, which may bring positive economic developments for northern Morocco, for maritime traffic, fishing and tourism. The Project also envisages the creation of a nature interpretation centre in northern Morocco, a training scheme for tourism professionals, the introduction of a quality seal for local products, as well as the development of tourist facilities and rural development groups.

The project proposal for this reserve was drafted between 2003 and 2006 under the aegis of the Council for the Environment of the Junta de Andalucia with the cooperation of Morocco's High Commission for Water, Forests and Combating Desertification, and the UNESCO MAB programme through its Spanish and Moroccan national committees along with the Andalusian committee. The Project is based on the MAB program of UNESCO and the Interreg III Community Initiative Programme which aims to strengthen social and economic cohesion throughout the EU and foster cross-border, transnational and interregional cooperation with the goal of promoting conservation and a sustainable use of resources by local populations. The programme has a budget of 3.7 million euros, 75% of which are financed through the FEDER funds.

Sources: www.iucn.org, www.juntadeandalucia.es, www.mma.es

MAP 2 **Geographical Area of the Intercontinental Reserve of the Mediterranean**

Source: Council for the Environment of the Junta de Andalucia.

to bring forward or delay their summer holidays or even decide to go elsewhere. The possible reactions of the tourism industry would be to discourage Mediterranean summer holidays and try to make it a destination in spring and autumn.

Water: A drier climate with reduced rainfall and surface runoff, and a rise in demand from the agricultural sector, will worsen the already high level of water stress in the region. A 1°C increase in temperature could lead to a reduction of 5 -14% in water yields in Spain, while a similar rise in Algeria would probably lead to a water demand that exceeds available water resources by 800 million m^3.

Heating and Cooling: As is to be expected, heating requirements will probably decrease in the north. However, cooling needs will increase in other parts

of the region, especially in the south. In the south of the Iberian Peninsula and along the entire southern Mediterranean coast to Syria, an additional month of heavy cooling will be required. With increasingly dry years, there will be less hydroelectric energy available and the problem will worsen if the energy deficit is covered with fossil fuels.

Biodiversity Studies: warn us that a 3.6°C warming could lead to a loss of over 50% of plant species in the northern Mediterranean, with a loss of over 80% in northcentral Spain and in the mountains, particularly in France. A greater fire risk as a result of a warmer and drier climate will also encourage the spread of invasive grass species, which in turn could lead to more frequent and more intense fires.

Health: Climate change has a direct and indirect impact on human health. A shorter period of frost and a longer warmer period would bring about an expansion of infections that are transmitted by animal vectors, such as malaria and dengue, which are transmitted by mosquitoes and require specific temperature and humidity conditions to survive. A rise in temperatures also accentuates other illnesses such as allergies, which are a consequence of an increase in pollen and spore concentrations.

Today's Actions Determine Tomorrow's Climate

The good news is that we are still in time to mitigate this important problem. To do so, it is essential and urgent to decrease emissions and set up adaptation measures to avoid the worst consequences of climate change. It is very important to keep global temperature below the 2°C rise since pre-industrial levels, which requires: industrialised countries to comply with their commitments under the Kyoto Protocol and adopt reductions of around 30% by 2020 and 80% by 2050; developing countries to control their emissions and directly adopt clean technologies with the help of wealthy countries, which must transfer technologies and resources; the replacement of the current energy model that is greatly responsible for greenhouse gas emissions that cause climate change.

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The Cost of Not Taking Measures Will Be Even Greater

It is frequently said that the measures to combat climate change have a cost, but that not taking them has even greater costs, both in economic terms and in loss of human lives. The Stern Report, published in October 2006, reached the conclusion that the cost of inaction could be 5 -20% of the annual global GDP, while acting could limit such a cost to 1%. It also warns that a delay in implementing measures increases both the danger and the cost.

Bibliography

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