Desertification in the Mediterranean Region

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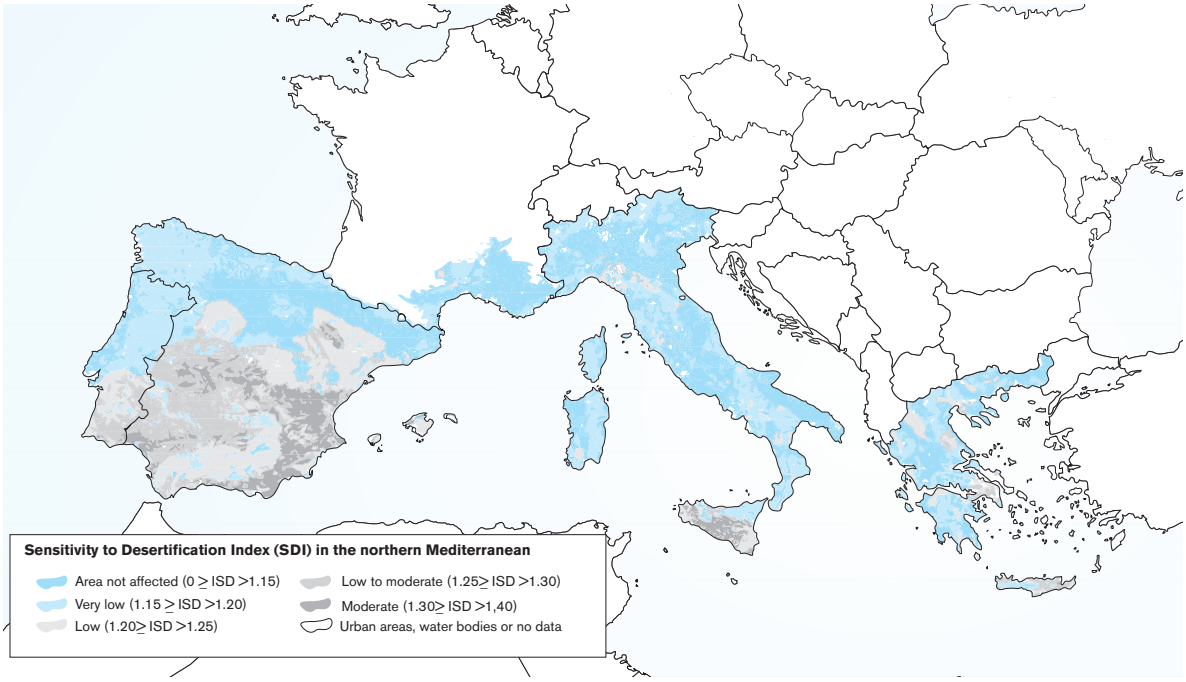
What Is Desertification?

Desertification is a term widely used and poorly understood. Often people confuse it with natural deserts and forget that *desertification* is mostly a human-induced process occurring outside deserts. The term was coined by the French ecologist Auberville, who, in the early 1950s, used it to describe the process of the transformation of tropical forests in Africa into savannahs and, ultimately, desert-like environments. It was not until more than two decades after Auberville's warning that the topic reached the political agenda. This was largely due to the impact of extended drought in the West African Sahel in the early seventies, which brought about the United Nations Conference on Desertification held in Nairobi in 1977. Following the historical Rio Earth Summit in 1992, the UN Convention to Combat Desertification (UNCCD) entered into force in 1996, defining desertification as *a process of land degradation in arid, semi-arid, and dry sub-humid areas of the world that is the result of natural phenomena (e.g. climate variation) and anthropogenic factors*. The outcome of this type of degradation has typically been considered to be either a *persistent* reduction in or loss of both the biological and economic productivity of land and environmental quality. The UNCCD uses the *aridity index* (calculated as the ratio of mean annual precipitation (P) to mean annual potential evapotranspiration (PET)) to define drylands, which include those areas with an aridity index of between 0.05 and 0.65 (excluding polar and sub-polar regions). More recently, the UNCCD has endorsed new terminology that groups desertification, land degradation and drought (DLDD) together. This seems to accommodate better the broad coalition of countries that have signed the convention rather than causing them to shy away from its major focus on drylands. Given the disputable results on the ground, the current prevailing belief is that rather than on "combating desertification," heavy focus should be placed on supporting sustainable land management by promoting best management practices that combine traditional methods with modern technology. The Mediterranean is also affected by desertification, although the intensity of the process varies from South to North and depends on both biophysical and socioeconomic and political contexts. Nevertheless, a complete and accurate estimate of the extent to which desertification affects the region as a whole is lacking, despite the concerted studies and extensive research carried out, especially over the last two decades. It is worth emphasising that, together with two other UN Conventions, specifically those on climate change and biodiversity, the UNCCD is of tremendous importance in the global environmental agenda.

How to Assess Desertification?

Originally, desertification was seen as the expansion of deserts into greener environments (i.e. sand encroachment), and numerous efforts were made to "measure such enlargement" through remote sensing technology or fieldwork, especially in sub-Saharan Africa. But desertification is not straightforward or easy to evaluate, especially in quantitative terms, and a number of indicators are needed. As a *land degradation* process, it has myriad components, in-

MAP 4 **Sensitivity to Desertification in the Northern Mediterranean**



Source: European Environment Agency (2008).

cluding water and wind erosion, salinisation, nutrient depletion, organic soil loss, etc., which together result in the physical, chemical and biological degradation of the land. Human-induced processes, such as overgrazing, deforestation, deliberate forest fires and soil sealing and compaction, exacerbate the intensity of desertification. Often, offsite damage, such as sedimentation, is much greater than onsite damage. When these factors are combined with adverse socioeconomic conditions, the final effects are far more devastating.

The need for better and more accurate assessments of desertification has haunted the UNCCD for the fifteen years since its entry into force and was once again strongly emphasised at the last Conference of Parties (COP9), held in Buenos Aires, Argentina in September 2009. A number of assessment methodologies have been suggested to meet this need, all of which strive to integrate the assessment of desertification through the use of both biophysical and socioeconomic indicators recently summarised as the "dryland development paradigm" (Lambin et al., 2009). However, often major problems do not derive from a lack of methodologies, but rather from a lack of harmonisation and the difficulty of using desertification figures (qualitative or quantitative) to describe areas and regions whose biophysical, socioeconomic and political contexts can differ so widely.

The situation in the Mediterranean is at best *incomplete*. Studies suggest that 30% of semiarid Mediterranean drylands are affected by desertification (Rubio and Recatala, 2006) and that 47% of the region's people suffer these effects (Safriel, 2009). Country studies and estimates do exist, but they either do not always cover the whole national territory or are based on locally developed methods of estimation, thereby creating confusion for regional users, since what might be "severe erosion" in Italy may not be the same in Tunisia and Morocco and vice versa.

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The European Environment Agency's European Topic Centre on Land Use and Spatial Information has produced a map at 1:1 million scale showing the Northern Mediterranean's sensitivity to desertification using a composite evaluation of soil, climate and

relief characteristics but without taking socioeconomic factors into consideration (Map 4). Despite its limitations, such a methodology could be expanded to make at least an initial regional assessment.

Why Worry about Desertification in the Mediterranean?

The Mediterranean region is tectonically active and subject to frequent earthquakes, and Etna is one of the most active volcanoes in the world (hopefully Vesuvius will not wake up!). Soils are relatively young in geological terms and highly vulnerable to erosion, while the climate is characterised by an unequal annual distribution of rainfall with more than 80% falling from October to March, often in the form of torrential rain. Summers are hot and dry, and the topography is often rugged. When one adds the long periods of overgrazing, deforestation and wildfires, one has the "perfect ingredients" for land degradation.

Drylands, as defined by the aridity index, cover 33.8% of the territory of the Mediterranean EU countries (with the exception of France, these countries are all included in Annex IV of the UNCCD). Dryland areas cover about 69% of Spain and 66% of Cyprus, and in Greece, Portugal, Italy and France, this figure ranges from 62% to 16%. The distribution of drylands is quite accentuated in the Southern and Eastern Mediterranean countries, where such lands account for up to 61.3% of the territory of the countries involved. The Southern countries bordering the Sahara and Arabian deserts have hyper-arid drylands (true deserts), semi-arid drylands, and dry sub-humid drylands. In contrast, the Northern Mediterranean countries have semi-arid drylands, dry sub-humid drylands, and non-dryland regions or otherwise humid areas. Overall, there are 30 million ha of semi-arid drylands in the Mediterranean (Rubio and Recatala, 2006).

Other concerns relate to the well-known fact that the availability of fertile soil suitable for crop production in the region is quite limited. This is especially true in the Middle East and North Africa, or MENA countries, where, excluding Turkey, the percentage of agricultural land is only 5%. The situation is critical in Libya (1.2%), as well as in Algeria and Egypt, which both report only 3.4 %, and Jordan, where just 4.5% of the land is fit for agriculture. The rest of the land in these countries is comprised of desert sands, shallow, saline, waterlogged and gypseous soil, and rock outcrops. Additionally, controversial options for agricultural expansion at the expense of forests or pastures (as occurs in the Tropics) are limited or nil in the Mediterranean. Even if land were to be reclaimed for agricultural production, it would most likely be of poor quality and require intensive investments to be or remain productive. Hence, the challenge of sustained agricultural production largely depends on proper use and management of existing land and water resources, which no doubt complement each other better than in any other region in the world. If water availability were to increase in the region, so could the options for growing crops.

Another indicator to consider is the ratio of agricultural land per capita. In general, Mediterranean Europe is blessed with more land suitable for agriculture than the MENA countries (once again excluding Turkey). This ratio is around 0.25 in the MENA region, compared to 0.30 in the Mediterranean EU. In contrast, the population is increasing at a faster pace in the South. Data and predictions for the whole region show that by 2020 agricultural land per capita will stand at 0.22 ha, down from 0.48 ha in 1961. This decrease is mostly due to population growth, but also to desertification and rapid decline of soil quality.

A striking example of this is *soil salinity build-up* compounded by the use of poor-quality water for irrigation. In Egypt, affected areas have grown by more than one million cropland hectares over the last two decades. Salinity and sodicity are also naturally widespread throughout the region, affecting more than 10 million ha, including 3.4 million ha in Spain, followed by 2 million ha in Turkey. Urban areas, especially on the Mediterranean coast or around big cities, have also grown at the expense of fertile agricultural land. The most impressive examples are the cities of Barcelona, Athens, Cairo, Tripoli (Libya), Beirut, Casablanca and many others big metropolises in Spain, Côte d'Azur in France, the islands of Sardinia and Sicily (Italy), Malta and more.

Population Pressure, Tourism, Livelihoods and Desertification

The Mediterranean is home to more than 430 million people, but contains only about 7.9% of the world's agricultural land. The region's population

has increased by 50% over the last 30 years, and the upward trend remains strong, especially in the South, which has registered annual growth of 2.1%. Likewise, urban areas of the MENA region, which are mainly concentrated in coastal areas, have registered annual population growth rates as high as 4%. The population in the South, including Turkey, could reach 300 million people by the year 2020.

The tourism industry has also had a significant impact. According to the outlook for 2025, tourist flows could reach as high as 396 million, nearly doubling the region's population, particularly in summer. A remarkable example is Malta, which has a population of less than half a million but receives about 1.2 million tourists each year. Overall, such high human pressure, along with drastic changes (and occasional mismanagement) in land use, has a direct impact on water and land consumption and the degradation of ecosystem services, thereby accelerating desertification to such a degree that many authors compare the impact of the last 50 years to that of entire past centuries. The tourism industry has moreover played a major role in the overdevelopment of coastal regions, and this has accelerated a special form of desertification known as "littoralisation," while also increasing eutrophication of the Mediterranean Sea.

Desertification should also be seen as a major *environmental security threat* for the region due to its many negative features, which degrade biological productivity, provoking famine and malnutrition and consequently social unrest

Other issues affecting desertification include poverty, income levels, public health and South-North migration flows, which have different consequences for each side. It is likewise worth mentioning that desertification should also be seen as a major *environmental security threat* for the region due to its many negative features, which degrade biological productivity, thereby provoking famine and malnutrition, especially among women and children, and consequently social unrest.

Climate Change and Mediterranean Desertification

There is ample evidence that climate change will impact the Mediterranean in various ways, but all climate models predict that the region will become *drier* and *hotter* and that the intensity of extreme events and drought will increase. Another issue is rising sea levels. In countries such as Egypt, a mere one-meter rise in the sea level could flood an area of 970 km^2 in the Nile Delta, affecting 9% of the country's population and about 13% of its arable land, not to mention causing extensive damage to coastal wetlands. Italy could also lose 6% of its territory, and many of the Mediterranean lagoons may disappear (ISMEA IAMB, 2009).

A typical link between climate change and desertification would be the increase of arid areas at the expense of more humid ones, which will be accompanied by reduced crop productivity. Further on, agriculture could also suffer from a shorter growing season, heat stress during flowering and rain during sowing. Other consequences of climate change include increased erosion and flash flooding, decreased slope stability, and groundwater recharge. Finally, the tourism industry could suffer, too, as tourists may look for cooler destinations.

Learning from the Past and Preparing for the Future

Extensive EC-funded research has been conducted over the last two decades mostly in the Northern Mediterranean. Since the milestone MEDALUS (Mediterranean Desertification and Land Use) project, which ran from 1991-1999 under the leadership of Dr J. B. Thornes, a number of other projects have been carried out. One recent positive example worth mentioning quickly is the Desert-Watch Information System, which the European Space Agency is using as a prototype to help countries outside the Mediterranean meet their UNCCD reporting obligations.

However, one cannot expect to remain in the assessment stage forever, and sooner or later the infamous "Mediterranean syndrome" must come to an end. The need for action on the ground in order to leave behind the era of pessimism is stronger than ever, and the best way to combat desertification is to support *sustainable land management*

(SLM). Studies show that SLM has the potential to increase yields by 30-170%, increase soil organic carbon sequestration by up to 3%, thereby mitigating climate change, and increase water-use efficiency by up to 100%. Technologies such as conservation agriculture, no-till or reduced tillage systems, afforestation and agro forestry, growing halophytes in saline areas, water harvesting, increased water-use efficiency, mulching, controlled grazing and terracing need to be implemented. The Mediterranean is the birthplace of agriculture, and its people have had the ingenuity to build efficient irrigation systems since ancient times, including the amazing, millenary terraces of Cinque Terre in Italy, which still stand today. However, the time has come for sustainable agricultural and rural development in the region, and especially dryland development, to be linked to other economic activities, too, such as eco-tourism, solar energy production (although not at the expense of fertile soil!), aquaculture and perhaps less farming and pastoral activities in areas where the degradation process has reached irreversible levels.

The Mediterranean stands at the crossroads of three continents, and its countries are divided into four different UNCCD Annexes (I, II, IV and V). Some are considered to be affected by desertification, while others are considered to be both affected and donors (Annex IV). Given this unique case, the Secretariat of the Union for the Mediterranean might consider creating a special unit within the organisation's Division of Environment and Water to ensure more harmonised, regional coordination of country focal points not only under the UNCCD but also under other UN conventions, such as those on climate change and biodiversity. In short, desertification, together with inefficient and inequitable use of water, exacerbates hardship and political instability, and solutions to these problems are still pending.

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