CHAPTER 4

SUSTAINABLE DEVELOPMENT OF LAND RESOURCES

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The Mediterranean region and in particular the Middle East and North Africa (MENA) are characterised by the scarcity of their land resources suitable for biomass production due to aridity, inherently poor and human-degraded soils – especially in the mountainous areas – as well as limited rainfall and water supplies (Vianey *et al.*, 2015). The cultivated area could increase by improving the availability of water, as for instance in Egypt (between Cairo and Alexandria and in the Matrouh region). However, in a water-stressed region like the Mediterranean that is significantly affected by climate change (CC) impacts, these examples are exceptions and not the norm. Reports of the Intergovernmental Panel on Climate Change (IPCC) and other organisations involved in climate change scenarios in the Mediterranean region make no mention of the opportunity that the possible increase in water availability and arable land will present in the coming decades. In very limited cases, such as in Syria, before the political and social unrest rehabilitation actions were undertaken to bring new land into production through the building of terraces in rocky areas in order to grow olives and fruit trees. However, these interventions are costly, and require further investments for the soil to remain productive.

The scarcity of arable land and available water are among the main reasons why the MENA region strongly relies on food imports to feed its people. Furthermore, competition for land driven by strong economic interests and the increase in population, leads to an increasing pressure on natural resources. For these reasons, the Mediterranean, in particular the MENA region, no longer affords to waste its land.

Soil scientists and land experts do not like the term wasteland, as the land could never be waste or useless for any purpose. On the contrary, they believe that the multiuse nature of land involves various trade-offs that favour one use at the expense of others. Decisions that lead to changes in land use are often made on economic or political grounds rather than on ecological or social ones. This often leads to an

inappropriate use or management of land resources and this may have many negative impacts: the degradation of soil and of water and biological resources, the loss of ecosystem functions and associated services, hence the wasting of land resources, urbanisation on productive soils, use of poor quality water or inadequate water for irrigation leading to salinisation, disturbance of fragile coastal ecosystems accompanied by biodiversity losses and ecological disruption.

Maintaining productive land and healthy soils to ensure food security, sustainable development and restoration of degraded land is crucial for the future of humankind. The 68th session of the United Nations General Assembly proclaimed 2015 as the International Year of Soils to raise awareness on the importance of soils. In response to these challenges, the Food and Agriculture Organization of the United Nations (FAO) and its Member Countries established in 2012, the Global Soil Partnership (GSP) whose mandate is to improve governance of the planet's soil resources in order to guarantee healthy and productive soils for a food secure world.

The Sustainable Development Goals (SDG) are explicitly aimed at improving soil quality, combating desertification and restoring degraded soil as well as improving access to ownership and control over land (SDGs 1.4, 2.3, 2.4, 15.3) (Osborn *et al.*, 2015). A promising way to conserve land resources and sustain productivity and ecosystem services for the present and the future, is by promoting the wide adoption of sustainable land management (SLM) practices and approaches that integrate biophysical, socio-economic and institutional considerations.

In regions such as the MENA region, where climatic conditions are particularly unfavourable, land degradation and desertification are threatening people's livelihoods and food security. Promising SLM options are available to reverse land degradation, sustain land productivity and reduce land waste. A comprehensive land-based approach is proposed to start with identifying and prioritising target areas where some of these options have high potential of success, then selecting the most appropriate SLM and, lastly, disseminate its practice supported by proper policies, financial mechanisms and continuous monitoring to be able to adapt to future climatic and socio-economic variations. Farmers' needs and wishes should be at the centre of sustainable land development processes.

This chapter provides an overview of the status of land resources in the Mediterranean region, highlighting the needs for their sustainable utilisation and emphasising why wasting them is not an option for the region, especially for food security reasons. The aim is also to highlight the regional and global efforts striving to support decision makers to achieve better land management and avoid wasting precious land resources through the establishment of partnerships and the implementation of national and regional projects.

Matrouh Rural Development Project (MARSADEV) project in Egypt: greening the desert

This multifaceted project aims to improve the living conditions of the Bedouin rural communities by recovering degraded lands, preventing erosion, enhancing water saving and harvesting, enriching soil fertility, and improving crop yields. One of the most significant achievements of the project is the land reclamation of the Wadi Kharrouba, a barren, eroded and abandoned watershed that has become a 13 hectare cultivated area of figs and olives. The region is very arid, with an average annual rainfall rate of about 100 mm a year. A number of dry tolerant plants such as *Opuntia ficus-indica*, *Atriplex litoralis spp*, *Moringa oleifera* and *Medicago arborea* will be planted in the semi circle terraces located in the surrounding slopes of the *wadi*. They will be used both for income generation and erosion control. Supplementary irrigation will be provided through water harvested in one upland reservoir. Wadi Kharrouba shows that "greening the desert" is possible when technological innovation and tradition are complementary to each other and local communities are both actors and players of the rural development process.

Source: www.facebook.com/Marsadev-project-Egypt-784471981631262/timeline/

Limited productive lands and fragile environments are under pressure

The Mediterranean region covers about 854 million hectares of land but only 118 million hectares (or 14%) are suitable for agricultural production. Northern Mediterranean countries cultivate on average about 35% of their territories but in the MENA region this figure drops to 5%. Libya is an extreme case with only 2% cultivated lands, Algeria with less than 4% and the vast majority of Egypt's 5% of agriculture land occurs in the Nile Delta. In addition, land cover in the region is composed of 15% natural pastures and rangelands, 8% forests and woodlands and 63% desert sands, shallow, saline and sodic soils, rocky and/or rock outcrops, waterlogged areas and, above all, areas sealed by urbanisation (Zdruli, 2014).

Drylands cover 33.8% of the territory of the Mediterranean Member States of the European Union – with the exception of France, these countries are all included in Annex IV of the United Nations Convention to Combat Desertification UNCCD. In Spain, drylands cover about 69% of the country. In Greece, Portugal, Italy and France, this number varies from 62 to 16%. Drylands are mainly concentrated in the southern and eastern Mediterranean countries where they cover 61% of the overall territory. Using the UNCCD aridity index, Uriel Safriel (2006 and 2009) points out that all Mediterranean countries have a great variety of drylands and their management should therefore take account of the local specificities. In southern countries bordering the Sahara-Arabian deserts there are hyper-arid lands (true deserts), semi-arid lands and dry-sub humid lands. In northern Mediterranean countries there are semi-arid lands, dry sub-humid lands, as well as humid areas (non drylands).

The *Mediterranean coastline* is roughly 46,000 km long and is almost equally divided into rocky and sedimentary coasts. The northern coast of the basin is especially toothed and includes big islands like Sardinia, Corsica, Crete, Cyprus, Malta and

numerous small islands mostly belonging to Greece. These coasts and islands are subject to erosion, salt intrusion and flood risks due to sea-level rise. Coastal areas including wetlands are under continuous pressure from urban sprawl and infrastructure development fuelled mostly by the tourism industry that brings into the region about 300 million people each year. Impacts include associated waste and sanitation problems and loss of wildlife leading to a decline in the pristine land and seascapes that initially attracted tourists and residents.

Wetlands cover nearly 1 million hectares and paralic ecosystems (deltas, mud flats, lagoons, ponds, and coastal marshes) occupy about 500,000 hectares. Coastal wetlands play a crucial role in maintaining and enhancing environmental quality and providing invaluable economic benefits (Quentin Grafton *et al.*, 2009): they purify water, sequester carbon, help maintain the equilibrium of the water cycle, host millions of migratory birds and provide excellent environments for relaxation. Some European studies value the ecological services of wetlands as some 2.4 million euros per km^2 per year (Benoît and Comeau, 2005). The Mediterranean Sea could store an estimated 17.8 million tonnes of CO_2 every year worth up to 1.7 million a year, providing important climate change mitigation benefits (Melaku Canu *et al.*, 2015).

Irrigated lands cover 20% of the total agricultural lands (field and permanent crops) in the northern European Mediterranean countries. Spain ranks first in absolute terms for the total irrigated area that accounts for about 3,780,000 hectares while Greece ranks first for the irrigated area nationwide in percentage terms (38%). Due to its humid climate Slovenia irrigates only 1.5% of its agricultural lands (Zdruli, 2014). The situation is somewhat similar in southern and eastern Mediterranean countries that overall irrigate 22% of their agricultural lands or a total of about 13,585,000 hectares. Egypt tops the list since it literally irrigates (99%) or the whole land available for crop production. Expansion of irrigation has created salinity build-up problems in many countries in the Mediterranean: over the last two decades, in Egypt for instance about 1 million hectares have been affected by soil salinity due to inadequate irrigation water (Goma, 2005). Special attention should therefore be given to the quality and amount of water used for irrigation and the establishment of irrigation systems that are both efficient in water use and crop productivity and that provide adequate water for the leaching of accumulated salts and drainage to avoid water logging.

The *extension of urban areas* especially along the Mediterranean coasts and around big cities has often been made at the expense of agricultural lands. Built-up areas now cover nearly 40% of the Mediterranean coastline and if these trends continue, the figure could reach 50% by 2050. The most impressive examples are cities like Alexandria and Cairo (Egypt), Tripoli (Libya), Beirut (Lebanon), Casablanca (Morocco), Istanbul (Turkey) and many others cities in the South and East of the region. Extensive urbanisation changes have occurred mostly after the 1960s in big European cities like Barcelona (Spain), Athens (Greece), Marseille (France) and some islands like Sardinia and Sicily (Italy). With a total population of about 400,000 people, Malta accommodates around 1.2 million tourists every year. Montenegro is also worth mentioning. In 2013, it hosted almost 1.5 million tourists,

which is more than twice its population. The tourism industry has played a major role in the overdevelopment of the coasts creating thousands of jobs and bringing economic revenues but associated with accelerated "littoralisation", which in itself is a specific process of land degradation (Zdruli, 2008).

Land degradation in the form of salinisation, water and wind erosion, sand encroachment, overgrazing, deforestation, compaction, organic matter decline and sealing is a serious problem in many countries. Saline and sodic soils alone cover more than 10 million hectares in the Mediterranean region. Estimates show that if the existing rates of land degradation and desertification, including land take and soil sealing (due to urbanisation and infrastructure development) will continue, by 2020 another 8.3 million hectares of agriculture land will be lost compared with 1960. Could this area be considered wasted? Consequences of land degradation are extremely serious as the agricultural land would drop from 0.48 hectares per capita in 1961 to 0.21 hectares per capita, or less than half in 2020 (Zdruli, 2014). These frightening scenarios indicate possible social unrest, accelerated waves of immigration towards the North Mediterranean (already occurring) and perhaps in the longer term, increased unemployment, famine and civil strife including ethnic/religious reprisals.

The above analyses provide insights on the status of land resources in the region and the ongoing dynamics of change, often accelerated by specific social and political contexts. This supports the need for comprehensive planning of resources across sectors and actors to optimise the use of limited land and water to avoid wasting them. This becomes even more critical when addressing emerging challenges such as population movements, land degradation and climate change. Therefore, understanding the current status of land use planning opportunities and promoting participatory approaches, up-to-date geospatial, economic analysis and scenario development tools are necessary to plan the optimal use of the land, satisfy competing interests and minimise conflicts at regional and country level.

Technically, assessing land suitability for different land uses taking into account, social, economic, environmental and governance issues, should guide the selection of the optimum utilisation that improves productivity, reduces land degradation and provides livelihoods for local populations. Soil-landscape modelling is among the available modern tools to support land suitability analysis (Al-Shamiri and Ziadat, 2012; Ziadat *et al.*, 2015). However, the land use planning process needs to be revised to ensure efficient integration of all related issues that govern the allocation of different land uses. "Action to promote balanced development on both shores of the Mediterranean is more necessary than ever; once the cobwebs of its former attributes have been removed, the new *mare nostrum* will be feasible if, and only if, *terra nostrum* also becomes a common horizon!" (Hervieu and Thibault, 2009). Seven years later this statement remains valid more than ever.

Mediterranean soils and climate change

There is ample evidence that climate change will impact the Mediterranean region in various ways but all climate models predict that the region would become *drier* and *hotter* and the intensity of extreme events and drought would increase

(Giannakopoulos *et al.*, 2005; Seguin, 2010; CIRCE project, 2011). Sea level rise is also a critical issue for countries such as Egypt that could have dire consequences as a one metre increase could cover an area of 970 km^2 in the Nile Delta affecting 9% of the whole population and about 13% of its agricultural land without considering extensive damage to infrastructure and to the fragile coastal ecosystems such as the wetlands. Italy may also lose 6% of its territory and many of the Mediterranean lagoons may disappear (ISMEA and IAMB, 2009).

Among the commonly mentioned major impacts of climate change in the Mediterranean are coastal flooding, soil erosion, sea water intrusion in aquifers affecting irrigation groundwater reserves and consequently causing soil salinity build up, increased aridification and desertification[1] (Giupponi and Schecter 2003; Saadi *et al.*, 2015). Economic activities, particularly in coastal zones and for the vulnerable population of small islands, and food security are also being threatened. Climate migrants atop of political and economic refugees from the South towards the North are also a point of increasing concern.

Besides the potential decrease of land resources suitable for crop production, climate change could also be associated with the increase of arid areas at the expense of more humid ones. If this happens, reduced capacity of agricultural production and increased irrigation water demands will be the direct consequence. Over time, agriculture could also suffer due to shorter growing seasons for crops, heat stress during flowering and rainy days during sowing with negative impacts on livestock due to declining fodder and water resources. Other consequences of climate change in particular could include heavy rainfall and storms that can increase soil erosion by wind and water, flash flooding, slope instability, reduced soil water retention and ground water recharge. These effects could have further impact on the economic development of the region, as tourists or incoming residents may look for alternate destinations putting at risk all the heavy investments made by the tourist and housing industry.

Potential climate change may affect the yields of some crops (such as legumes, cereals and tubers) and contribute to the disappearance of some olive groves due to reduction of rainfall water and poor annual distribution. This is quite worrying. Again, the southern Mediterranean is most likely to experience crop failures, livestock stresses and reduced productivity aggravating the already vulnerable food security and poverty situation. Global estimates indicate that maize production would be roughly 6% higher and wheat production 4% higher had agriculture not been exposed to climate trends observed since 1980 (Lobell and Costa-Roberts, 2011). One way of addressing climate change impacts on agricultural production would be the adoption of adapted crop and livestock management techniques such as changes in sowing dates, development of new cultivars that are drought and salinity resistant, agroforestry and crop-livestock integration (Benauda *et al.*, 2015). The role of healthy soils in building a resilient system against climate change/variability and providing ecosystem services is very crucial. The best documented example is conservation

1 - The UNCCD defines desertification as "land degradation in arid, semi-arid and dry sub-humid areas resulting from various factors, including climatic variations and human activities".

agriculture that integrates permanent soil cover, minimum soil disturbance and crop rotations as complementary remedies to climate change by protecting the soil, increasing organic matter content and biological activity in the soil and enhancing carbon sequestration. Countries are encouraged to identify and develop for each agro-ecological context a set of adapted climate smart agriculture technologies (including conservation agriculture), that simultaneously contribute to productivity, adaptation to climate change and mitigation.

Soil ecosystem functions and services

As noted under the Global Soil Partnership (GSP) vision, soil is a *non-renewable* resource in the human life span. It can be considered renewable only on a geological time scale. It is far more than a substrate to provide nutrients and water to plants, it is fundamental for filtering water, buffering pollutants, recharging aquifers, regulating gas and nutrient exchanges and mediate bio-geo-physical and chemical interactions with the surrounding environment. Healthy land (and therefore people) requires sustained soil fertility and the well functioning of the soils as a basis for biomass production and environmental services. Soil is the "foundation" for the functioning of the ecosystem and ensures renewable water reserves. Therefore, sustainable use and management of soil ensures the wellbeing of human beings and the society as a whole.

The International Year of Soils

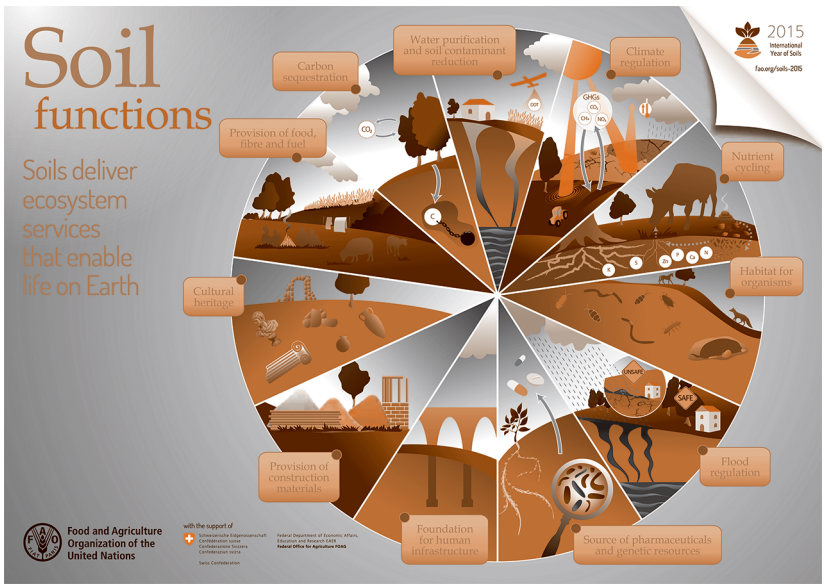
A major platform for raising awareness of the importance of soils for food security and nutrition and essential eco-system functions

On 5 December 2014, the 68th UN General Assembly declared 2015 the International Year of Soils (IYS) and endorsed the celebration of World Soil Day on 5 December. The Food and Agriculture Organization of the United Nations has been nominated to implement the IYS 2015 within the framework of the Global Soil Partnership and in collaboration with Governments and the secretariat of the UN Convention to Combat Desertification. The FAO is also supporting and encouraging World Soil Day advocacy and events worldwide. The "Healthy Soils for a Healthy Life" initiative will continue to promote the importance of healthy soils and encourage the adoption of regenerative landscape management practices to ensure continued momentum post IYS.

Soil is an important component of the natural ecosystem (see Figure 1) but the reduction of *supporting ecosystem services* is already occurring and will ultimately lead to the persistent decrease in the ability to provide *provisioning* and *regulatory*

services (Haygarth and Ritz, 2009; Dominati *et al.*, 2010). *Supporting services* include soil functions of crucial importance such as primary production for terrestrial vegetation, soil formation, rock weathering, nutrient cycling and release of nutrients. It is widely recognised that nutrient cycling is the largest contributor of goods and services providing annually about 51% of the total value (USD 33 trillion) of all ecosystem services (FAO, 2011). The importance of soil functions in maintaining sustainable production of food and ecosystem services is especially emphasised in the southern Mediterranean region that faces relatively complex climatic and socio-economic conditions. Therefore, building a soil management decision support system is needed to formulate and put in practice related policies. Systems like this provide the tools needed by decision makers to design sustainable land use planning based on baseline data and on strategic development priorities at different scales.

Figure 1 - Soil functions and services



Source: FAO, 2015 (www.fao.org/resources/infographics/infographics-details/en/c/284478/).

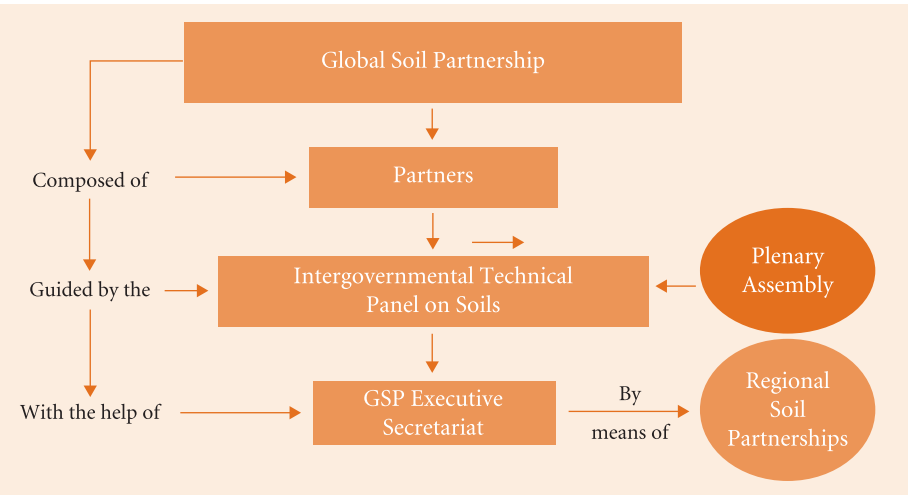
The Global Soil Partnership serves as the global institutional framework in support of an overwhelming process leading to the adoption of sustainable development goals for soils and their subsequent implementation:

– The GSP will contribute to environmental wellbeing by, for example, preventing soil erosion and degradation, reducing greenhouse gas emissions, promoting carbon sequestration and sustainable use of agricultural inputs for soil health and ecosystems management.

– It will equally contribute to human wellbeing and social equity through improved use and governance of soil resources, by finding alternatives to soil degrading practices through participatory experiential processes, and being sensitive to issues of gender and rights of indigenous peoples.

The GSP is an interactive and responsive partnership. The GSP will also increase awareness and contribute to the development of capacities, build on best available science, and facilitate/contribute to the exchange of knowledge and technologies among stakeholders for the sustainable management and use of soil resources. The GSP addresses five main pillars of action:
– Promote sustainable management of soil resources for soil protection, conservation and sustainable productivity;
– Encourage investment, technical cooperation, policy, education awareness and extension in soil;
– Promote targeted soil research and development focusing on identified gaps and priorities and synergies with related productive, environmental and social development actions;
– Enhance the quantity and quality of soil data and information: data collection (generation), analysis, validation, reporting, monitoring and integration with other disciplines;
– Harmonisation of methods, measurements and indicators for the sustainable management and protection of soil resources.

Figure 2 - GSP composition and governance



Source: www.landmatrix.org/en/

Land dynamics and socio economic implications

Mediterranean complexity in land issues is expressed both in physical, socio-economic and governance terms. As most of the northern countries are EU member states, the legislation dealing with land and soil follows EU regulations and directives. There are differences across southern and eastern Mediterranean countries due to lack of mechanisms for harmonisation. A good example could be the diverse stand

taken by countries on issues related to land acquisitions. Egypt for instance is making land acquisitions elsewhere in the world but at the same time is also subject to such investments. On the contrary, Morocco is a recipient country in relation to large land acquisitions and it appears that there is internal support for these foreign investments (Mahdi, 2014) as they are associated with increased employment and domestic productivity. Rural specialist economists have different views about land acquisitions that are also referred to as "land grabbing" or "large land acquisitions". The largest land acquisitions are obviously made by powerful European countries, USA and fast growing economies (China, India, UAE) whose priority is to meet their own food needs.

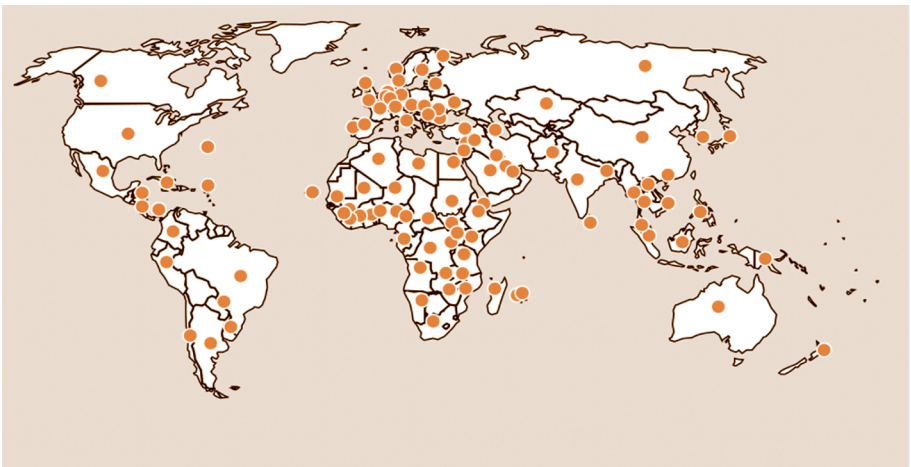
While recognising the need for foreign investments in many developing countries including those in the MENA region, the governments of these countries should give first priority to their national food security interests and not to the economic goals of land buyers or leasers. Moreover, prior legal contracts should be agreed upon on many issues and in particular in food distribution and access allowing hosting countries to first improve their food security standards.

The globalisation of the world economy led to important changes in the land dynamics. Europe for instance has become a net food importer with about 40% of its needs for direct food products or animal feedstuff coming from lands cultivated outside the continent. Such trend may even become more evident due to climate change impacts predicting yield anomalies (IPCC, 2014). On the other hand, if soil-sealing rates in the EU continue to increase, they could have severe consequences both in the region and abroad. Studies show that for each hectare of agricultural land sealed or lost from agricultural production in the EU, about ten more hectares of land have to be put into production elsewhere to compensate for these land losses (Gardi *et al.*, 2015) hence putting at risk the food supplies of other much vulnerable countries.

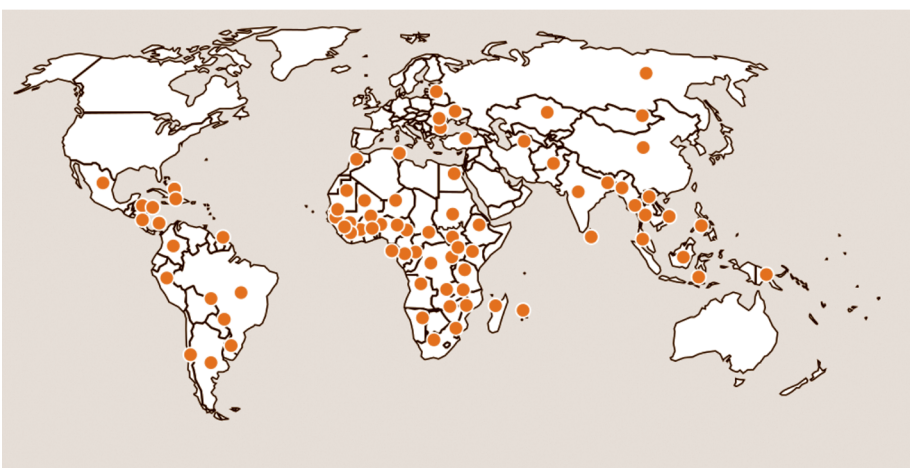
Various researchers, reported by the media, have put forward the fact that the Arab Uprisings were fuelled by the increasing food prices especially in Tunisia and Egypt. However, at least in the case of Tunisia, processes of agricultural restructuring during the past twenty years contributed to a large extent to the revolutionary dynamics, giving thus a political dimension to food issues (Gana, 2012).

Land dynamics and governmental policies play a fundamental role in the socio-economic situation in the Maghreb. For example in Tunisia and in Morocco since the late 1980s much attention has been concentrated on the development of the coastal areas bringing fresh revenues from the tourism industry, but such process has been largely detrimental for inland areas (Gana, 2012). This is also the case in Egypt where there are great disparities between the delta region, which is highly urbanised and the Nile valley where rural development has, in recent years, received only secondary attention from public policy. Indeed, priority has been given to urban issues that are considered as potentially explosive.

Figure 3 - Land acquisitions globally



Global investor countries. Note the complex figures in Sub Saharan Africa and the intensity of these deals from European countries.



Target countries offering land deals. Sub Saharan African countries are both targets and investors. Note that Europe is the largest investor in land deals.

Source: www.landmatrix.org/en/get-the-idea/global-map-investments/

At political level, the process of land reform in Tunisia is neither easy nor straightforward. The policies of the late 1980s were directed towards the transfer of farm cooperatives to private investors creating large farms of olive groves, fruit trees and horticulture crops. This is much different from the traditional cereal-based agriculture. However, such process brought about tensions and many peasants lost their right to land and got involved in land protest movements. The same was true with the transfer of state-owned farms to private investors. There is growing consensus among the political parties in Tunisia regarding the fact that a land agrarian reform

may be needed to also solve potential social issues (Gana, 2012). The Tunisian case demonstrates the importance of land tenure and land rights as determining factors of social stability in the mostly rural societies of the MENA region.

The FAO has recently adopted the Voluntary Guidelines on the Responsible Governance of Tenure of Land, Fisheries and Forests in the context of national food security (see box) as a way forward to improve governance and thereby encourage sustainable land management and enhance food security. These principles should be thoroughly implemented in the MENA region.

Voluntary Guidelines on the Responsible Governance of Tenure of Land, Fisheries and Forests in the Context of National Food Security

These Voluntary Guidelines seek to improve governance of tenure of land, fisheries and forests. They seek to do so for the benefit of all, with an emphasis on vulnerable and marginalised people. Their goal is to ensure food security, progressive realisation of the right to adequate food, poverty eradication, sustainable livelihoods, social stability, housing security, rural development, environmental protection, sustainable social and economic development and to:

1) Improve tenure governance by providing guidance and information on internationally accepted practices for systems that deal with the rights to use, manage and control land, fisheries and forests.

2) Contribute to the improvement and development of the policy, legal and organisational frameworks regulating the range of tenure rights that exist over these resources.

3) Enhance the transparency and improve the functioning of tenure systems.

4) Strengthen the capacities and operations of implementing agencies; judicial authorities; local governments; organisations of farmers and small-scale producers, of fishers, and of forest users; pastoralists; indigenous peoples and other communities; civil society; private sector; academia and all persons concerned with tenure governance as well as to promote the cooperation between the actors mentioned.

The Voluntary Guidelines on the Responsible Governance of Tenure of Land, Fisheries and Forests or VGGT were officially endorsed by the Committee on World Food Security on 11 May 2012. Since then, their implementation has been encouraged by the G20, Rio+ 20, the United Nations General Assembly and the Francophone Assembly of Parliamentarians. The Guidelines are meant to benefit all people in all countries, although there is an emphasis on vulnerable and marginalised people. The Guidelines serve as a reference and set out principles and internationally accepted standards for practices for the responsible governance of tenure. Whilst providing a framework that States can use when developing their own strategies, policies, legislation, programmes and activities, they also allow governments, civil society, the private sector and citizens to judge whether their proposed actions and the actions of others constitute acceptable practices.

Sustainable land management is the answer

Feeding an increased population will be a significant challenge for the whole region but for the MENA region this could be an enormous endeavour. While recognising the need for mitigation actions to alleviate climate change effects, adaptation (Brown *et al.*, 2015) would be the ultimate and unavoidable choice. Nevertheless, the agriculture sector should be supported by appropriate funding to reach this goal. Hence, the most pressing and urgent need for the region would be to support the wide adoption of sustainable land and water management practices, including the conservation and sustainable use of biodiversity to value the substantial economic, environmental and social benefits that would be generated. This would enable investments to be prioritised, scaled up and mainstreamed across the diverse production systems, landscapes and eco-regions. Adapted Sustainable Land Management (SLM) practices should be identified for each biophysical and socio-economic context as they can increase productivity, particularly by improving water use efficiency, restoring degraded soils, optimising nutrient cycles for sustained crop production, enhancing vegetation cover and biodiversity, sequestering carbon and reducing greenhouse gas emissions, increasing food security and the resilience to climate change. Healthy soils and diversified production systems produce healthy food, support healthy lives, and promote a healthy environment as well as contribute to climate change adaptation and mitigation.

Furthermore, given the fact that 70% of the food produced globally comes from small scale farmers (Maass Wolfenson, 2013) and the average farm size in the MENA region is much less than 5 hectares, small farmers play a crucial role in food production in the region. Enhancing their capacities to get better organised would help them to strengthen their position along agricultural food chains. Smallholders, the majority of whom are family farmers, make significant contributions to the sector thanks to the economic, cultural and environmental functions they accomplish in rural societies and the overall agricultural sector. Hence, success can only be reached when farmers either individually or grouped in associations and cooperatives are willing to apply innovative technologies that boost production and protect the environment. Despite initial mistrust when new technologies such as no till or minimum tillage are first implemented, there are endless examples showing that, even under Mediterranean conditions, the successful uptake of such technologies is possible when they first are implemented through a participatory processes, in consultation and in agreement with local people (ICARDA-CCAFS, 2012). The scaling out and mainstreaming of SLM options to reach farmers and decision-makers is therefore very crucial now more than ever.

The World Overview of Conservation Approaches and Technologies (WOCAT)[2] initiative has shown that SLM has the potential to increase yields by 30% to 170%, increase water use efficiency by up to 100% and increase SOC by 1% in degraded soils and up to 2% to 3% in non-degraded ones (WOCAT, 2007; CDE, 2010). Most common SLM techniques include soil and water conservation measures (terracing,

2 - www.wocat.net

contour planting, living barriers, reduced tillage, mulches, cover crops, grazing corridors, water harvesting) and soil fertility management (manure, compost, biochar[3], biomass transfer, agro-forestry with nitrogen-fixing trees like Faidherbia albida and shrubs like Tithonia). These can be integrated in suitable combinations through integrated soil and ecosystem management including intercropping and rotations with biological nitrogen fixing (BNF) legumes that can add (allow nitrogen fertilisation) to the soil up to 300kg N/ha^{-1} in a season, for the effective use of the soil profile, for pest and disease control and integrated crop-tree-livestock management in the wider landscape.

Innovation technologies like "EverGreen" agriculture as a form of more intensive farming that integrates trees with annual crops to sustain a green cover on the land throughout the year or "Climate-Smart Agriculture", which includes techniques such as mulching, inter-cropping, no-till farming, improved grazing and better water management are proving to be efficient by increasing farmers' income also through carbon credits and providing environmental benefits that reduce greenhouse gas emissions and enhance food security (World Bank Institute, 2012). Additionally, Conservation Agriculture (Benauda *et al.*, 2015) especially in the drylands is also promising as it provides a low-cost entry point for long-term sustainability. It is based on a "no-tillage" approach, which aims to reduce the impact of farming on the environment and on the farmland itself and it is characterised by three principles namely: 1) minimum mechanical soil disturbance, 2) permanent organic soil cover, and 3) diversification of crop species grown in sequences, rotations and/or associations.

"4 pour 1000: soils for food security and climate": a French Government initiative

Key to the success of COP21 on Climate Change held in December 2015 in Paris, the "4 pour 1000" combines the restoration of degraded land, food production and the fight against climate disruption. Building on solid, scientific evidence and concrete actions on the ground, it aims to show that food security and combating climate change are complementary and ensures an agriculture that provides solutions to climate change. This initiative consists of a voluntary action plan under the Lima Paris Agenda for Action (LPAA), backed up by a strong and ambitious research programme. The "4‰" Initiative aims to improve the organic matter content (by 4 grammes for every 1,000 grammes of CO2 a year) and promote carbon sequestration in soils through the application of agricultural practices adapted to local situations both economically, environmentally and socially applying the principles of agro-ecology, agroforestry, conservation agriculture and landscape management.

Source: www.4p1000.org

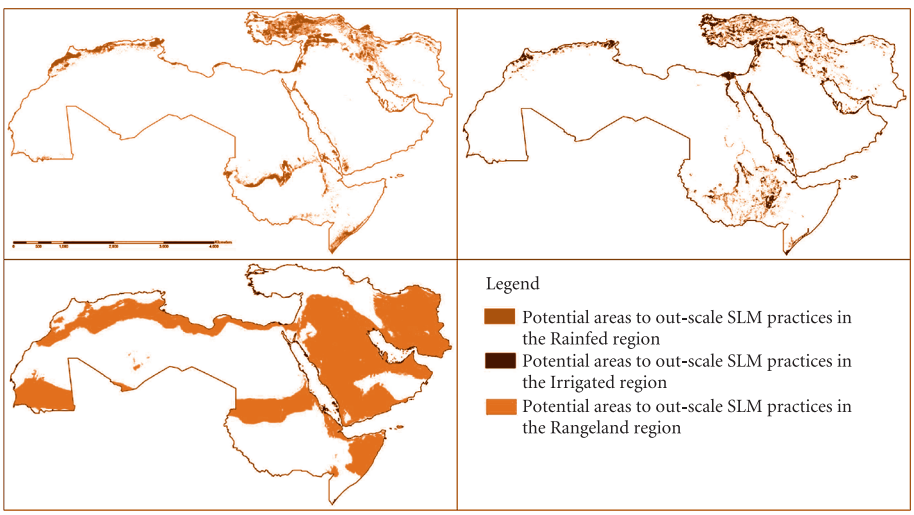
The issues of SLM, soil quality (Mandal *et al.*, 2011; Bone *et al.*, 2012) and holistic adaptive land management (Herrick *et al.*, 2012), however, require a profound recognition of local conditions as there are no universal "ready-to-use recipes" for each place on Earth. Over the last two decades, WOCAT, at the front line of this process,

3 - www.biochar-international.org

supported by a management team from the Centre for Development and Environment (CDE) of the University of Bern, the FAO and the International Soil Reference and Information Center (ISRIC), has established a well-accepted and unique framework for documentation, evaluation, monitoring, and dissemination of SLM knowledge, covering all steps from data collection to database creation, mapping of degradation and conservation to the use of this information for decision support (Schwilch *et al.*, 2014). In 2013-2014 the Partnership was expanded to an international consortium that supports the global knowledge management activities and the country and regional network of members. The WOCAT database has been selected by UNCCD as the reference database on SLM best practices.[4]

Over the past several years, technical practices were fine-tuned and tested and a number of solutions for the best management of water and land were developed for the MENA region. Among some of the proven interventions are water-harvesting practices in the driest areas, water-saving techniques (raised-beds and deficit irrigation) in irrigated areas, and supplemental irrigation in rainfed areas. To ensure their adoption by farmers and positive results from their implementation, suitable techniques/technologies need to be disseminated on a large scale. Identifying areas similar to those where these technologies were established and verified is needed to facilitate the out-scaling process. Similarity analyses, made available for decision makers, were used to find potential areas for out-scaling selected SLM practices (see Figure 4) (Ziadat *et al.*, 2015).

Figure 4 - Potential areas for out-scaling SLM practices in three dominant agro-ecosystems of the MENA region



Source: Ziadat *et al.* (2015).

4 - From a WOCAT management team (Centre for Development and Environment, University of Bern, FAO and ISRIC) and funding for the Secretariat mainly provided by the Swiss Development Cooperation, to a consortium of partners supporting the wider WOCAT network among countries, also including SDC, GIZ, FAO and the CGIAR centres – CIAT, ICIMOD and ICARDA.

SLM adoption needs a governance that ensures access rights over land resources by men and women including female headed households, secure tenure arrangements, as well as a supportive enabling environment for the testing, validation and wider uptake of proven practices for example through access to credit, extension services, markets, etc. Payments for environmental services that are generated through SLM practices notably, carbon, water and biodiversity credits, are being tested in the MENA region as means to enhance income for the land users.

However, they have been proven to be more suitable for landscape scale interventions rather than at individual farm level because of high transaction costs in monitoring, verifying, reporting and paying. The VGGT described above and the Guidelines for Responsible Agricultural Investments (RAI) that have been developed by the FAO through wide consultative processes provide a basis for enhancing governance and investments in SLM, and must therefore, as far as possible, be disseminated and implemented. In early December 2015, the FAO Council supported the initiative for developing the Voluntary Guidelines for Sustainable Soil Management whose main goal will be to support the implementation of the principles of the World Soil Charter.

Conclusion

Land misuse and mismanagement not only destroys soils and results in loss of ecosystem services but also impacts our human heritage. Anticipated climate change may worsen the situation as about 175 million more people may go hungry by the end of the century if no action is taken (Brown *et al.*, 2015). On the other hand, all over the world, generations of farmers and herders have shaped and maintained specific agricultural systems and landscapes that value local natural resources. Their management is based on experience, practices and local knowledge. These ingenious *agricultural* systems, that abound in the Mediterranean region, reflect the evolution of humankind, the diversity of its knowledge, and its profound relationship with nature.

Due to its natural conditions, demographic trends and environmental constraints, the challenge of sustained agricultural productivity in the Mediterranean relies mostly upon proper use and management of existing agricultural land resources. These are also the conditions that could provide a measure of success in the quest for achieving the recently endorsed Sustainable Development Goals to improve food security and living conditions, especially for the rural poor. The dramatic political and social events throughout the Arab World initiated since 2011 only reinforce the need for continued stewardship for land resources (Zdruli and Lamaddalena, 2015). This could only be achieved if sustainable land use planning is introduced in governmental agendas and maximum care is applied to implement legislation that optimise and protect land and avoid its wasting.

Traditional Mediterranean agro-ecosystems that have adapted and evolved over the years have resulted not only in outstanding landscapes, a globally significant agricultural biodiversity, but also, above all, in the sustained provision of multiple goods and services, food and livelihood security and quality of life. The innovations and

ingenious practices of the land users themselves, the farmers, livestock keepers, forest managers and even fisher folk, contribute to improving food supply and providing environmental benefits for the community (Laureano, 2001) as well as sustaining livelihoods and wellbeing of rural societies.

Awareness on SLM is also important. Since 2012, the UNCCD honours outstanding farmer organisations and NGOs involved in soil conservation activities with the Land for Life Award. In 2015, the SEKEM Initiative[5] in Egypt was awarded with this prestigious price. The UNCCD is also promoting the "*Zero-net land degradation*" by 2030 concept (UNCCD, 2012), further developed by the COP12 in Ankara in October 2015; for each degraded hectare of land another one must be restored or rehabilitated elsewhere building hence a land-degradation neutral world (Stringer, 2012). The African Great Green Wall Initiative for the Sahara and the Sahel and the TerrAfrica Strategic Investment Programme for Sub-Saharan Africa represent concrete examples of awareness by African Governments, the African Union, the New Partnership for Africa's Development (NEPAD) and by the donor community of the necessity to reverse degradation across ecosystems, landscapes and the wider continent and their commitment to the achievement of land degradation neutrality.

The challenges of SLM as a tool to avoid land waste and improve food security must be addressed simultaneously with the development of policy guidelines and their implementation. Experience has shown that land protection priorities often take a back seat in governmental agendas. The Thematic Strategy for Soil Protection for instance never materialised as an EU Directive and in 2015, the European Commission noted that the proposal for a Soil Framework Directive had been pending for eight years with no effective action; as a result it decided to withdraw the proposal. This was a big setback. Nevertheless, in 2013, the 7th Environment Action Programme restated the EU's commitment to "*reduce soil erosion, increase soil organic matter, limit the effects of man-made pressures on soil, manage land in a sustainable fashion, and remedy sites with contaminated soils*". In 2015 the EC presented a Communication aiming "no net land take" by 2050, reducing erosion rates and increasing soil organic matter. These are a good starting point also for the MENA countries to set targets that respond to their specificities and needs.

The "Mediterranean syndrome" characterised by structural deficiencies common to most countries in the region such as corruption and lack of comprehensive plans to combat environmental problems and poor cooperation between the various administrative sectors that hold competencies for land management and territorial development should not last forever. It should not take the occurrence of calamities, such as the latest flooding in the Côte d'Azur area in France in October 2015 that killed 17 people, to make governments be concerned about the sealing or degradation of land and their impacts on the environment, returns from investments and human livelihoods and welfare. If we are to meet the increasing demands from the growing world population and changes in living standards that are estimated by the FAO to require a 70% increase in global food production by 2050, business as usual is no longer an option. Protecting land from degradation processes and restoring already

5 - www.sekem.com/aboutus.html

degraded lands is a long but essential process requiring a transformation towards sustainable food and agricultural systems and appropriate strategies and actions should be included in the long-term development plans of each Mediterranean country.

In September 2015, the United Nations General Assembly approved 17 SDGs. Among them, SDG 15 calls to "*Sustainably manage forests, combat desertification, halt and reverse land degradation, and halt biodiversity loss*". SDG 15.3 specifically tackles land and soil: "*By 2030, combat desertification, restore degraded land and soil, including land affected by desertification, drought and floods, and strive to achieve a land degradation-neutral world*". This was a historic shift from the previous Millennium Development Goals because at this point in time there are no countries that tell others what to do, but all have an equal share of responsibility for the wellbeing of the planet. Given this context and due to its geographical and political position, the Mediterranean offers a great opportunity for implementing the SDGs to secure a better future for its people.

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