Module 2

Environment: The Case of Tunisia

The environment, as it is the area that we are living in, has to be preserved from any kind of pollution for present and future generations.

Unfortunately, this is far from the real situation. In fact, our environment is facing various sorts of pollution that could be qualified as local or global. Let's start with local examples of pollution. In many cities of the world, swimming in the sea is a leisure activity. This is not the case in Monastir Bay in Tunisia. In fact, this coastal city which in the past was famous for its wonderful sea, is now called the "Triangle of Death" due to the sanitary problems. Fish and humans have recorded health problems because the sea has become a toxic dumping site of raw effluents from mainly two wastewater treatment plants (median O_2 concentration: 12% instead of 90%). These two plants discharged their effluents directly in the sea and sometimes even without any treatment.

The fauna of fish, crabs and octopus lying on the sand in the sea became white and red which is a sign of contamination so there is no more fishing, an activity that was helping some poor families living there. This pollution affected also the atmosphere and the groundwater through the proliferation of green alga which are emitting a major quantity of hydrogen sulfide affecting people's health. As a result, the city has recorded the highest cancer rates. The local inhabitants decided to force the closing of the two treatment plants but this is not a complete solution as the industries (local and mostly international) are still working and still discharging different sorts of pollutants.

Another case of local pollution is illustrated by the threat of a cholera epidemic on Djerba Island better known as the "Island of Dreams", which is located in the southern part of Tunisia, where dust and massive waste were not being removed for months. The air pollution and waste that existed near hotels and houses made the place not fit for tourist activity but a favorite place for insects and mosquitoes.

Also, the city of Gabes, in southern Tunisia, is living an "urban genocide" since the dumping of pollutants by the Tunisian Chemical Group. In fact, the production of fertilizers created the dangerous by-product of phosphogypse, estimated at 8 million tons a year. Consequently, cancers, asthma and osteoporosis are affecting the health of almost 300,000 persons and a diverse assortment of pollution has emerged as shown in Table 1. Can we consider this outcome as a natural consequence of

industrialization and a part of sustainable development? Does society have a choice? Everyone wants to have a job and work but what about the cost to human health?

Table 1. Types and intensities of various kinds of pollution in Gabes

Délégation (معتمديـــة)	Population (عدد النّسمة) (INS, 2004)	Types de pollution (أنـواع التّلوّث)			
		P. atmosphérique (التّلوّث الهوائـــي)	P. marine (التّلوّث البحـــري)	P. sonore (التّلوّث السّمعي)	P. visuelle (التّلوّث البصـــري)
Gabès Médina (قـــابس المدينـــة)	47 057				
Ghannouch (غنـوش)	22 681				
Gabès Sud (قـــابس الجنوبيـــة)	61 699				
Gabès Ouest (قـــابس الغربيـــة)	28 289				
El Hamma (الحامة)	62 390				
Mareth (مارث)	61 340				
Matmata Nouvelle (مطماطة الجديـــدة)	15 969				
Matmata (مطماطة القديمـــة)	5 766				
Métouia (المطويـــة)	25 862				
Menzel El Habib (منـزل الحبيـــب)	11 477				

*** Les différentes nuances de la couleur rouge reflètent la variation de l'intensité de chaque pollution par délégation.

*** تعكس مختلف التباينات في اللون الأحمر تغيّر في شّدة كلّ نوع من التلوث بكلّ معتمديّة.

The local fauna is also affected by the number of zoobenthic species that are agressively increasing because of the active work of the Tunisia Chemical Group in that area as shown in Figure 1.

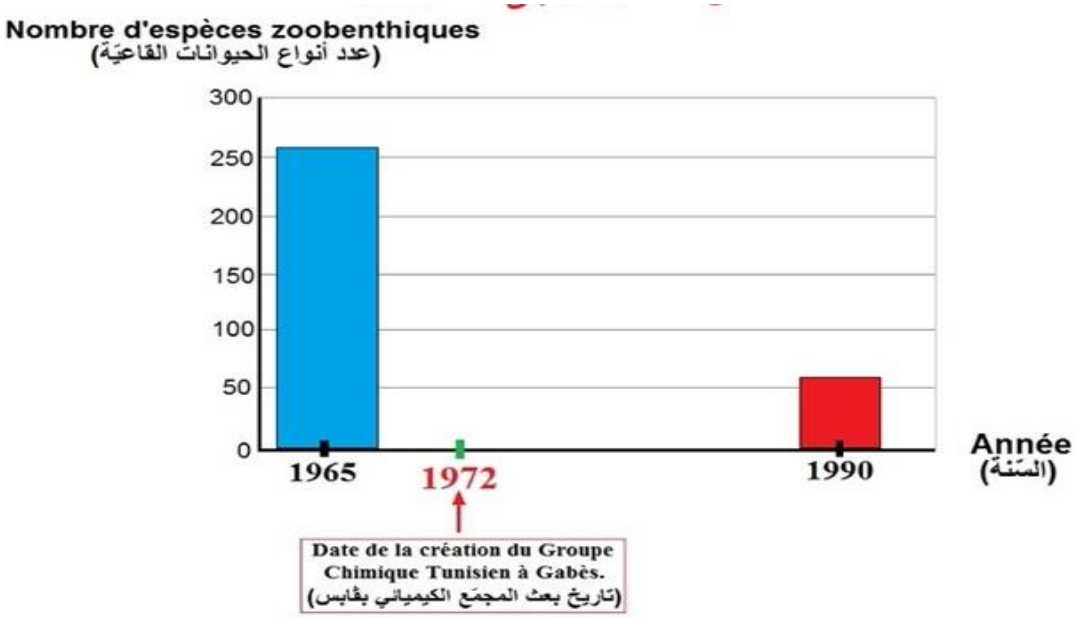

Figure 1. Decrease of the biological diversity in the Gulf of Gabes (1965-1990)

Let's now look at an example of interdependent pollution. The Fukoshima nuclear incident, induced after an earthquake, caused the escape of radioactive elements into the atmosphere and their discharge into sea caused potential threats all the way to China and Korea.

Another example is the eruption of the volcano Eyjafjallajökull in Iceland which caused enormous disruption to air travel across western and northern Europe affecting about 10 million travelers because of the immense cloud formed in the atmosphere.

Let's now focus on climate change, a "force beyond borders". Climate change is caused by human activity that increases air pollution and CO2 concentrations mostly from the industrialized countries (like China, USA, Europe and India as shown in the Figure 2) and it is irreversible.

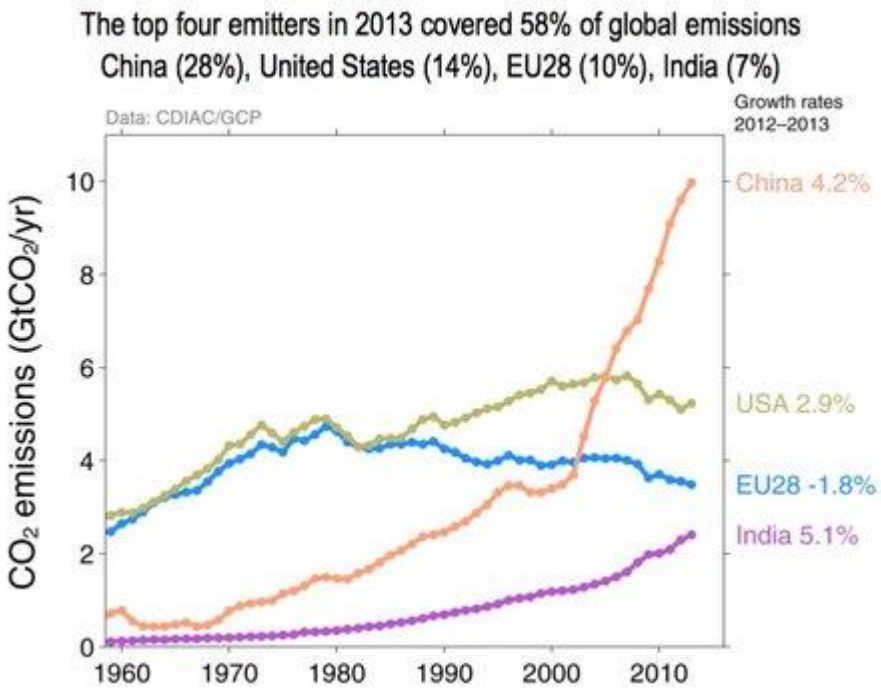

Figure 2. Rates of CO2 emission from a few countries (China, United States, European Union and India)

Climate change is one of the most critical global challenges because to combat it, people will be asked to make hard choices in terms of present personal pleasures in order to prevent the risks for future generations who they will never meet.

All gas emissions of CO_2, CH_4 and N_2O, which are mainly anthropogenic in origin, are released into the atmosphere, which in turn contributes to climate change and global warming.

Global warming can be evidenced through climatic disturbance: summers are becoming hotter. For example, according to NASA, the earth has recently experienced the warmest six months stretch ever recorded.

These climate disturbances will unfortunately lead to changes in flora and fauna. In France, they noted a presence of a summer flower in March instead of June. Consequently, this will disturb the whole ecosystem (insects, pollinators, etc.) and ecosystem functions and services.

The consequence of climate change was also visible recently when 35,000 walruses, all at the same time, took refuge in a beach in Alaska because of the floe melting induced by climatic warming. Margaret Williams, managing director of the World's Wild Fund's Arctic program, said the phenomenon is "another remarkable sign of the dramatic environmental conditions changing as the result of sea ice loss."

A rise in temperature is causing ice to melt essentially at the poles (Annual average Artic sea ice extent has shrunk by 2.7% per decade, with a larger decrease in summer of 7.4% per decade) which will increase the sea level. As a result, many cities and islands are in threat of being totally submerged. The global average sea level rose at an average rate of 1.8 (1.3 to 2.3) mm per year from 1961 to 2003 and at an average rate of about 3.1 (2.4 to 3.8) mm per year from 1993 to 2003 as shown in Figure 3.

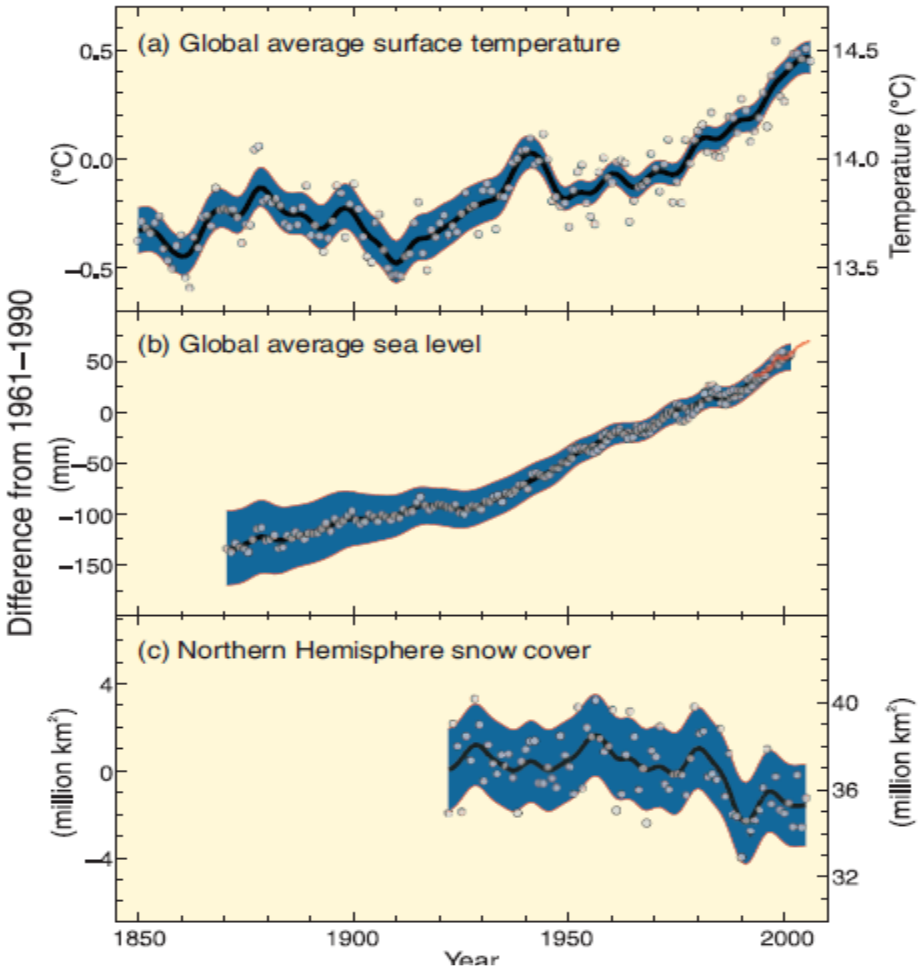

Figure 3. Changes in temperature, sea level and northern hemisphere snow cover

Combined with rising seas and shifting weather patterns, warming and acidification will have significant impacts on global biodiversity, ecological functioning and people (Bindoff et al., 2007; Hansen et al., 2008). Much attention has been placed on coral reefs because they are one of the most vulnerable ecosystems to climate change impacts and because a substantial number of the world's poorest people depend directly on them (Hoegh-Guldberg et al., 2007; Burke et al., 2011). If water temperatures stay higher than usual for many weeks, the zooxanthellae that corals depend on for some of their food and which give corals their color leave their tissue.

Without it, corals turn white and are called bleached. Bleached corals are weak and less able to combat disease.
Concerning Tunisia, specialists really fear that climate change will affect the geological and seismic risks. Additionally, the sea water increases will amplify the coastal erosion process in the northern part of the country. Experts are also forecasting a critical water shortage between 2030 and 2050.

So, climate change is affecting ecosystems, food, coasts, industries, settlements, water and health for the whole world as shown in Figure 4.

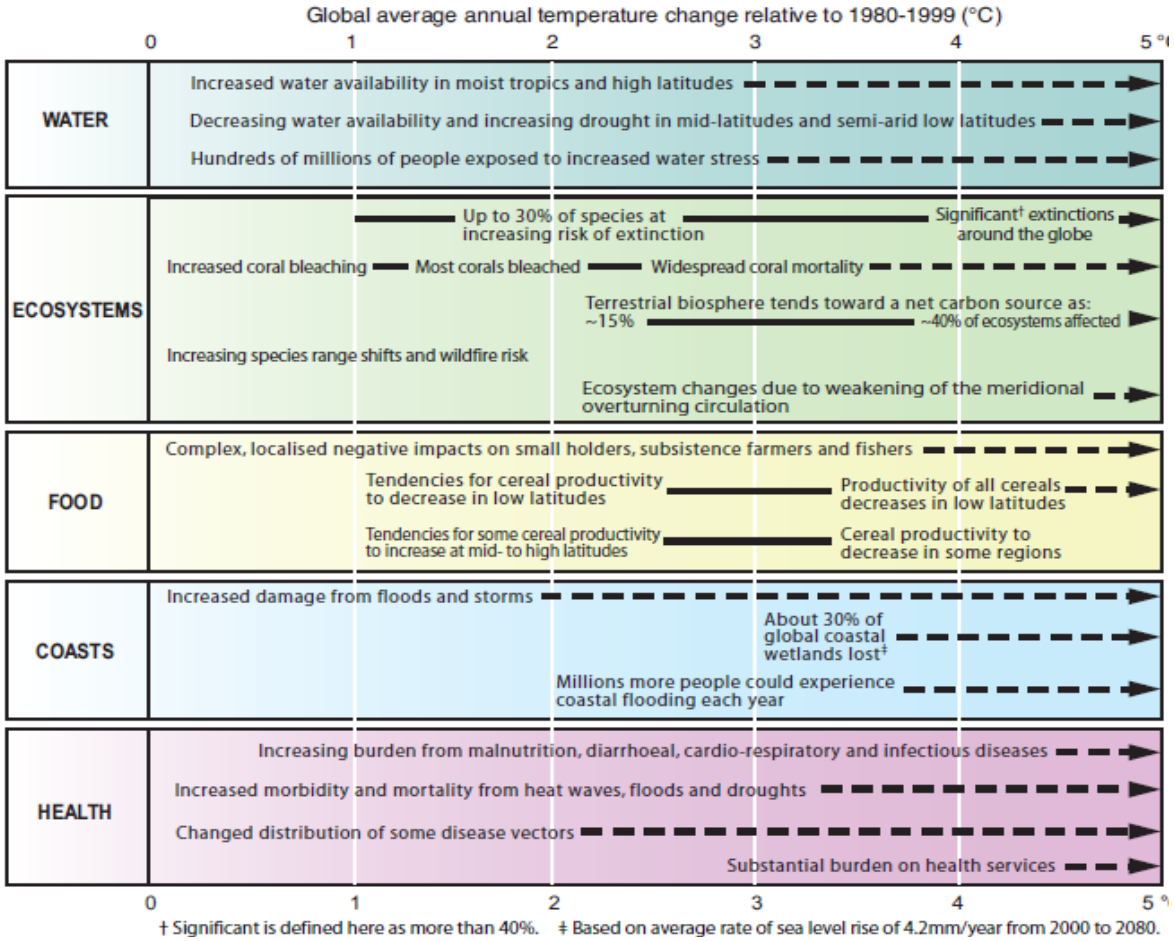

Figure 4. Significant effects of the climate change on water, ecosystems, food, coasts and health

In order to have any chance of managing this challenge, we need to alter our consumption patterns and possibly our way of life. We also need to get inspiration from culture and Islamic values that promote peace and empathy with all living creatures and communities of life (ummam). The local culture in the MENA region which is guided by Islamic teachings believes that if we hurt any living organism,

then we are silencing a community of worshipers since Islam teaches that all living species are in a state of prayers (tasbeeh) (Al-Jayyousi, 2012).

As indicated by Al-Jayyousi (2012) celebrating diversity, living lightly on the earth (Zuhd), limiting waste, pollution (fassad) and overconsumption, and caring and respecting every creation of God (ummam) are necessary measures to mitigate climate change. Other measures to address climate change include:

- **Reducing energy consumption**: The building thermal exchange factor needs to be reduced by choosing a convenient orientation that considers environmental factors in order to reduce energy consumption.
- **Reducing greenhouse gas emissions**: New electric cars are supposed to reduce the greenhouse gas emissions from 10 to 30%. Also, other clean fuels which are from renewable energies could contribute to an 80% reduction in the life cycle. In addition, 50 to 70% of greenhouse emissions are contributed by current agriculture practices which need to be revised.
- **Reducing deforestation:** The destruction of forests that can balance gashouse emissions must be stopped and afforestation, the establishment of a forest, must be enhanced.
- **Reducing waste emissions**: Emissions from waste and wastewater were between 290 and 460 million tons of carbon in 1990 and they are expected to increase as waste is being discharged untreated instead of being treated or recycled.