BRIEFING

European Parliament

Desertification and agriculture

SUMMARY

Desertification is a land degradation process that occurs in drylands. It affects the land's capacity to supply ecosystem services, such as producing food or hosting biodiversity, to mention the most well-known ones. Its drivers are related to both human activity and the climate, and depend on the specific context. More than 1 billion people in some 100 countries face some level of risk related to the effects of desertification. Climate change can further increase the risk of desertification for those regions of the world that may change into drylands for climatic reasons.

Desertification is reversible, but that requires proper indicators to send out alerts about the potential risk of desertification while there is still time and scope for remedial action. However, issues related to the availability and comparability of data across various regions of the world pose big challenges when it comes to measuring and monitoring desertification processes. The United Nations Convention to Combat Desertification and the UN sustainable development goals provide a global framework for assessing desertification. The 2018 World Atlas of Desertification introduced the concept of 'convergence of evidence' to identify areas where multiple pressures cause land change processes relevant to land degradation, of which desertification is a striking example.

Desertification involves many environmental and socio-economic aspects. It has many causes and triggers many consequences. A major cause is unsustainable agriculture, a major consequence is the threat to food production. To fully comprehend this two-way relationship requires to understand how agriculture affects land quality, what risks land degradation poses for agricultural production and to what extent a change in agricultural practices can reverse the trend. Cropland expansion and intensification of agriculture are among the drivers of land degradation processes that can lead to desertification. Yet, agriculture itself can provide solutions to land degradation.

Almost half of the EU Member States have declared that part of their territory is affected by desertification, yet there is no EU-level strategy to tackle this problem.

EU agricultural policy can have an impact on the elements and drivers of desertification, for example, by promoting sustainable agriculture in the awareness that protecting farmland productivity is of interest to the public and farmers alike.

In this Briefing

EPRS | European Parliamentary Research Service

Author: Rachele Rossi

Members' Research Service

PE 646.171 – February 2020

EN

What is desertification?

The term desertification may evoke images of desert-like regions with a hot and dry climate and water scarcity. Some decades ago, it was indeed used to describe the development of desert-like conditions in sub-Saharan Africa. Later on, the focus moved to all drylands, identified as the areas where degradation was affecting livelihoods most severely. Nowadays, the term land degradation designates the reduction or loss of biological productivity, ecological integrity or value to humans; when this process occurs in drylands, it is described as desertification, though it is not related to expanding deserts and is not necessarily irreversible.

> '*Desertification means land degradation in arid, semi-arid and dry sub-humid areas resulting from various factors, including climatic variations and human activities.*'
> (Article 1 of the United Nations Convention to Combat Desertification, 1994).

> '*Desertification is a result of a long-term failure to balance demand for and supply of ecosystem services in drylands.*'
> (Millennium Ecosystem Assessment, 2005).

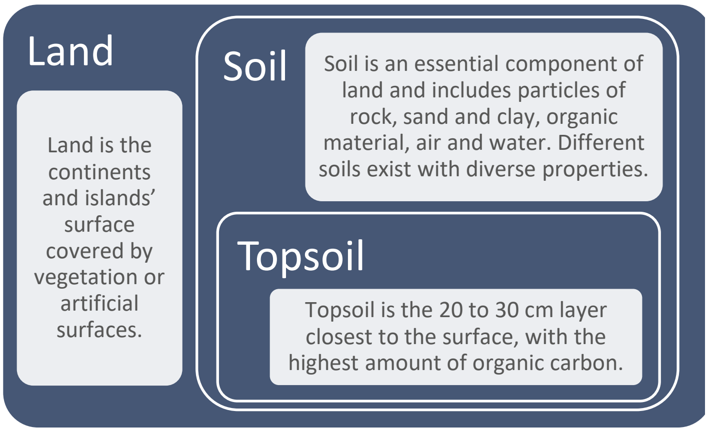
A broader definition of desertification includes degradation processes that extend beyond drylands: land degradation by wind erosion in the globe's Nordic regions or by water runoff in wet regions constitutes progressive reduction in the soil's ecosystem services possibly leading to desertification.

The drivers of the complex and interrelated causes that lead to desertification are both human- and climate-related, with their relative contribution depending on the specific ecological and socioeconomic context. For instance, an increased frequency of droughts can cause a persistent change and impoverishment in a certain ecosystem, thus leading to a climatic-led version of land degradation. In other cases, the dominant force of land degradation is human-led land use/land cover change. It has been estimated that every minute, 23 hectares of land are lost to land degradation (12 million hectares per year), more than the EU average farm size of nearly 17 hectares.

Desertification and soils

The fundamental role of soils (see Figure 1) in supporting terrestrial ecosystems is widely recognised in the scientific community but largely overlooked in the public debate.[1] The key messages on soils of the UN Food and Agriculture Organization (FAO) highlight their strategic role in producing healthy food, feed, fibre, fuel and medicines, in supporting and hosting biodiversity, and in storing carbon (thus, combating climate change) and water (thus, preventing floods and droughts).

Figure 1: Land, soil and topsoil



Source: EPRS, based on EEA information, 2019.

Soil is the result of extremely slow natural processes and, from the perspective of a human lifetime, it is regarded as a non-renewable resource that should be protected against numerous pressures and threats. A major factor that contributes to the impoverishment of the fertile topsoil is soil erosion, i.e. the detachment and transport of soil from its original location. In many regions of the world, soil erosion represents the greatest threat to soil health and soil ecosystem services. The three main types of soil erosion are water, wind and tillage, with human-induced erosion happening at a higher pace. Moreover, natural phenomena, such as heavy rain or strong wind, have more severe consequences on soils already depleted by human activities. Besides soil erosion and desertification, soil threats include other types of soil deterioration,[2] such as salinisation and sodification (accumulation of salts in the soil) or soil compaction (increased soil density as a result of compressed soil particles and reduced air volume).

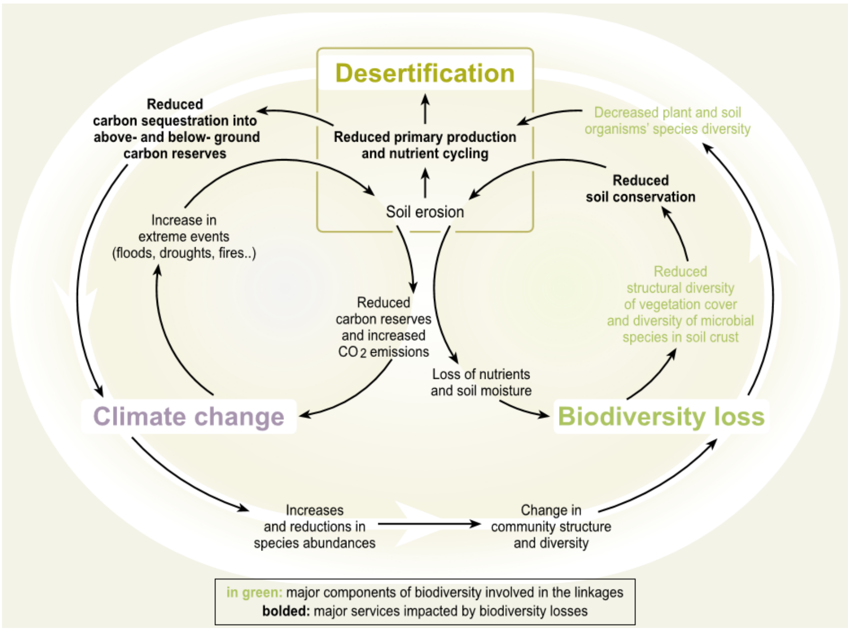
Desertification and human activities

Desertification is not a recent phenomenon; it was triggered thousands of years ago among other things by human-led alterations of the environment that made it possible to produce food and domesticate the living space. Yet, in its present shape it might be more extreme than in previous times, because modern human activities have a stronger effect on already degraded land. Human activities that can favour desertification are unsustainable farm practices (overgrazing, the excessive use of chemicals and mechanisation), heavy industry and mining, deforestation, overexploitation and contamination of water and other natural resources, urbanisation and increase in artificial surfaces, etc. The loss of soil properties can produce poverty and force people to abandon their impoverished land. Political instability, migration and conflicts are often common traits of countries and regions affected by desertification. All these elements participate in a downward spiral of desertification that is potentially the most threatening ecosystem change affecting the livelihoods of the poor and overall human wellbeing. Globally, the United Nations estimates that the livelihoods of more than 1 billion people in some 100 countries are at some level of risk linked to the effects of desertification.

Desertification and climate change

Desertification, climate and biodiversity are in a vicious circle of reciprocal reactions and interactions (Figure 2). Characterised by degraded soil and lack of vegetation, desertification affects global climate through the release of large amounts of carbon to the atmosphere.[3] Climate change degrades land through heats and droughts, sand and dust storms and heavy rainfalls that erode and damage soils. Loss of soil properties intensifies biodiversity loss, which in turn erodes soils further and favours desertification.

Figure 2: Linkages and loop interrelations among desertification, climate change and loss of biodiversity



Source: Millennium Ecosystem Assessment, 2005.

Moreover, climate change may extend drylands at risk of desertification to territories previously judged outside the scope of desertification and then developed into dry or arid regions for climatic reasons.

Measuring and mapping desertification

Indicators of land degradation

Researchers have identified the conditions that signal whenever a certain ecosystem has moved to a degraded state; such conditions involve, for instance, loss of plant cover or soil that loses its capacity to store water and retain nutrients. Such a state can be reached through a process of deterioration that can be slow or rapid. Therefore, a lot of effort has been put into defining indicators on desertification that would allow to monitor and exchange information in support of both decision-makers and public awareness-raising campaigns.

In recent decades, a huge number of indicators have been defined through research and institutional projects. Initially, the focus was on biophysical elements (as in the case of the 1978 Handbook on Desertification Indicators), then on other characteristics such as socio-economic conditions or land use. The main problems faced in defining proper indicators include access to knowledge, especially in less developed countries, and varying levels of data availability and comparability across different regions of the world.

Besides existing parameters and measurements, an indicator should capture the effects of the complex processes that lead to desertification. It should also be cheap and easy to measure and understand. Moreover, indicators should alert to the potential risk of desertification while there is still time and scope for remedial action. An EU research project conducted at the end of the 1990s proposed the identification of environmentally sensitive areas using key indicators for soil, climate, vegetation and management quality (from rock fragments to overgrazing), with the objective of setting up local remediation or mitigation action plans. This approach was further developed by successive EU projects, which led to the DIS4ME desertification indicator system used for assessing sensitivity to desertification through a list of physical and ecological, economic, social, and institutional indicators, and a composite index on environmental sensitivity. This method has been used to calculate desertification risk for particular land uses and its results have been used to demonstrate the economic and environmental benefits of certain agricultural practices for risk reduction. Moreover, researchers have sought to identify the most effective indicators for assessing the level of desertification risk. One such assessment concluded that rain seasonality, slope gradient, plant cover, rate of land abandonment, land-use intensity and the level of policy implementation were among the most important indicators in this respect.

The sustainable development goals (SDGs) and the UNCCD 2018-2030 strategic framework involve a global approach to performance review and assessment (see box above). The indicators currently used by the UNCCD cover topics as diverse as the living conditions of affected populations and the abundance of selected species. The UNCCD reporting process contributes to the 2030 Agenda for Sustainable Development, and the UNCCD secretariat is the custodian for SDG Indicator 15.3.1.

Finally, among the many indicators on land and soil conditions, there are those developed to monitor the environmental performance of agricultural policies, both within the EU (such as the

Combating desertification globally

Established in 1994, the United Nations Convention to Combat Desertification (UNCCD) is a legally binding international agreement among 197 parties, linking environment and development to sustainable land management. In 2017, the parties to the UNCCD committed to a global roadmap to address land degradation, by adopting the 2018-2030 strategic framework. Its aim is to improve the living conditions of people in drylands, maintain and restore land and soil productivity, and mitigate the effects of drought.

In 2015, all UN member states adopted the 2030 Agenda for sustainable development, which set out an action plan for people, planet and prosperity, as well as for strengthening universal peace in larger freedom. The 17 sustainable development goals (SDGs) are at the core of this plan, together with their related thematic issues, targets and indicators. The objective is to address social, economic and environmental issues with comprehensive strategies in a global partnership.

Goal 15 Life on land aims to 'protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss'. It sets one specific target for desertification: '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' (SDGs Target 15.3). Indicator 15.3.1 measures the progress made towards this target in terms of proportion of land that is degraded over total land area. It includes sub-indicators on land cover and land cover change, land productivity, and carbon stocks above and below ground. Recent progress reports show both encouraging and disappointing signs for Goal 15, with certain indicators being on track.

28 agri-environmental indicators developed by the European Commission services jointly with the EU countries' national authorities and the European Environment Agency (EEA)) and in wider regional contexts (such as the 62 agri-environmental indicators developed by the OECD).

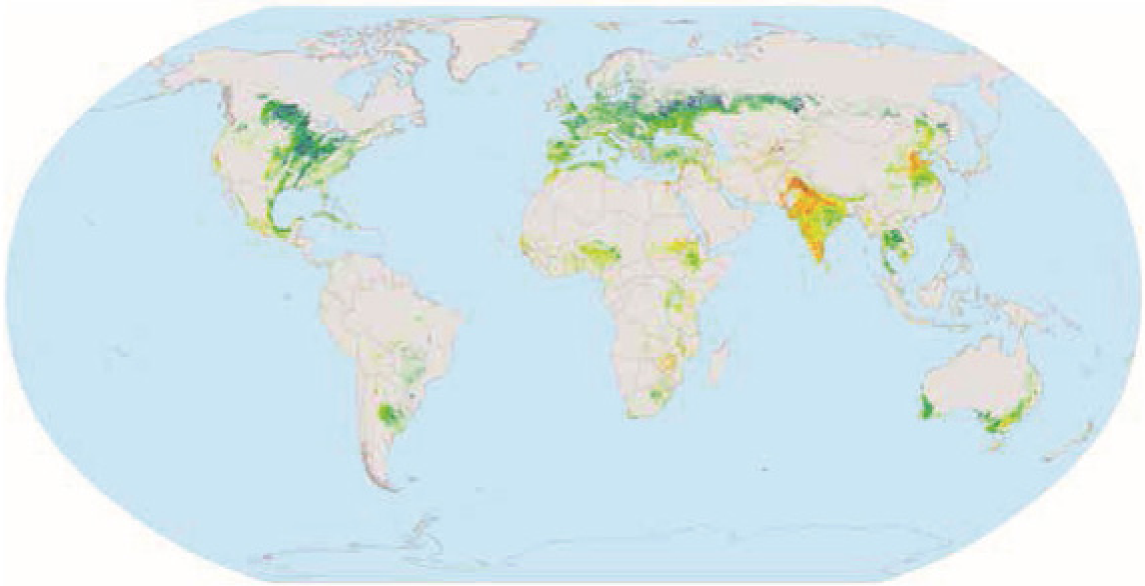
Evidence of desertification

Global estimates of total degraded area vary from less than 1 billion hectares to over 6 billion hectares. Many researchers have stressed the lack of standardised procedures for desertification assessment, which prevents them from obtaining comparable results across different regions of the world. Regional-scale studies offer location-specific information on desertification but do not allow for global comparisons. A 2019 report by the UN Intergovernmental Panel on Climate Change (IPCC) asserts that current data availability and methodological challenges do not allow for the mapping of global desertification. The report also analyses the use of satellite-based remote sensing to investigate vegetation changes that identify those drylands that are undergoing desertification. In this context, it highlights a major shortcoming: satellite sensors do not detect vegetation composition (i.e., the increased presence of invasive plant species or intensive mono-cropping with a high level of fertiliser application may be seen as greening, while many indicators would identify them as risk factors for land degradation). The EEA notes that a better monitoring system would provide crucial information on the status of land, such as the composition of soils and the amount of carbon and nutrients stored in areas. It suggests that further advances in the Copernicus satellites, which already monitor biophysical elements (for example, chlorophyll and water contained in leaves), are set to improve land monitoring in Europe in the years ahead.

The latest edition of the World Atlas of Desertification, released in 2018 by the Commission's Joint Research Centre with collaboration from UN Environment, focuses on the concept of 'convergence of evidence' as a move away from conventional desertification analyses. This implies a wide-ranging approach that looks at the complex dynamics in global land degradation processes and addresses both their multifaceted nature and the difficulty of interpreting them. According to this approach, 'when multiple sources of evidence are in agreement, strong conclusions can be drawn even when none of the individual sources of evidence is significant on its own' (UNCCD, 2017). Therefore, instead of mapping a single indicator of desertification, the atlas provides patterns of coinciding processes in different types of areas (such as rangeland with vegetation suitable for grazing, forests, high/low input cropland and irrigated or rain-fed cropland), to help identify those that are affected by land degradation or can potentially move towards degradation or recovery.

Maps of the convergence of evidence thus show the human-environment land change processes that are affecting land and the patterns of the different levels of pressure, by combining datasets on the various issues related to the human environment (e.g. migration and urban sprawl), land use (e.g. livestock density and practices) and the natural environment (e.g. soil condition). Figure 3 presents such a map depicting high-density cropland areas (i.e. where more than half of each square kilometre is under cultivation). Yellow to brown shades indicate the highest number of concurrent variables among 14 anthropogenic-induced and/or biophysical land change processes or issues (i.e., built-up area change, low nitrogen balance, irrigation, high nitrogen balance, income per capita, population change, population density, livestock density, fire, tree loss, decreasing land productivity, climate-vegetation trends, water stress, and aridity) that trigger land change processes relevant to land degradation. Analysis shows that the main croplands facing multiple pressures include intensively agricultural areas in the Mediterranean region and in central Europe seen together, where, in more than 25 % of the area, the main issues affecting land productivity are population and livestock density, high-input agriculture and water stress (the latter is particularly relevant to the southern part of the analysed area, where there is also a larger convergence of coinciding issues).

Figure 3: Convergence of evidence of key issues on high density cropland areas



Source: UNCCD, Global land outlook, 2017.

Desertification and agriculture: a two-way relationship

Producing food at the expense of the environment

According to a UN report, food-producing agricultural activities have had the largest impact on ecosystems on which people rely for their food, with crops and livestock using more than 33 % of the planet's land surface (mostly for livestock and livestock-feed production) and 75 % of its freshwater resources. In recent decades, increased demand for animal products has triggered 65 % of agricultural land use change. In the past 20 years, there has been an increase by 16 % of harvested areas worldwide, with almost 45 % of the agricultural land located in drylands (mainly in Africa and Asia) and supplying about 60 % of global food production. The World atlas of desertification states that more than 62 % of global food production goes to feed people, the remainder being used for animal feed (35 %) and for bioenergy and other industrial uses (3 %). By 2050, it is estimated that global food production would need to increase by 50 % to feed more than 9 billion people.

Any type of agricultural activity implies a certain level of alteration of natural cycles with the aim to domesticate the environment and produce food. Lands converted to agriculture are often those locally best-suited for biological productivity in terms of soils, climate and water. This conversion implies a reduction of land ecosystem services to humans. Therefore, land use changes are key to explaining desertification, above all if they disregard land attributes and degrade soil structure.

However, not all agricultural practices induce the same effects in terms of land use and soil degradation. Traditional farming systems in combination with natural processes can help sustain the functioning of soil and land. On the other hand, farming practices, such as converting grassland to arable land or leaving soil bare at critical moments of the year, can have an important impact on soil erosion, as can irrigation and mechanisation on soil quality. A range of farm-related factors, such as overcultivation, overgrazing, deforestation, overuse of chemical inputs and poor irrigation practices, have been identified as unsustainable land use practices and are major causes of desertification. These are mostly driven by the pursuit of higher yields through overexploitation of natural resources and overuse of chemicals. Moreover, despite improvements in agricultural efficiency, there has been a massive agricultural expansion during the past two human generations, and it is still an issue in some regions of the planet. In certain areas of South America, cropland and pasture have been expanding at a rapid pace to increase soybean and beef production at the expense of local ecosystems, especially through deforestation to convert land to agriculture.

Agricultural intensification and industrialisation have led to loss of soil biodiversity and fertility, hence loss of the soil's carbon sequestration capacity. Increased use of inputs, such as fertilisers, to offset the loss of fertility, increases GHG emissions, producing further soil deterioration and climate change. The abandonment of traditional land use has led to the reduction of semi-natural habitats of high conservation value and the disappearance of associated local knowledge and practices.

The planet has a finite amount of agricultural land area to meet global food demand. Options to convert more land to agricultural uses are decreasing. In drylands, climate change and desertification are projected to cause reductions in crop and livestock productivity, modify the plant species mix and reduce biodiversity. Agricultural intensification involves overconsumption of limited natural resources, leading to land degradation and a further decline in productive agricultural land and crop yields in many parts of the world. The significant yield gap between different agricultural systems across the globe due to factors as diverse as climate, soils, technology, farm size, crop varieties, input use, etc., can help estimate and map the potential for improvement.

Desertification puts pressure on agricultural production

According to the UN, 2.6 billion people depend directly on agriculture, yet 52 % of agricultural land is moderately or severely affected by soil degradation, with arable land loss estimated at 30 to 35 times the historical rate. Unsustainable land management practices, adopted to produce more food, can turn into a serious threat to agricultural production and food security. FAO estimates indicate that approximately two-thirds of arable land could be lost to desertification in Africa by 2030. Moreover, reduced and less predictable agricultural yields due to desertification constitute both a threat to the food security of people living in affected areas and a cause of more land degradation due to survival strategies developed to address people's most urgent needs.

Where there is desertification, agricultural production cannot exist by definition. On a global scale, it is difficult to assess the costs in terms of agricultural production and income foregone due to desertification (because of the differences in yields and prices, as well as the lack of commonly accepted estimation methods). Estimates based on specific types of land and regions across the world have been used to compute global figures; these add up to US$42 billion in annual income lost to land degradation and desertification. This figure has been subsequently inflation-adjusted to US$64 billion, of which approximately US$35 billion lost from rangeland productivity, US$12 billion from rain-fed agriculture, and US$17 billion from irrigated lands (although these figures could be outdated, considering the ongoing spread of land degradation). On the other hand, it is estimated that sustainable land management could deliver up to US$1.4 trillion in increased crop production, while enhanced carbon storage in land and soil would increase food and water security.

More studies exist at regional level, one such being a 2018 assessment of the costs of land degradation in India, which places agricultural production losses at close to 4 % of agricultural production value in 2014-2015 (at a very conservative level, as certain crops, regions or degradation types are not included). According to other estimates, agricultural production in developing countries is being lowered by 3-7 % annually because of the impact of land degradation on cropping systems, with bigger losses being sustained in irrigated areas, where salinisation has led to land abandonment in previously highly productive areas. Studies conducted in Ethiopia reveal that the annual costs of land degradation stand at 2-3 % of agricultural production value, representing serious cumulative losses to land degradation over time for an agriculturally based economy.

In addition to the above estimates, other aspects are also taken into account when evaluating the impacts of desertification. Firstly, the real impact of land degradation on food production could have been masked by yield growth due to greater use of technology and inputs over the last decades. Secondly, land degradation may not represent a threat to global food production (at least for current generations), but it is often related to food insecurity and poverty, with the food gap between what is produced and the minimal per capita consumption needs widening in low-income developing countries, especially in Africa. Thirdly, the range of soil ecosystem services extend the scope of those affected by soil degradation beyond agriculture, touching upon supply chain businesses and food industry, but also public interests such as human health-,[4] wildlife- and natural habitat protection.

Finally, one of the key messages of an assessment report on land degradation and restoration by the Intergovernmental Science Policy Platform on Biodiversity and Ecosystem Services (IPBES) is that investing in approaches that help avoid land degradation is a cost-effective strategy compared to the long-term losses generated by land degradation and the cost of the restoration of degraded land. To raise awareness of the costs and benefits of the land, the UNCCD initiative on Economics of Land Degradation (ELD) highlights the reward of investing in land management and provides a universal approach for the analysis of the economics of land degradation.

Agricultural solutions to land degradation

Land degradation and desertification are reversible processes, but not in all cases. Combating desertification includes various sustainable land use measures that aim to:

- prevent or reduce land degradation;
- rehabilitate partly degraded lands;
- reclaim more severely desertified areas.

In this context, land degradation neutrality is a multi-sectoral initiative based on the growing emphasis on avoiding and reducing land degradation to support the land's functions.

Land degradation neutrality

The UNCCD defines land degradation neutrality (LDN) as: 'A state whereby the amount and quality of land resources, necessary to support ecosystem functions and services and enhance food security, remains stable or increases within specified temporal and spatial scales and ecosystems'.

In September 2019, the UNCCD parties committed to achieving land degradation neutrality by 2030.

Source: UNCCD.

Some experts agree on the advantages that changing production methods in intensive agriculture would bring to the land. Analysis shows that the majority of practices associated with intensive farming (e.g. field operations including the heavy use of machinery, tillage or chemicals) negatively affect key soil parameters such as organic matter, structure, cover, biodiversity and water content. Research projects have judged positively the capacity of sustainable land management practices to preserve or enhance the soil's characteristics, such as its carbon stock capacity. The IPCC has assessed land-related activities and measures that can help combat desertification by avoiding, reducing and reversing degradation in drylands. Among the agricultural response options, those involving increased food productivity, agro-forestry and improved cropland management appear to contribute to efforts to combat land degradation and desertification. However, their potential is context-specific and relates to the adaptive capacities of communities and regions.

The farming system is another element to consider in defining context-specific solutions, as the types of land degradation related to different farm types are as diverse as the range of solutions for preventing or reducing land degradation. A study on land degradation and desertification classifies agricultural solutions to land degradation in terms of: i) intensity/inputs (e.g. organic farming, reduced grazing season and intensity, use and storage of manure and chemicals); ii) cropping techniques (e.g. crop rotation between productive crops, cover crops sown after the main crop to protect the soil during winter, intercrops planted between the rows of the main crop); iii) machinery and equipment (e.g. contour ploughing on sloping lands, lower machinery load and pressure on the land, increased efficiency of irrigation systems), including with the help of precision farming (such as high-technology GPS equipment to control machinery movements or irrigation).

In 2017, the FAO issued a set of voluntary guidelines providing technical advice on sustainable soil management. The latter is defined as the balance between the soil services and the soil functions that enable those services. The guidelines touch upon a broad range of soil-related issues, to which they suggest context-specific technical solutions. In 2019, the FAO complemented these guidelines with a Fertilisers Code on voluntary practices for the use and management of plant nutrients.

A 2019 UN foresight brief describes agricultural practices that can improve carbon sequestration in the soil. Agricultural practices that enhance both productivity and sustainability of farming operations are presented in a 2017 study commissioned by the Parliament's Committee on Agriculture and Rural Development. These practices range from applying satellite imagery-based irrigation to developing organic supply chains. A EU-funded project assessed policy and management responses to desertification across the world (including in the larger EU southern countries), subdivided into rehabilitation and restoration measures (such as afforestation or plantation of tree/shrub native slow growing species) and mitigation and prevention measures (such as post-fire or rangeland management). Moreover, besides specific solutions and practices, holistic approaches to sustainable farming can help to preserve soils, as explained in the textbox.

The extent of agricultural land degradation seems to suggest that sustainable agricultural practices are not being implemented, despite farmers' primary interest in maintaining their soils in good health. Placing short-term goals before longer time-scales objectives (achieving maximum yields than soil conservation) may be one explanation for this behaviour. Addressing this issue requires recognizing that protecting the value of soil needs long-term investments and a mechanism through which these can be transferred to farmers with appropriate incentives to reward sustainable land management. Other reasons may include a lack of awareness of the problem (i.e., threats are not present or not noticeable on the farm) or of existing solutions, including the use of additional inputs (from fertilisers to water) that shift the cost of land degradation outside the farm. A 2019 study by the European Commission's Joint Research Centre suggests that, besides a purely economic perspective, behavioural factors (such as the opinions of the local community or personal motivations and beliefs) play a major role in farmers' decisions to adopt environmentally sustainable practices. Last but not least, sustainable agriculture involves societal changes in diets and a reduction of food waste (as emphasised in the FAO's State of food and agriculture 2019).

Holistic approaches to preserving soils

Organic farming is a farm management and food production system based on principles that minimise human impact on the environment and that operate as naturally as possible. It combines best environmental practices with the preservation of natural resources while maintaining high levels of biodiversity and animal welfare standards. Its importance is increasing in the EU.

Agro-ecology is a farming system based on the agroecosystem's natural elements and processes. It applies ecological management approaches to agricultural production, such as by promoting natural defences to tackle adverse conditions. There is evidence of its economic potential.

Conservation agriculture is a farming system based on a minimum mechanical soil disturbance, the maintenance of permanent soil organic cover, and plant species diversification. The FAO promotes its principles, which help to prevent loss of arable land while regenerating degraded land.

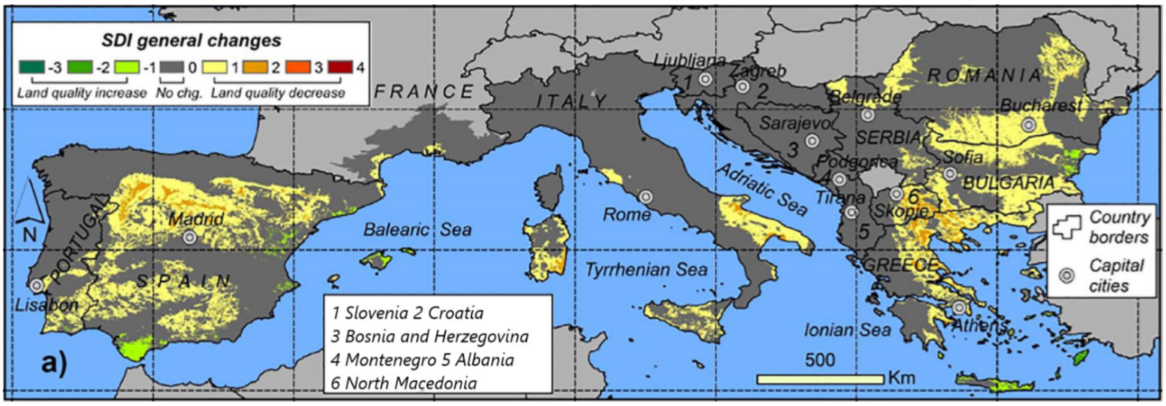
Desertification and EU agriculture

The EU's agricultural land faces multiple and severe pressures. Its deterioration process, especially in southern regions, had already started in ancient times, with the conversion of vast areas (including forests) to cropland and pasture. More recent land use changes, involving mechanisation, overexploitation of water resources and expansion of irrigated areas, intensive cultivation, and agricultural abandonment in mountain areas, have resulted in a very advanced state of land degradation or, in dryland regions, in desertification. Almost half of the EU Member States (Bulgaria, Croatia, Cyprus, Greece, Hungary, Italy, Latvia, Malta, Portugal, Romania, Slovakia, Slovenia, and Spain) have declared that they are affected by desertification under the UNCCD.

An EU-funded research study on Mediterranean desertification identified overgrazing, deforestation, forest fires and land management practices as the main causes of land degradation and desertification triggered by direct human actions. The study noted that the absence of land-stressing activities can prove beneficial, as it leaves land resources enough time for recovery and restoration. However, the abandonment of severely degraded land has led to further environmental degradation and vulnerability in many Mediterranean regions. Removal of existing natural vegetation to favour the growth of grass, followed by overgrazing by livestock, or the abandonment of terraced agriculture, which exposes the terrains to rapid soil removal through water run-off, are just two of many examples of processes that have prevented soils from supporting a sufficient vegetative cover to avoid desertification.

Based on soil, climate and vegetation quality parameters, 14 countries (Albania, Bosnia-Herzegovina, Bulgaria, Croatia, France, Greece, Italy, North Macedonia, Montenegro, Portugal, Romania, Serbia, Slovenia, and Spain) had areas of high to very high sensitivity to desertification in 2008. Less than a decade later, an improved sensitivity desertification index revealed that the situation had worsened: there were over 400 000 km^2 of land of high and very high sensitivity in 2017, compared to the initially estimated 234 000 km^2 (and 30 000 km^2 instead of 10,000 km^2 for land of very high sensitivity). Figure 4 shows in yellow to red shades the change towards decreased land quality. Of all 14 countries, Spain is the most severely threatened by desertification, but major concerns exist as well for extensive and expanding areas highly prone to degradation in Greece, Bulgaria, Italy, Romania and Portugal.

Figure 4: Changes in Sensitivity Desertification Index (SDI) classes from 2008 to 2017



Source: R. Prăvălie et al., CATENA Volume 158, November 2017, pages 309-320.

This situation could get even worse due to the combined effects of climate change, spoiled condition of soils (according to Eurostat's agri-environmental indicator on soil erosion, about 11.4 % of the EU territory is estimated to be affected by a moderate to high level erosion; the same occurs on 12.5 % of the EU's arable land,[5] i.e. an area larger than the surface of Greece) and continuation of unsustainable land use practices. Based on simulations of climate change scenarios, researchers found out that large parts of Spain, southern Italy, south-eastern Europe, and the Danube Delta are likely to face different levels of desertification risk, depending on the extent of climate change. In the worst-case scenario, roughly 11 % of European territories would be at risk of desertification by the end of the century. As stressed by an EEA 2019 report on agriculture and climate change, crop and livestock production is projected to decrease due to climate change, and this may even lead to agriculture abandonment. The report quotes a 2016 Spanish study, according to which the expected changes in aridity would increase the risk of desertification all over Spain, with 22 % of the territory evolving to arid or dry areas by 2100. Therefore, climate change may result in expanded areas vulnerable to desertification, negatively affecting agriculture in Europe in the years to come.

Is the EU acting on desertification?

In 2018, a European Court of Auditors' special report on combating desertification in the EU concluded that there is no EU-level strategy on desertification and land degradation. A range of EU policies, programmes and projects with different aims and scopes of action focus on soil management, but not on desertification (e.g. the EU's agricultural policy, strategies and programmes on environment and climate, cohesion and regional policy, water policy, and research programmes). Moreover, although data on desertification-related parameters do exist (such as those produced by the Copernicus land monitoring service, the CORINE land cover inventory, and the LUCAS land use and land cover survey), there is no EU methodology to assess the phenomenon.

In the past, there have been attempts to address desertification within an integrated EU legislation framework. The 2006 thematic strategy for soil protection put forward a proposal for a directive for the protection of soil which should have contributed to halting desertification. Having encountered opposition from several EU Member States, the proposal was withdrawn as obsolete in 2014. Meanwhile, EU Member States have tackled desertification through international (such as the UNCCD) or national strategies and plans, without a common EU approach to this issue.

The EU farm policy

In the absence of a framework strategy to combating desertification, EU legislation can influence elements and drivers of desertification, for example, by protecting soils through requirements promoting sustainable agriculture. A 2017 report funded by the European Commission looked at EU policy instruments and their coverage of soil threats and functions. As for the common agricultural policy (CAP), the study analysed cross-compliance (standards on the environment, land conditions, plant and animal welfare, etc.), greening payments (for practices addressing environment policy goals) and rural development programmes (including measures to protect natural resources). The main soil threats covered by these instruments are soil erosion and the loss of soil carbon and soil biodiversity, while the key soil functions they address relate to maintaining the fertility, resilience and productive capacity of soils for agriculture. The report considered cross-compliance standards to be the instrument with the widest policy reach across the EU, applying to all farms in receipt of EU payments. It also noted that the significant degree of subsidiarity characterising CAP instruments means that their impact depends also on choices made at Member State, region or farm level.

Although an overall evaluation of the impact that CAP measures activated after 2014 have had on EU soils may still be premature, there is some evidence of positive effects that could also serve as suggestions for future improvements. The European Network for Rural Development has identified some opportunities for action regarding soils and also factors limiting uptake. Researchers evaluating the CAP greening measures noted that it was too early to see evidence of actual environmental impacts in 2017. However, they report a slowdown in the trend towards monoculture crops that may be due to greening measures, such as crop diversification, with potentially significant effects at local level. In Spain, the replacement of cereal crops by legumes on 2.8 % of the arable area is likely to have brought benefits for soil quality; protection of soil from erosion may have improved in France, Germany and the Netherlands, where maize has frequently been replaced by crops providing better soil cover (e.g. wheat, barley and other cereals, or legumes). Although desertification is only just mentioned, an evaluation study on the impact of the CAP on climate change (financed by the European Commission and published in 2019) reports various examples of CAP-funded soil-enhancing actions, such as the support for extensive agroforestry systems to improve the resilience of the territory to fires and desertification in Andalusia (Spain), the promotion of drought-resistant cropping systems in southern Romania (where around 900 000 ha of arable land is at risk from drought and desertification), or the synergies between CAP measures to address soil erosion issues in Saxony-Anhalt (Germany).

A 2018 research study on CAP performance in relation to EU soil concluded that studies have not yet shown whether the current CAP is improving the biodiversity and functioning of soils. Taking stock of current issues, it puts forward ideas on how the future agricultural policy currently under discussion could boost CAP performance as regards soil, such as encouraging more crop rotation that can increase soil organic carbon and improve soil structure, or developing soil reports by farmers and other land owners to record the status of their soils. A 2018 research paper put forward ideas on how the future CAP could work from a soil perspective, suggesting that EU Member States should define what key soil degradation threats agricultural and forest land are facing, and identify targets for no further deterioration and improvement. Finally, many suggest that the post-2020 CAP should rely on and put in practice innovation stemming from soil research (worth almost €200 million under the 2014-2020 Horizon 2020 programme). With the unveiling of the European Green Deal in late 2019 and the launch of the strategy 'From Farm to Fork' in 2020, the climate-related and environmental ambition of EU policies could contribute to more soil-friendly farming.

The European Commission has launched an evaluation to assess the impact of the EU agricultural policy instruments and measures on sustainable soil management and soil quality in the EU. Citizens and stakeholders provided their feedback in 2019. The evaluation report should be finalised and presented to the European Parliament and the Council by 2021.

MAIN REFERENCES

Climate Change and Land: an IPCC special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems, The Intergovernmental Panel on Climate Change, IPCC, 2019.

World atlas of desertification, Joint Research Service, European Commission, 2018.

Global land outlook, United Nations Convention to Combat Desertification, UNCCD, 2017.

Imeson A., Desertification, Land Degradation and Sustainability, Chichester: Wiley-Blackwell, 2012.

Land degradation and desertification, Policy Department for Economic and Scientific Policy, European Parliament, March 2009.

ENDNOTES

1 To help raise awareness on this crucial issue, the Food and Agriculture Organization (FAO) proclaimed 2015 International Year of Soils and 5 December World Soil Day.

2 A detailed description of soil threats is available in the report edited by the European Commission's Joint Research Service Soil threats in Europe: status, methods, drivers and effects on ecosystem services of November 2015. An overview of soil threats is also available in the study Preserving agricultural soils in the EU of March 2017, requested by the European Parliament's Committee on Agriculture and Rural Development and authored by researchers from European universities.

3 When they are in good health, soil and vegetation act as natural carbon sinks, i.e. they absorb, capture and store carbon dioxide (CO_2) from the atmosphere and reduce its concentration in the air. This process of carbon sequestration helps to mitigate global warming and combat climate change.

4 According to estimates, the cost of soil degradation in the EU stands at €97 billion per year, two-thirds of which are costs to human health.

5 According to a 2018 study by the Commission's Joint Research Service, soil erosion inflicts EU countries losses worth €1.25 billion in annual agricultural productivity and €155 million in gross domestic product. Italy suffers the highest annual loss (€619 million), with 33 % of its agricultural area severely eroded.

DISCLAIMER AND COPYRIGHT

eprs@ep.europa.eu (contact)

www.eprs.ep.parl.union.eu (intranet)

www.europarl.europa.eu/thinktank (internet)

http://epthinktank.eu (blog)