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**COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN
PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL
COMMITTEE AND THE COMMITTEE OF THE REGIONS**

**EU Soil Strategy for 2030
Reaping the benefits of healthy soils for people, food, nature and climate**

{COM(2021) 699 final}

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This Staff Working Document provides the knowledge base in support of the approach and actions that constitute the new EU Soil Strategy, as well as a synopsis of the consultation that the Commission conducted with Member States, stakeholders and the public for the preparation of the Strategy.

PART I: KNOWLEDGE BASE IN SUPPORT OF THE NEW SOIL STRATEGY

1. INTRODUCTION: POLITICAL AND LEGAL CONTEXT

1.1. Soil and the European Green Deal

Soils are essential ecosystems that deliver valuable services such as the provision of food, energy and raw materials, carbon sequestration, water purification and infiltration, nutrient regulation, pest control and recreation. Therefore, soil is crucial for fighting climate change, protecting human health, safeguarding biodiversity and ecosystems and ensuring food security. Healthy soils are a key enabler to achieve the objectives of the European Green Deal¹ such as climate neutrality, biodiversity restoration, zero pollution, sustainable food systems and a resilient environment.

1.2. EU soil policy: from the 2006 Soil Thematic Strategy to the European Green Deal

1.2.1. The 2006 Soil Thematic Strategy and the proposal for a Soil Framework Directive

The Soil Thematic Strategy COM(2006)231 (STS) adopted by the Commission in 2006 aimed to protect European soils through the prevention of further degradation, the conservation of soil functions and the restoration of degraded soils. The STS was accompanied by a proposal for a Soil Framework Directive² and its impact assessment³.

The Thematic Strategy was the result of a preparatory communication COM (2002) 179 that announced the policy approach for soil protection. The main threats to soil were described, with a focus on erosion, decline in organic matter and biodiversity, contamination, sealing, compaction, salinisation, landslides and flooding. The Commission stressed the importance of integrating soil aspects into other policies, but also indicated the need for legislation focussing exclusively on soil.

This Communication was the subject of favourable conclusions by the other European institutions which recognised that soil has a major role with respect to long term European sustainability. The European Parliament stated “the urgent need to regulate its (soil) use and assess and mitigate the impact of external actions”, and generally supported the approach of

¹ [A European Green Deal | European Commission \(europa.eu\) https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en](https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en)

² Proposal for a Directive of the European Parliament and of the Council establishing a framework for the protection of soil and amending Directive 2004/35/EC, COM/2006/0232 final - COD 2006/0086

³ SEC(2006)620, Commission Staff Working Document, Impact Assessment of the Thematic Strategy on Soil Protection

the Commission, including the necessity for Community action and legislative proposals⁴. The Council welcomed the Communication as it “provides a comprehensive overview of the elements and factors related to soil threats, as well as of existing Community policies relevant for soil protection, and establishes the basis for the identification of the future Community actions for its protection” and underlined that “the proper functioning of the single market may require also a common approach to soil policy, in so far as its protection and remediation at all relevant levels may also affect competitiveness”⁵.

The Soil Thematic Strategy defined the common approach to counter soil degradation in the EU and set the frame by stating the four key pillars of action around which policy measures had to be taken:

- Integration of soil protection in the formulation and implementation of national and EU policies;
- Closing the recognised knowledge gap in certain areas of soil protection through research supported by EU and national research programmes;
- Increasing public awareness of the need to protect soil;
- Development of framework legislation with protection and sustainable use of soil as its principal aim.

The Commission proposal for a Soil Framework Directive (SFD)⁶ aimed at implementing the legislative pillar of the Soil Thematic Strategy. The European Parliament discussed the proposal for a SFD and adopted a positive opinion on the text in first reading in November 2007⁷. For several years, very difficult and sensitive political discussions took place in the Council of the EU under successive EU presidencies which, despite the efforts of many involved, never reached a common position due to a blocking minority of five Member States⁸. Finally, after been pending for eight years, the proposal was withdrawn in May 2014 by the Commission with the statement “The Commission remains committed to the objective of the protection of soil and will examine options on how to best achieve this. Any further initiative in this respect will however have to be considered by the next college”⁹.

In 2013 the EU had agreed in legislation that “the Union and its Member States should reflect on how best to make such a commitment operational within their respective competencies. The Union and its Member States should also reflect as soon as possible on how soil quality issues could be addressed using a targeted and proportionate risk-based approach within a binding legal framework. Targets should also be set for sustainable land use and soil.”¹⁰

⁴ Resolution of the European Parliament on the Commission communication “Towards a Thematic Strategy for Soil Protection” (COM(2002) 179 - C5-0328/2002 - 2002/2172(COS)) adopted on 19 November 2003

⁵ Council conclusions on integrated soil protection adopted on 25 July 2002

⁶ Proposal for a Directive of the European Parliament and of the Council establishing a framework for the protection of soil and amending Directive 2004/35/EC, COM/2006/0232 final - COD 2006/0086

⁷ Position of the European Parliament adopted at first reading on 14 November 2007 with a view to the adoption of Directive 2008/.../EC of the European Parliament and of the Council establishing a framework for the protection of soil

⁸ [Procedure File: 2006/0086\(COD\) | Legislative Observatory | European Parliament \(europa.eu\)](#)

⁹ Withdrawal of obsolete Commission proposals (2014/C 153/03) OJ C 153, 21.5.2014, and Corrigendum OJ C 163, 28.5.2014

¹⁰ Decision 1386/2013/EU of the European Parliament and of the Council of 20 November 2013 on a General Union Environment Action Programme to 2020 “Living well, within the limits of our planet”

The EU Green Deal Communication announced that “To ensure that the EU plays a key role, the Commission will present a Biodiversity Strategy by March 2020, to be followed up by specific action in 2021. The strategy will outline the EU’s position for the Conference of the Parties, with global targets to protect biodiversity, as well as commitments to address the main causes of biodiversity loss in the EU, underpinned by measurable objectives that address the main causes of biodiversity loss. The biodiversity strategy will identify specific measures to meet these objectives. These could include quantified objectives, such as increasing the coverage of protected biodiversity-rich land and sea areas building on the Natura 2000 network. Member States should also reinforce cross-border cooperation to protect and restore more effectively the areas covered by the Natura 2000 network. The Commission will identify which measures, including legislation, would help Member States improve and restore damaged ecosystems to good ecological status, including carbon-rich ecosystems.”

In turn, the EU Biodiversity Strategy for 2030 followed up these commitments and specifically for soil stated that “It is therefore essential to step up efforts to protect soil fertility, reduce soil erosion and increase soil organic matter. This should be done by adopting sustainable soil management practices, including as part of the CAP. Significant progress is also needed on identifying contaminated soil sites, restoring degraded soils, defining the conditions for their good ecological status, introducing restoration objectives, and improving the monitoring of soil quality. To address these issues in a comprehensive way and help to fulfil EU and international commitments on land-degradation neutrality, the Commission will update the EU Soil Thematic Strategy in 2021.” Additionally, the Farm to Fork Strategy aimed to ensure that the food chain has a neutral or positive environmental impact, including to preserve, protect and restore land and soil.

1.2.2. Learning from the Soil Framework Directive proposal of 2006

Few Member States have developed, with difficulty, national or regional legislation on soil in the 90s (for example it took to Germany 11 years to come to the German Soil Act in 1999). Those MS then raised to the EU level the issue of competitive advantage for those other MS which had less legal constraints in using soils. The Commission followed this call up with the Communication of 2002 and with the Thematic Strategy and the proposal for a Soil Framework Directive in 2006.

During subsequent Council discussions, a small number of MS, in particular those countries already having legislation on soil modified their position on the topic, reflecting several concerns and subsidiarity issues. This position did not reflect the evidence from the Commission on transboundary effects of soil degradation.

Today the situation has changed in many aspects: the EU has an increased knowledge and increasingly shared awareness of the transboundary impacts of soil and land degradation, concerning the impact on climate change, biodiversity, food safety and security, and of the need to use soils to maximize carbon sinks in croplands, forests and wetlands. Farmers have an interesting business case for carbon farming and the CAP has developed conditionalities for protecting soil from the most degrading practices. Furthermore, there are MS which have

developed and are implementing ambitious plans to remediate all polluted sites in their territory¹¹.

1.2.3. The EU Expert Group on Soil Protection

Based on the mandate that “the Union and its Member States should also reflect as soon as possible on how soil quality issues could be addressed using a targeted and proportionate risk-based approach within a binding legal framework” enshrined in the 7th EU Environment Action Programme¹² the Commission set up an expert group with soil specialists nominated by the Member States and with a connection with national authorities dealing with soil issues at a political level. The expert group met for the first time in October 2015 and since then has been supporting the Commission in the development of the element of the new EU soil policy framework. An overview of the discussions in the EU Soil Expert Group is included in the second part of this SWD.

1.2.4. Gaps in EU soil policy

The European Environment Agency concluded in 2019 that the lack of a comprehensive and coherent policy framework to protect land and soil reduces the effectiveness of the existing incentives and measures that may limit Europe’s ability to achieve future objectives in relation to sustainability and environmental protection.

Europe is not on track to protect its soil resources based on the existing strategies. The underlying drivers of soil degradation are not projected to change favourably, so the functionality of soils is under even more pressure. There is a lack of binding policy targets, and some threats to soil are not addressed in existing European legislation. There is a high risk that the EU will fail some of its own and international commitments such as land degradation neutrality.¹³ Measurements and monitoring of soil threats are incomplete.¹⁴ Harmonised, representative soil monitoring across Europe is needed to develop early warnings of exceedances of critical thresholds and to guide sustainable soil management. This should feed a consistent set of indicators and representative databases for all soil threats across Europe, which to date has not yet been fully established. Efforts shall build on existing indicator systems (SDGs, agro-environmental indicators, CAP indicators, EEA Land and Soil Indicator Set, indicators under the Zero Pollution Action Plan¹⁵, 8th EAP monitoring framework¹⁶).¹⁷ Experts from the Mission Board ‘A Soil Deal for Europe’ have also proposed an approach for soil health monitoring based on a limited set of indicators; these can also feed into the

¹¹ [Contamination industrial point source - Inventory and Assessment of Soil Protection Policy Instruments in EU Member States - EC Extranet Wiki \(europa.eu\)](#)

¹² Decision 1386/2013/EU of the European Parliament and of the Council of 20 November 2013 on a General Union Environment Action Programme to 2020 “Living well, within the limits of our planet”

¹³ European Environment Agency (2019), The European Environment: State and Outlook 2020 <https://doi.org/10.2800/96749>

¹⁴ European Environment Agency (2019), The European Environment: State and Outlook 2020 <https://doi.org/10.2800/96749>

¹⁵ [SWD\(2021\)141](#) towards a monitoring and outlook framework for the zero pollution ambition

¹⁶ [Environment action programme to 2030 \(europa.eu\)](#)

¹⁷ EEA (2022). Soil monitoring in Europe: Indicators and thresholds for soil quality assessments. <https://www.eea.europa.eu/publications/soil-monitoring-in-europe-indicators-and-thresholds/>

discussion. The urgent need to reverse the deteriorating trends is undisputed, as well as the call for action at EU level, to complement initiatives taken at national level.

As part of the work to deliver the commitments of the 7th EAP, the Commission in 2017 established, with the support of a consultant and in cooperation with the Member States, an inventory of soil protecting instruments at national and EU level in the form of a wiki.¹⁸ The database contains 35 EU level policies and 671 national instruments that directly or indirectly contribute to the protection of soils.

An overview of EU legislation with the most relevant soil provisions:

- The Sewage Sludge Directive regulates the use of sewage sludge on agricultural land and sets limit values for heavy metals in sludge and in the soil on which sludge is applied.
- The Industrial Emissions Directive sets an obligation for certain operators to produce a baseline report and periodic monitoring of the soil and groundwater condition, and to return them to their initial status upon cessation of the activities.
- The European Pollutant Release and Transfer Register (E-PRTR) Regulation includes an obligation to report emissions to soil.
- The Common Agricultural Policy includes measures for soil sustainable management, such as the Good Agricultural and Environmental Conditions (GAEC)¹⁹, the obligation of crop diversification under greening, and the rural development support for investments in forests, agro-environment and climate measures and organic farming.
- The Environmental Liability Directive establishes an EU-wide liability regime for damage to land, based on the polluter pays principle.
- The Waste Framework Directive and the Landfill Directive lay down rules to prevent risks from waste management and landfilling to soil and the environment.
- The Land Use Land Use Change and Forestry (LULUCF) Regulation aims to ensure that the LULUCF sector does not generate net emissions and contributes to the enhancement of sinks in forests and soils (no-debit obligation).
- EU water legislation establishes a framework for the protection of inland surface waters, transitional waters, coastal waters, groundwater, drinking water and the management of flood risks. These provisions have a beneficial impact on the soil-sediment-water system.
- National Emissions Directive sets emission reduction commitments for air pollutants, including heavy metals and persistent organic compounds in soil.

¹⁸ [Wiki: Inventory and Assessment of Soil Protection Policy Instruments in EU Member States](#) (having or creating an EU login account is needed to access it)

¹⁹ [“Good Agricultural and Environmental Conditions” most relevant for soil health are:](#)

- GAEC 1: Maintenance of permanent grassland based on a ratio of permanent grassland in relation to agricultural area;
- GAEC 2: Appropriate protection of wetland and peatland;
- GAEC 3: Ban on burning arable stubble, except for plant health reasons;
- GAEC 6: Tillage management reducing the risk of soil degradation, including slope consideration;
- GAEC 7: No bare soil in most sensitive period(s);
- GAEC 8: Crop rotation;
- GAEC 9: Ban on converting or ploughing permanent grassland in Natura 2000 sites.

- EU legislation on specific substances such as the Fertilising Products Regulation, the Sustainable Use of Pesticides Directive, the Plant Protection Products Regulation,, the Mercury Regulation or the Persistent Organic Pollutants Regulation contribute to the prevention of soil pollution and the improvement of soil quality.
- The Environmental Impact Assessment and Strategic Environmental Assessment Directives require that the significant effects of certain projects, plans and programmes on land and soil should be assessed.
- The Nitrates Directive aims protecting waters against pollution with nitrates from agriculture and sets a maximum for manure that can be applied on land.

Furthermore, the different EU funds, such as the LIFE programme, Horizon Europe and Cohesion Policy provide support for sustainable soil management, soil restoration, soil research and land rehabilitation.

At national level, the inventory showed that soil protection coverage varies a lot across the EU. Some Member States have quite developed soil protection policies and rules, others do not have provisions beyond those derived from existing EU policies. The inventory identified that 45% of the 671 national policy instruments are directly linked, and 21% partly linked, to existing EU policies (mostly on water and waste), while only 35% of the identified instruments are nationally initiated instruments.

Member States having less soil-protecting policy instruments are often those suffering from high pressures on soil. On the other hand, the management of soil contamination has progressed faster in the few Member States that opted to tackle the historical contamination resulting from their industrial heritage with strong legislation and targets. This creates a distortion in the common market where companies should instead compete on a level playing field.

The most important conclusion from the inventory was that very few Member States have a comprehensive legal framework that covers soil protection, restoration, sustainable use and monitoring, and that would set the necessary conditions to integrate soil protection in other policy areas, and thus ensure soil protection and restoration in other policy areas.

In addition to the lack of strategic coordination of soil concerns at EU level, other weaknesses that were identified in the coverage of EU law included:

- That soil protection is an outcome mostly derived from the protecting of other environmental resources, addressing other environmental threats or delivering other goals or targets;
- Key policies that offer some strategic vision are non-binding. As such they cannot be used as a clear basis for integrating and reinforcing the protection of soil within existing EU laws in the way that, for example, water protection laws such as the Water Framework Directive can be cross referenced within the Industrial Emission Directive (IED)²⁰ or under Statutory Management Requirements set out in CAP cross-compliance.

²⁰ Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions (integrated pollution prevention and control)

- Land protection may not equate to soil protection. Thus, land is not protected against soil sealing at the EU level and insufficiently at Member State level. In some key EU policies protection from contamination is focused on land protection and not explicitly on soil protection. These are not necessarily one and the same thing. Land can be protected but important soil functionality can be lost.
- Historic contamination that persisted before the introduction of key EU policies, such as IED (and prior to IED, the IPPC Directive²¹) and the Environmental Liability Directive²² is not addressed by EU laws and there are no binding rules in place for detecting or defining contaminated sites.
- There is limited elaboration in EU law of soil functions, what these consist of and the actions that their protection implies. Moreover, a question has also emerged during the study regarding the elaboration of the role of ecosystem services provided by soils and the limited representation of these in legal texts.

Evidence shows that very few EU countries benefit from an integrated, comprehensive and effective legislative framework to protect soil from all pressures and establish the boundaries of its sustainable use. Few Member States have a legal definition of what a healthy soil is and what the obligations are to achieve it. If these gaps are not addressed, soil will continue to lack the protection it deserves, while degradation will continue and accelerate. Without comprehensive legal protection framework, the EU risks failing to achieve its Green Deal and international commitments on climate change, biodiversity, land degradation and desertification, while also endangering food security and safety. Economic actors would have to continue to compete on an uneven and playing field. The fact that costs for soil remediation in one country are fully covered by the public sector while in several other countries costs are borne up to 70% by the private sector, is just one example of such market distortion.

The FAO and the Global Soil Partnership recently created a similar database as the EU Soil Wiki called SoiLEX at global level with information on existing legal instruments for soil protection and prevention of soil degradation.²³

2. WHAT ARE THE PROBLEMS?

It has been estimated that about 60 to 70% of soils in the EU are not in a healthy state (based on a definition of soil health applied in the context of the Mission 'A Soil Deal for Europe', under the EU Horizon Europe research programme²⁴). Land and soil continue to be subject to severe degradation processes in the EU reflecting diverse pressures such as unsustainable land-use and management, climate change, pollution, overexploitation and biodiversity loss.

²¹ Directive 2008/1/EC of the European Parliament and of the Council of 15 January 2008 concerning integrated pollution prevention and control

²² Directive 2004/35/CE of the European Parliament and of the Council of 21 April 2004 on environmental liability with regard to the prevention and remedying of environmental damage

²³ [SoiLEX | FAO Soils portal](http://www.fao.org/soils-portal/soilex/) <http://www.fao.org/soils-portal/soilex/>

²⁴ European Commission (2020), [Proposed Mission "Caring for soil is caring for life - Ensure 75% of soils are healthy by 2030 for food, people, nature and climate"](https://ec.europa.eu/info/publications/caring-soil-caring-life_en), [Independent Expert Report](https://ec.europa.eu/info/publications/caring-soil-caring-life_en) https://ec.europa.eu/info/publications/caring-soil-caring-life_en; see in particular Annex I

EEA has developed a technical report²⁵ that summarizes the current state of knowledge about key soil indicators in the light of current and new policies in support of healthy soils.

While this is not an exact exercise and may evolve with new knowledge (e.g. on soil biodiversity), it indicates that the development and application of thresholds sensitive to the functioning of the soils is the prerequisite to understand where soils are degraded. Once critical limits are exceeded, the soil cannot provide its multiple services, for example as a medium to filter contaminants or store and release nutrients.

All the scientific evidence is indicating that in the EU land and soil degradation is continuing and even worsening, climate change is reaching a tipping point, biodiversity is declining dramatically and many other ecosystems are degrading as well.

12.7% of Europe is affected by moderate to high erosion, causing an estimated loss of agricultural production in the EU of €1.25 billion per year.²⁶ In the EU, we lose every year through water erosion alone the equivalent of a one metre-depth soil on an area corresponding to the size of the city of Berlin. It can take up to 1,000 years to produce 1 cm of fertile soil but only a couple of years to lose it.²⁷

Organic carbon stocks in cropland topsoils are declining: an estimated 45,000 – 55,000 km² of organic soil have been drained for agricultural use and are currently losing carbon²⁸. It has been estimated that drained organic soils used for agriculture emit around 100.5 Mtonnes CO₂ per year in the EU-27; drained organic forest soils emit 67.6 Mt CO₂ per year; peat extraction emits 5.6 Mtonnes CO₂ a year²⁹; mineral soils under cropland are losing every year around 7.4 million tonnes of CO₂. The extent of wetland in the EU has been steadily decreasing with around half of wetlands having disappeared since the beginning of the 20th century.³⁰ Also, climate change and unsustainable forest management lead to carbon losses from forest biomass and soils.

Local pollution is also present in all countries and 14% of an estimated total of 2.8 million potentially polluted sites from industrial activities are expected to require remediation, that is 390,000 sites. By 2018, only some 65,500 of these sites were remediated.³¹ Diffuse soil contamination by atmospheric deposition, land management practices, industrial emissions, sewage sludge and other waste disposed on land is widespread and results in elevated levels of heavy metals, pesticides, antibiotics, excess nutrients, microplastics, and other substances of concern.

²⁵ EEA and ETC/ULS (2021). Soil monitoring in Europe: Indicators and thresholds for soil quality assessments. <https://www.eionet.europa.eu/etcs/etc-uls/products/uls-reports>

²⁶ Panagos, P. et al. (2018), Cost of agricultural productivity loss due to soil erosion in the European Union: From direct cost evaluation approaches to the use of macroeconomic models <https://doi.org/10.1002/ldr.2879>

²⁷ Soil matters for our future | European Commission (europa.eu) https://ec.europa.eu/info/news/soil-matters-our-future-2019-dec-05_en

²⁸ Tanneberger, F. et al. (2017), The peatland map of Europe <https://doi.org/10.19189/MaP.2016.OMB.264>; European Commission (2008), [Review of Existing Information on the Interrelations between Soil and Climate Change](#) (CLIMSOIL final report) <https://doi.org/10.2779/12723>.

²⁹ European Commission (2015), [Soil threats in Europe: status, methods, drivers and effects on ecosystem services](#) <https://doi.org/10.2788/828742>

³⁰ LIFE Focus (2007), LIFE and Europe's wetlands <https://doi.org/10.2779/22840>

³¹ Joint Research Centre (2018), Status of local soil contamination in Europe <https://publications.jrc.ec.europa.eu/repository/handle/JRC107508>

Polluted soils not only cause a loss of biodiversity, but also reduce soil productivity and fertility, and can impact human health through direct exposure via inhalation, dermal contact, ingestion, or indirect exposure via dietary intake of contaminated food or drinking water. Children are at greatest risk of exposure because they play close to the ground. It is estimated that soil pollution with heavy metals (especially lead) and chemicals causes between 200.000 and 800.000 deaths globally per year.³²

Land take and soil sealing continue predominantly at the expense of agricultural land at an annual net land take estimated at 440 km²/year in the period 2012-2018.³³ While the annual rate of land take and consequent habitat loss has gradually slowed, ecosystems are under pressure from fragmentation of peri-urban and rural landscapes. Land recycling accounts for only 13 % of urban developments in the EU. The target of no net land take by 2050 is unlikely to be met unless annual rates of land take are reduced and land recycling increased³⁴.

Intensive land management and land use change negatively impacted in recent decades soil biodiversity such as the species richness of earthworms, springtails and mites.³⁵ At the same time, the state of soil biodiversity in the EU is still largely unknown. Only 1% of soil micro-organisms has been identified yet, compared to over 80% of plants.³⁶

Human induced salinization affects 3.8 million ha in the EU, with severe soil salinity along the coastlines, particularly in the Mediterranean. While naturally saline soils occur, inappropriate irrigation practices, poor drainage conditions or the use of salt for de-icing roads induce anthropogenic or secondary salinization.³⁷ Salinity intrusion costs range from € 577 – 610 million per year in Europe and are projected to increase significantly over time with sea-level rise over time.³⁸

In southern, central and eastern Europe 25% of soils show high or very high sensitivity to degradation³⁹ corresponding to about 411 000 km²⁴⁰. Projections on climate change in Europe indicate that the risk of desertification is increasing. Hot semi-deserts already exist in southern Europe, where the climate is transforming from temperate to arid. This phenomenon is already extending northwards. Man-made emissions have substantially increased the probability of drought years in the Mediterranean region. Climate change scenarios show water is becoming scarcer in parts of Europe, and droughts occurring more frequently. This

³² Landrigan, P.J.. et al. (2018), The Lancet Commission on pollution and health [https://doi.org/10.1016/S0140-6736\(17\)32345-0](https://doi.org/10.1016/S0140-6736(17)32345-0)

³³ [Land take and net land take — European Environment Agency \(europa.eu\) https://www.eea.europa.eu/data-and-maps/dashboards/land-take-statistics](https://www.eea.europa.eu/data-and-maps/dashboards/land-take-statistics)

³⁴ European Environment Agency (2019), The European Environment: State and Outlook 2020 <https://doi.org/10.2800/96749>

³⁵ European Environment Agency (2019), The European Environment: State and Outlook 2020 <https://doi.org/10.2800/96749>

³⁶ European Commission (2010), The factory of life: why soil biodiversity is so important https://ec.europa.eu/environment/archives/soil/pdf/soil_biodiversity_brochure_en.pdf

³⁷ FAO and ITPS (2015). Status of the World's Soil Resources <http://www.fao.org/3/i5199e/i5199e.pdf>

³⁸ Tzemi, D. et al. (2020), Economic impacts of salinity induced soil degradation <https://northsearegion.eu/media/14789/chap2-economic-analysis-of-salinization.pdf>

³⁹ “Desertification means land degradation in arid, semi-arid, and dry sub-humid areas resulting from various factors, including climatic variations and human activities” (see UNCCD definition under article 1 of the Convention; https://treaties.un.org/doc/Treaties/1996/12/19961226%2001-46%20PM/Ch_XXVII_10p.pdf). It includes processes such as strong wind and water erosion, lack of water during the growing season, soil crusting and subsoil compaction, as well as salinization.

⁴⁰ [Právělie et al. \(2017\)](#), Quantification of land degradation sensitivity areas in Southern and Central Southeastern Europe.

increases the vulnerability to desertification. The risk of desertification is expected to be significant in particular in Spain, southern Italy, Portugal, and areas of south-eastern Europe including Bulgaria, Greece, Cyprus and the Danube Delta in Romania. Particularly strong increases in dryness and decreases in water availability in southern Europe and the Mediterranean when shifting from a 1.5 °C to a 2 °C global warming.⁴¹

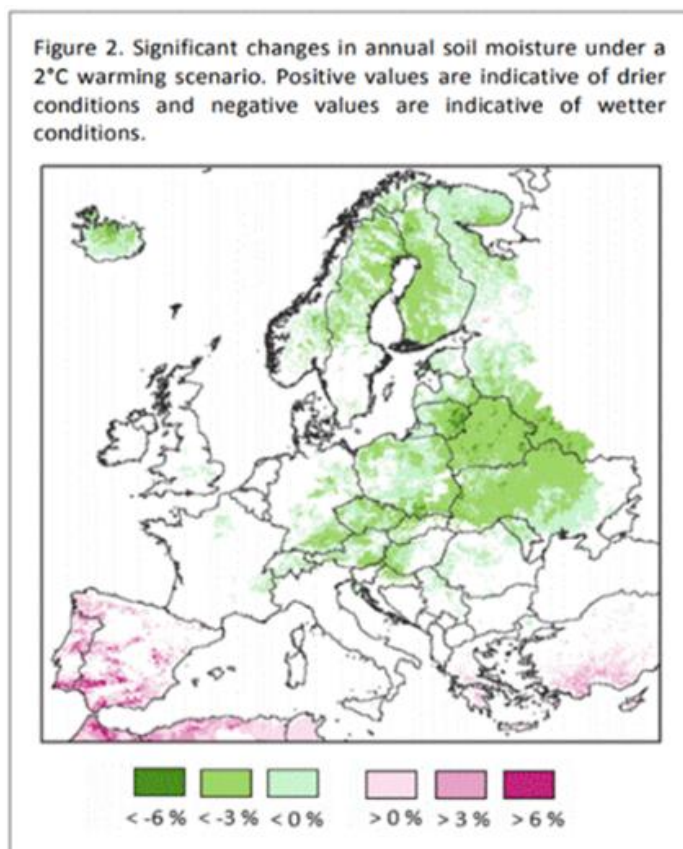


Figure 1: Source: [JRC PESETA III Science for Policy Summary Series](#)

On the other side, as seen in recent years, the EU has experienced a number of significant flooding events, with severe social and economic impacts⁴². The EEA estimates that hydrological events in 2019 caused just over 5 billion euro worth of damage⁴³. Most studies agree that the risk of severe winter storms, and possibly of severe autumn storms, will increase for northern, north-western and central Europe over the 21st century⁴⁴, with increased impacts on people and property.

The volume and velocity of surface runoff into rivers is a major factor in flooding. The way in which the landscape, and in particular soil, is managed can have a significant impact on this

⁴¹ European Court of Auditors (2018), [Special report n°33/2018: Combating desertification in the EU: a growing threat in need of more action](#) <https://doi.org/10.2865/425778>

⁴² <https://www.sciencemag.org/news/2021/07/europe-s-deadly-floods-leave-scientists-stunned>

⁴³ <https://www.eea.europa.eu/data-and-maps/indicators/direct-losses-from-weather-disasters-4/assessment>

⁴⁴ <https://www.eea.europa.eu/data-and-maps/indicators/storms-2/assessment>

process. Land cover change is known to increase the rate and volume of flood peaks⁴⁵. Increased herd sizes and the use of larger, heavier machinery for arable farming cause soil compaction, which reduces the rate of rainfall infiltration and the volume of water that can be stored within the subsoil⁴⁶. This coupled with the development of soil caps and crusts, results in more rainfall being delivered to rivers via faster surface runoff⁴⁷. Natural water retention measures, which include improved soil structure to support higher infiltration and slower overland flow, are increasingly recognised as being complementary to traditional flood control strategies⁴⁸.

In parallel, the loss of drainage systems due to urban and infrastructural growth increases the susceptibility to flooding. Pluvial flooding can occur in urban areas when drainage systems are unable to cope with intense or prolonged rainfall events given the lack of infiltration by sealed soils⁴⁹ ⁵⁰. It should be noted that flooding mechanisms are not independent. For example, the rapid arrival of fluvial flood peaks can be significantly augmented by pluvial flooding as the system fails soils to move water out of urban areas. In turn, pluvial flooding can then contribute to downstream fluvial flooding. Urban planners should increasingly adopt established guidelines on best practices to limit, mitigate or compensate for soil sealing⁵¹.

TABLE ES.1 Summary of past trends, outlooks and prospects of meeting policy objectives/targets

Theme	Past trends and outlook		Prospects of meeting policy objectives/targets		
	Past trends (10-15 years)	Outlook to 2030	2020	2030	2050
Protecting, conserving and enhancing natural capital					
Terrestrial protected areas	Green	Green	Green	Green	Green
Marine protected areas	Green	Green	Green	Green	Green
EU protected species and habitats	Green	Green	Green	Green	Green
Common species (birds and butterflies)	Green	Green	Green	Green	Green
Ecosystem condition and services	Green	Green	Green	Green	Green
Water ecosystems and wetlands	Green	Green	Green	Green	Green
Hydromorphological pressures	Green	Green	Green	Green	Green
State of marine ecosystems and biodiversity	Green	Green	Green	Green	Green
Pressures and impacts on marine ecosystems	Green	Green	Green	Green	Green
Urbanisation and land use by agriculture and forestry	Green	Green	Green	Green	Green
Soil condition	Red	Red	Red	Red	Red
Air pollution and impacts on ecosystems	Yellow	Yellow	Yellow	Yellow	Yellow
Chemical pollution and impacts on ecosystems	Yellow	Yellow	Yellow	Yellow	Yellow
Climate change and impacts on ecosystems	Red	Red	Red	Red	Red
Indicative assessment of past trends (10-15 years) and outlook to 2030			Indicative assessment of prospects of meeting selected policy objectives/targets		
Improving trends/developments dominate	Year	Green	Green	Green	Largely on track
Trends/developments show a mixed picture	Year	Yellow	Yellow	Yellow	Partially on track
Deteriorating trends/developments dominate	Year	Red	Red	Red	Largely not on track

Table 1: summary from EEA SOER 2020 showing the negative trends and outlook to 2030 for soil condition.

⁴⁵ Rowe, L. (2003): Land Use and Water Resources: A Comparison of Streamflow from New Zealand Catchments with Different Vegetation Covers. SMF2167: Report No. 6. Landcare Research for Ministry for the Environment, p.139.

⁴⁶ <https://wrt.org.uk/wp-content/uploads/2017/12/soils-and-nfm.pdf>

⁴⁷ <https://www.linkedin.com/pulse/soils-forgotten-role-natural-flood-management-soils-alliance/>

⁴⁸ Collentine, D. and Futter, M. (2018), Realising the potential of natural water retention measures in catchment flood management: trade-offs and matching interests. J Flood Risk Management, 11: 76-84. <https://doi.org/10.1111/jfr3.12269>

⁴⁹ <https://www.jrf.org.uk/report/pluvial-rain-related-flooding-urban-areas-invisible-hazard>

⁵⁰ <https://www.isprambiente.gov.it/it/pubblicazioni/atti/working-group-f-thematic-workshop-flash-floods-and-2>

⁵¹ https://ec.europa.eu/environment/soil/pdf/guidelines/pub/soil_en.pdf

Following the EEA State of environment report 2020 (SOER 2020)⁵², the past trends and the outlook to 2030 of soil condition show the prevalence of a deteriorating development. The prospects of meeting policy objectives and targets is largely not on track.

3. WHY SHOULD THE EU ACT?

3.1. Legal basis

EU soil policy action is based on Article 191 of the Treaty on the Functioning of the EU (TFEU), which requires Union policy to aim at preserving, protecting and improving the quality of the environment, protecting human health, a prudent and rational utilisation of natural resources, promoting measures at international level to deal with regional or worldwide environmental problems, and in particular combating climate change.

3.2. Subsidiarity: necessity and added value of EU action

3.2.1. The costs of no action

Overall, the impact of land and soil degradation is very large and comes with a huge cost estimated at EUR 50 billion per year in the EU. Soil erosion costs European countries EUR 1.25 billion solely in annual agricultural productivity loss and EUR 155 million in GDP loss.⁵³ The loss of ecosystem services from land degradation at world level is estimated between USD 6.3 and 10.6 trillion per year, or a loss between USD 43 400 and 72 000 per km² per year globally, or between USD 870 and 1 450 per person per year.^{54 55} The cost of action is much smaller than the cost of inaction. It is estimated that on average the benefits of soil restoration are 10 times higher than the costs, underpinning that investing in land degradation prevention and soil restoration makes very sound economic sense.⁵⁶

⁵² <https://www.eea.europa.eu/highlights/soer2020-europes-environment-state-and-outlook-report>

⁵³ Panagos, P. et al. (2018), Cost of agricultural productivity loss due to soil erosion in the European Union: From direct cost evaluation approaches to the use of macroeconomic models
<https://doi.org/10.1002/ldr.2879>

⁵⁴ The Economics of Land Degradation (2015), The value of land https://www.eld-initiative.org/fileadmin/pdf/ELD-main-report_05_web_72dpi.pdf

⁵⁵ Nkonya, E., et al. (2016). Economics of Land Degradation and Improvement - A Global Assessment for Sustainable Development <https://doi.org/10.1007/978-3-319-19168-3>

⁵⁶ IPBES (2018), The IPBES assessment report on land degradation and restoration
<https://doi.org/10.5281/zenodo.3237392>

Economic value provided by ecosystem services in the EU (EU28, 2012, million EUR)

	Urban	Cropland	Grassland	Woodland and forest	Wetland	Heathland and shrub	Sparsely vegetated land	Rivers and lakes	Marine inlets and transitional waters
Crop provision	0	20 795	0	0	0	0	0	0	0
Timber provision	0	0	0	14 739	0	0	0	0	0
Crop pollination	:	4 517	:	:	0	:	0	0	0
Carbon sequestration	0	0	0	9 189	0	0	0	:	:
Flood control	89	1 015	3 129	11 388	333	357	1	:	:
Water purification	1 105	31 041	4 128	15 374	330	312	170	3 114	:
Nature-based recreation^(†)	77	4 073	7 482	30 723	2 296	3 097	1 351	1 015	279

Source: JRC

(†) The scope of nature-based recreation was restricted to daily trips within 4 km from human settlements and the highest natural quality sites.

Note: (:) not available.

Table 2: It has been estimated that cropland and grasslands in the EU provide EUR 76 billion worth of ecosystem services per year: less than one third come from crop production, the rest from other ecosystem services.⁵⁷

Soil degradation affects us all economically: 54% of the cost represents a loss of public services such as carbon sequestration, hydrological control, nutrient cycling, hosting soil biodiversity and provision of recreation. The other half of the cost rather comes at the expense of private parties and landowners due to a reduction in provisioning services such as biomass and raw materials.

3.2.2. Transboundary impacts of soil degradation

It is often said that soil does not move. Actually, it does, and the impact of soil degradation has no borders. Soil degradation, but also its drivers and impacts, can be transboundary. Soils play a major role in the nutrient, carbon and water cycle, and these processes are obviously not constrained by physical and political borders. While half of the 75 billion tonnes of soil carbon stocks rest in Sweden, Finland and the United Kingdom, fluxes have a much wider and transboundary impact on the climate.⁵⁸ The EU is globally the second largest emitter of greenhouse gases from drained peatlands with 99 % of these emissions caused by 16 out of 28 Member States, where peat is mainly present.⁵⁹ Rewetting only 3% of agricultural land in the EU, can mitigate climate change and reduce European agricultural emissions by 25%.⁶⁰ Peat is heavily traded within the internal market: the Netherlands, France and Germany were the largest importers of peat between 2013 and 2017 for a total value of almost 1,25 billion euro.

⁵⁷ European Commission (2021), [Accounting for ecosystems and their services in the EU](#) (INCA)

⁵⁸ European Environment Agency (2019), Soil, land and climate change <https://www.eea.europa.eu/signals/signals-2019-content-list/articles/soil-land-and-climate-change>

⁵⁹ Greifswald Mire Centre (2019), Briefing Paper on the role of peatlands in the new European Union's Common Agriculture Policy (CAP) https://greifswaldmoor.de/files/dokumente/Infopapiere_Briefings/GMC-briefing%20paper_CAP_final.pdf

⁶⁰ Data compiled by Greifswald Mire Centre based on National Inventory Reports 2019. (Sectors Agriculture, LULUCF - Cropland and Grassland)

At the same time, a footprint is left outside the EU: largest exporters of peat to the EU in the same period were Belarus, Ukraine and Russia.⁶¹

Luxembourg is a large exporter of contaminated soil since it lacks its own treatment facilities.⁶² Eroded soil particles are transported downstream and across borders in the form of sediment. The total sediment fluxes in the EU due to water erosion are estimated to about 160 million tonnes per year⁶³. The Port of Rotterdam dredges 12-15 million m³ of sediment per year, of which a good half is delivered by the Rhine as a result of erosion in other countries.⁶⁴ Coastlines are particularly susceptible to erosion: in Europe about 20,000 km corresponding to 20% of coastlines are affected by erosion,⁶⁵ which can lead to transboundary sedimentation (exacerbated by increasing intensity of storms driven by climate change). Erosion by wind transports soil particles and the harmful chemical substances attached to them across long distances and borders. The transport of Saharan sand to Europe and other parts of the world is a well-known phenomenon in this respect.

Contaminants can be mobile and cross borders via the air, surface water and groundwater and in the end pollute the soil, which in turn can pose risks for food safety in the internal market when the contaminated food is distributed. In 2016, 72.7% of EU agri-food products were traded between Member States. Globally, 3.2 billion people are directly affected by degraded soil. By 2050, four billion people are projected to be living in drylands. Land degradation and climate change are likely to force 50 to 700 million people to migrate by 2050, which can put pressure on European borders.⁶⁶

It is recognised that the high-consumption lifestyles of developed economies, together with increasing consumer expectations in developing and emerging economies, is a key cause of soil degradation as it drives unsustainable land management and loss of soil resources⁶⁷. Food, feed, fibre and timber imports can be considered de facto soil imports since they all depend on biomass production. Increased soil protection within the EU and individual Member States should not result in increased pressures on soil and moving degradation in other parts of the EU or exporting it beyond its borders. In this respect, increased effort should be focused to develop a robust approach to track MS and the EU's soil footprint, also at a global level. Such a tool should measure the impacts of demands on soil and their capacity to deliver the resulting functions (including plant-based food and fibre products, livestock, timber, absorb waste, and mitigate carbon emissions). Such a footprint would ensure that improvements

⁶¹ IUCN (2019), Legal provisions on soil import. Technical note prepared by IUCN for the European Commission. <https://circabc.europa.eu/sd/a/96fbf64a-c3e8-49ab-bb5f-efb6cdc16e85/Legal%20provisions%20on%20soil%20import.pdf>

⁶² Paleari, S. et al. (2012), Transboundary shipments of waste in the European Union. Reflections on data, environmental impacts and drivers. https://www.researchgate.net/publication/315390417_Transboundary_shipments_of_waste_in_the_European_Union_Reflections_on_data_environmental_impacts_and_drivers

⁶³ Borrelli, P. et al. (2018), A step towards a holistic assessment of soil degradation in Europe: Coupling on-site erosion with sediment transfer and carbon fluxes. <https://doi.org/10.1016/j.envres.2017.11.009>

⁶⁴ MUDNET (2018), Sediment management in the port of Rotterdam <https://d2k0ddhflgrk1i.cloudfront.net/Websections/MUDNET/Kirichek%282018%29%20Sediment%20management%20in%20the%20Port%20of%20Rotterdam.pdf>

⁶⁵ Gallina, V. et al. (2019), Assessment of Climate Change Impacts in the North Adriatic Coastal Area. Part II: Consequences for Coastal Erosion Impacts at the Regional Scale <https://doi.org/10.3390/w11061300>

⁶⁶ IPBES (2018), The IPBES assessment report on land degradation and restoration <https://doi.org/10.5281/zenodo.3237392>

⁶⁷ IPBES (2018), Summary for policymakers of the thematic assessment of land degradation and restoration https://reporterre.net/IMG/pdf/sols-ipbes_re_sume_pour_les_de_cideurs-mars_2018.pdf

brought about by the Soil Strategy and related initiatives on soil stewardship can be reported at a range of scales (continent, individual countries, eventually regions) and by activity. A soil footprint calculator could become a vital communication tool for citizen engagement and consumer education.

3.3. The position of other EU institutions on a renewed EU soil policy framework

3.3.1. European Court of Auditors

The European Court of Auditors performed an audit in 2018 on “Combating desertification in the EU: a growing threat in need of more action”⁶⁸. In its final report the ECA “found that the risk of desertification in the EU was not being effectively and efficiently addressed. While desertification and land degradation are current and growing threats in the EU, the Commission does not have a clear picture of these challenges, and the steps taken to combat desertification lack coherence. We found that there is no agreed methodology for assessing desertification and land degradation within the EU. Although the Commission and the Member States collect data about various factors with an impact on desertification and land degradation, the Commission does not analyse it to come up with a conclusive assessment on desertification and land degradation in the EU.”

The Court also recommended that:

1. “The Commission, in cooperation with the Member States, should: (a) establish a methodology and relevant indicators –starting with the UNCCD’s three indicators – to assess the extent of desertification and land degradation in the EU; (b) based on agreed methodology, collate and analyse relevant data on desertification and land degradation, much of which is already being collected, and regularly present it in a clear, user-friendly way for public use, preferably in the form of interactive maps for use in the EU.
2. The Commission should assess the appropriateness of the current legal framework for the sustainable use of soil across the EU, including addressing desertification and land degradation.
3. The Commission should: (a) further detail how the EU’s commitment to land degradation neutrality will be achieved by 2030, and report periodically on progress; (b) provide guidance to Member States on practical aspects of preserving soil and achieving land degradation neutrality in the EU, including dissemination of good practices; (c) on their request, provide technical support to Member States to establish national action plans to achieve land degradation neutrality by 2030, including identifying targeted measures, clear milestones, and a plan for intermediate reporting at Member State level.”

In response, the Commission has committed to finalize the EU methodology for the assessment and monitoring of land degradation neutrality, building on existing methodical knowledge, current and future data.⁶⁹ A new soil condition assessment (2022), currently conducted jointly by EEA and the Commission, is collecting the currently available evidence

⁶⁸ European Court of Auditors (2018), [Special report n°33/2018: Combating desertification in the EU: a growing threat in need of more action](#)

⁶⁹ EEA and ETC/ULS (2019). Land degradation knowledge base: policy, concepts and data. ETC/ULS Report 01/2019.

and trend about soil degradation in Europe. The EU Soil Observatory is evaluating the effectiveness of the SDG 15.3 methodology developed by the UNCCD and other land degradation methodologies, aiming at a comprehensive soil degradation indicator which will accurately capture the most widespread soil threats (e.g. soil erosion and SOC decline) from a post-industrial time to now; among others, this will provide the base for refining the actions needed for the achievement of land degradation neutrality.

3.3.2. *European Parliament*

On 28 April 2021, the European Parliament adopted a resolution on soil protection initiated by the Environment, Public Health and Food Safety (ENVI) Committee with 605 votes in favour, 55 against and 41 abstentions.⁷⁰ Overall, the Parliament's resolution recognizes the importance of protecting soil and promoting healthy soils in the Union for the objectives of the European Green Deal: climate neutrality, biodiversity restoration, the zero-pollution ambition for a toxic-free environment, healthy and sustainable food systems and a resilient environment.

The resolution calls the Commission to take a series of actions, both legally-binding and not, to address soil pollution and other types of soil degradation, covering several related aspects, such as research, knowledge and innovation, monitoring and digital aspects, financing, governance, policy coherence, communication, international aspects, and links to the other environmental policies (water and air pollution, waste and circularity, health, biodiversity, climate, agriculture).

In its resolution on the Biodiversity Strategy for 2030 from 8 June 2021,⁷¹ the European Parliament highlighted that soil biodiversity provides vital ecosystem services and mitigates climate change and noted with concern the increase in soil degradation and the lack of specific EU legislation on this topic. The Parliament acknowledged that there are some provisions in different laws that indirectly contribute to soil protection, but considered that this has resulted in partial protection and highly fragmented governance in the EU. The Parliament repeated its call on the Commission to submit a legislative proposal for the establishment of a common framework, with full respect for the subsidiarity principle, for the protection and sustainable use of soil and for the effective integration of that protection in all relevant EU policies. A common framework on soil should address all the main soil threats, including loss of soil biodiversity, loss of soil organic matter, contamination, salinisation, acidification, desertification, erosion and soil sealing. The Parliament emphasised the need to include common definitions, clear targets and a monitoring framework, while also supporting the establishment of a specific decontamination target. It also welcomed the launch of a Horizon Europe Mission 'A Soil Deal for Europe'.

3.3.3. *Council of the EU*

The Council in its Conclusions of October 2020 on the new Biodiversity Strategy indicated it *“SUPPORTS the Commission in stepping up efforts to better protect soils and soil biodiversity, as a non-renewable resource of vital importance, as well as to reduce soil*

⁷⁰ European Parliament resolution of 28 April 2021 on soil protection (2021/2548(RSP))

⁷¹ European Parliament resolution of 9 June 2021 on the EU Biodiversity Strategy for 2030: Bringing nature back into our lives (2020/2273(INI))

*sealing, and REAFFIRMS the EU's commitment to reaching land-degradation neutrality; WELCOMES the planned update of the EU Soil Thematic Strategy; STRESSES the need to promptly address desertification and land degradation in the EU; REITERATES the will to make progress towards the objective of 'zero net land take' by 2050".*⁷²

In reply to an oral question from the European Parliament⁷³, the Council confirmed that it remains fully committed to the fulfilment of the Sustainable Development Goals (SDGs) and SDG 15.3, which aims to combat desertification, restore degraded land and soil, including land affected by desertification, droughts and floods, and strives to achieve a land degradation neutral world by 2030. The Council welcomed the planned update of the 2006 EU Soil Thematic Strategy, which aims to address soil and land degradation within the EU in a comprehensive way, and looked forward to the adoption of this strategy by the Commission. The Council Presidency remains fully committed and determined to work with the Parliament and the Commission on soil protection once the updated Soil Strategy has been put forward and on any emerging initiatives that are proposed in this regard.

3.3.4. Committee of the Regions

The Committee of the Regions adopted in February 2021 an opinion on agro-ecology which *"calls on the European Commission to propose a new European directive on agricultural soils to halt the decrease in their organic matter content, stop erosion and prioritise soil life in agricultural practices"*.⁷⁴

3.3.5. The European Citizen Initiative 'People4Soil'

On 11 July 2016, the Commission received via the ECI register a request for registration of a proposed European Citizen Initiative titled "People4Soil: sign the citizens' initiative to save the soils of Europe!". The proposed initiative stated that "soil is one of the most strategic resources of Europe, as it ensures food security, biodiversity conservation and climate change regulation. It's time to protect the soils of Europe".

The main objectives of the proposed initiative were as follows: "Recognize soil as a shared heritage that needs EU level protection, as it provides essential benefits connected to human well-being and environmental resilience; develop a dedicated legally binding framework covering the main soil threats: erosion, sealing, organic matter decline, biodiversity loss and contamination; integrate soil related UN Sustainable Development Goals into EU policies; properly account and reduce greenhouse gases emissions from the farming and forestry sectors."

The Commission examined the proposed citizens' initiative to ascertain whether it met the conditions laid down in the concerned Regulation and decided to register the proposed initiative on 12 September 2016. While this ECI gathered the support of more than 500 organization from 26 EU countries, it did not manage to reach the target set in the Regulation of 1 million signatures. However, with over 220.000 signatures collected according to the

⁷² Council conclusions on Biodiversity - the need for urgent action, 23 October 2020.

<https://data.consilium.europa.eu/doc/document/ST-11829-2020-INIT/en/pdf>

⁷³ [Debate on Soil Protection on Monday 26 April 2021](#)

⁷⁴ Opinion of the European Committee of the Regions – Agro-ecology; 05/02/2021; Rapporteur CDR 3137/2020; Rapporteur: CROS Guillaume

strict rules of the ECI, it mobilised a large number of citizens and organisations in almost all EU countries to get involved in EU policy-making and raised awareness on the need for soil protection in the EU.

3.4. Knowledge base in support of the actions envisaged in the Strategy

3.4.1. Soil organic matter and climate change

Climate change has a major impact on soil, and changes in land use and soil can either accelerate or slow down climate change, and vice versa. Thus, to be on track for climate neutrality in 2050, the EU needs to reverse the current decline in land-based removals and start implementing actions to increase removals already in this decade, in order to account for the long lead times of land-based climate mitigation. An integrated sustainable approach linked with soil health may contribute to a significant resilience under adverse conditions. Increasing soil organic carbon is the best way to mitigate climate change and to ensure food security.

Soil organic matter (SOM) is soil organic carbon (SOC) in a form readily available to plants and is directly linked to soil fertility. Increasing SOM not only binds CO₂ thus contributing to climate change mitigation, but also offers many co-benefits for soil biodiversity, soil structure, water holding capacity, increased nutrient cycling while preventing nutrient loss, and biological pest control⁷⁵, making soil more resilient to disturbances and weather extremes.

Organic soils, including peatlands, have a high carbon content of more than 20% in dry weight⁷⁶ and cover 8% of the EU land⁷⁷. They represent approximately 25% of the current organic carbon stock of all EU soils⁷⁸. They are formed in all habitats where waterlogged conditions inhibit the decomposition of plant material. Nowadays, however, a very large proportion of former wetlands have been drained⁷⁹ so that organic soils at various stages of degradation are found on agricultural land, scrublands and forest. Such degraded peatland soils currently represent only about 4.5% of the EU agricultural area⁸⁰ but generate an important part of the total greenhouse gases coming from agriculture in the EU. Peatland drainage across all land categories in Europe alone has been estimated to emit around 220 million tonnes of CO₂ equivalent (MtCO₂eq) in the EU per year⁸¹, equivalent to around 5% of total EU greenhouse gas (GHG) emissions in 2017. Restoring drained organic soils alone

⁷⁵ EASAC report on Soil Sustainability (2018)

https://easac.eu/fileadmin/PDF_s/reports_statements/Soil_Sustainability/EASAC_Policy_Report_on_Soil_Sustainability_September_2018.pdf

⁷⁶ Tanneberger, F et al. (2017), [The peatland map of Europe. Mires and Peat No 19 \(22\), 1-17.](#)

For the detailed definition, see definition of histosols within the FAO (2015) World Reference Base for soil resources: [International soil classification system for naming soils and creating legends for soil maps.](#)

⁷⁷ Calculated from data derived from the national submissions to the UNFCCC.

⁷⁸ Schils, R. et al. (2008), [Review of existing information on the interrelations between soil and climate change. ClimSoil final report. European Communities Technical Report](#)

⁷⁹ Based on the best available evidence, an estimated 45,000 – 55,000 km² has been drained for agricultural use – see also Tanneberger, F. et al. (2021), The Power of Nature-Based Solutions: How Peatlands Can Help Us to Achieve Key EU Sustainability Objectives.

⁸⁰ Pérez Domínguez I., et al. (2020), Economic assessment of GHG mitigation policy options for EU agriculture: A closer look at mitigation options and regional mitigation costs (EcAMPA 3),

⁸¹ Tanneberger, F. et al. (2021), The Power of Nature-Based Solutions: How Peatlands Can Help Us to Achieve Key EU Sustainability Objectives.

could significantly reduce CO₂ emissions from land. Rewetting and restoration of peatlands comes with numerous co-benefits for nature, biodiversity and water protection.⁸²

Mineral soils are soils with a carbon content below 20% although most mineral soils contain below 5%. Around 45% of EU soils have low or very low organic carbon content (below 2%)⁸³. There is a biophysical potential to sequester between 11 to 38 MtCO₂eq annually in Europe⁸⁴ (9 to 30 MtCO₂eq annually in EU27)) if a range of management practices which have already been identified are applied on a larger scale in arable land.



Figure 2: how soils can store more carbon. Source: 4 per 1000 initiative⁸⁵

Land use change and unsustainable soil management have caused, and are still causing, organic and mineral soils to lose carbon, and with it part of their fertility, their capacity to absorb and retain water and the other co-benefits. Loss of SOM is highly relevant for climate change. Restoring soils that have lost SOM can be done by applying sustainable soil management (SSM), in particular agroecology and agroforestry principles. Several initiatives have been launched to promote soil as carbon sink. The Regulation on Land Use, Forestry and Agriculture proposes an overall EU target for carbon removals by natural sinks, equivalent to 310 million tonnes of CO₂ emissions by 2030⁸⁶. National targets will require Member States

⁸² European Commission (2021), Technical guidance handbook: Setting up and implementing result-based carbon farming mechanisms in the EU

⁸³ Ronchi S. et al. (2019), Policy instruments for soil protection among the EU member states: A comparative analysis

⁸⁴ Lugato et al. (2014), Potential carbon sequestration of European arable soils estimated by modelling a comprehensive set of management practices.

⁸⁵ <https://www.4p1000.org/>

⁸⁶ Proposal for a revision of the LULUCF Regulation, COM(2021) 554, <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52021PC0554>

to care for and expand their carbon sinks to meet this target. By 2035, the EU should aim to reach climate neutrality in the land use, forestry and agriculture sectors, including also agricultural non-CO₂ emissions, such as those from fertiliser use and livestock.

One of the initiatives contributing to this target is "4 per 1000", launched by France in 2015 at the COP 21, to encourage stakeholders to transition towards a productive, highly resilient agriculture, based on the appropriate management of lands and soils, creating jobs and incomes hence ensuring sustainable development⁸⁷. This initiative consists of a voluntary action plan under the Global Climate Action Agenda⁸⁸ accompanied with an ambitious research programme, and ultimately aiming at an annual growth rate of 0.4% in the soil carbon stocks, or 4‰ per year, in the first 30-40 cm of soil, which would significantly reduce the CO₂ concentration in the atmosphere.

The carbon farming initiative

The European Commission has published the final report of a two-year study on how to set up and implement carbon farming in the EU⁸⁹. Building on this study and on the input from several EU-funded projects and events, the Commission plans to launch the carbon farming initiative by the end of 2021⁹⁰.

The study "Technical Guidance Handbook – setting up and implementing result-based carbon farming mechanisms in the EU", carried out from 2018 to 2020, explored key issues, challenges, trade-offs and design options to develop carbon farming. It reviewed existing schemes that reward climate-related benefits in five promising areas: peatland restoration and rewetting, agroforestry, maintaining and enhancing soil organic carbon (SOC) on mineral soils, managing SOC on grasslands, and livestock farm carbon audit. It also explored how a widespread adoption of carbon farming can be triggered in the EU.

The study concludes that result-based carbon farming can contribute significantly in the EU's efforts to tackle climate change, bringing benefits in terms of carbon sequestration and storage and other co-benefits, such as increased biodiversity and preservation of ecosystems.

Robust certification rules for carbon sequestration in agriculture are the first step to enable farmers to sell certificates to private companies. The Commission will develop a regulatory framework to monitor and verify the authenticity of carbon removals in agriculture and forestry, providing an additional incentive on top of CAP payments for carbon farming. The new EU Carbon Farming Initiative will promote this new business model. A platform for exchange of experiences and mutual learning around the development of result-based carbon farming schemes could be part of such initiative, and could facilitate scheme development.

The aim of the carbon farming study was to produce technical guidance for setting up and implementing result-based carbon farming schemes in EU Member States with reference to opportunities for support under a future CAP. This is intended to offset emission from the land using sector and to carbon sequestration. The guidance includes information on generic

⁸⁷ See "4 per 1000" Initiative website: <https://www.4p1000.org>

⁸⁸ https://ec.europa.eu/clima/policies/international/negotiations/initiatives_en

⁸⁹ European Commission (2021), [Setting up and implementing result-based carbon farming mechanisms in the EU - Technical guidance handbook](https://doi.org/10.2834/056153) <https://doi.org/10.2834/056153>

⁹⁰ European Commission (2021), [Commission sets the carbon farming initiative in motion](https://ec.europa.eu/clima/news/commission-sets-carbon-farming-initiative-motion_en) https://ec.europa.eu/clima/news/commission-sets-carbon-farming-initiative-motion_en

principles and worked examples as to how Member States could set up carbon farming schemes relevant to arable and livestock management, and land use conversion.

3.4.2. Considerations for a test-soil-for-free initiative

Knowing the carbon content of the soil, as well as other key soil characteristics, is the starting point for each soil manager to take decisions on adequate and sustainable soil management practices. For this reason, the Soil Strategy launches the test-soil-for-free initiative. Below is an estimation of the order of magnitude of the costs that this initiative would imply at EU and national level.

Costs of the test-soil-for-free initiative – a scenario

A standard soil analysis (based on wet chemistry as in the LUCAS soil survey), including soil organic carbon, has currently an indicative cost of around 30 euro per sample (transport costs excluded).

Targeting 10 times the number of the 41,000 LUCAS soil samples (as planned for 2022), that is 410,000 free soil tests every year in the EU, would represent a total cost of about EUR 12 million, or 27.000 € per million people per year (excluding transport costs). Privileging agricultural holdings and limiting to one free test each, in 10 years about 40% of the 10.5 million agricultural holdings would have had its soil tested under this initiative. Based on the experience on LUCAS soil sample testing, the capacity for laboratories in the EU is not expected to be a limiting factor to deliver such a programme.

3.4.3. Soil and circular economy

Soils and land play an important role in the circular economy, as they store mineral materials, but also provide renewable and bio-based resources. Their role in closing the biogeochemical cycles for water, nutrients and carbon is crucial. As the formation of topsoil and the recovery of land and soil quality are extremely slow processes, soils can be considered essentially as non-renewable resources. Therefore, the sustainable recovery and reuse of land and soil is necessary to secure the future provision of natural resources and services for a growing world population. The circular economy provides a framework for the management of natural capital, including land and soil, mineral resources, fossil fuels, water and provides incentives for their efficient use and management.⁹¹

3.4.4. Organic farming, soil health and climate change

Many management practices used in organic agriculture (e.g. minimum tillage, returning crop residues to the soil, the use of cover crops and rotations, and the greater integration of nitrogen-fixing legumes), increase biologically available SOM and beneficial soil microbe and invertebrate activities, improve soil physical properties, reduce disease potential, and increase plant health.

⁹¹ Breure, A.M. et al. (2018). Soil and land management in a circular economy
<https://doi.org/10.1016/j.scitotenv.2017.12.137>

Carbon dioxide is a greenhouse gas, and increasing levels in the atmosphere are responsible for climate change. Organic agriculture has the potential to contribute to mitigating the adverse impacts of climate change by sequestering atmospheric carbon in the soil. Some evidence⁹² showed that organic farming systems sequestered up to 450 kg more atmospheric carbon per hectare and year through CO₂ bound into SOM. A synthesis of 15 years of research⁹³ reveals an increase in topsoil organic carbon (+25%), microbial biomass (+32%) and activity (+34%) and a shift in microbial communities with conversion from ploughing to reduced tillage. Additional application of composted manure has increased SOC by 6% compared to pure slurry application, with little impact on soil microbes.

The general results of the study indicated that SOC stocks were 3.5 tonnes per hectare higher in organic than in non-organic farming systems. However, the observed differences in SOC stock under organic and non-organic farming seemed to be mainly influenced by practices typical of mixed farming, i.e. livestock plus crop production, which are characterized by organic matter recycling via manure and forage legumes in the crop rotation. These measures are intrinsic to organic agriculture but can, in principle, be applied in any agricultural production system. This proves the importance of sustainable soil management in farming and that soil carbon levels under modern agricultural practices are likely to be improved if agro-ecological approaches, such as organic farming, are applied to any agricultural production system.

The Commission has put forward this year a comprehensive Action Plan for the Development of Organic Production⁹⁴ to help Member States stimulate both supply and demand for organic products, ensure consumer's trust through promotion campaigns and green public procurement. The action plan is broken into three interlinked axes that reflect the structure of the food supply chain and will be supported by 23 actions, mobilising also different sources of funding.

In the implementation of its Biodiversity and Farm to Fork Strategies and to reverse soil, water and air pollution and biodiversity loss, the Commission will take additional actions to reduce the overall use and risk of chemical pesticides by 50%, the use of more hazardous pesticides by 50% and the sale of antimicrobials by 50% by 2030. It will also act to reduce nutrient losses by at least 50%, while ensuring that there is no deterioration in soil fertility. All this will support the development of alternative and more environmentally friendly agricultural practises that would reduce soil pollution and foster soil sustainable management in agriculture.

Public interest in healthy food, protection from disease and cultural interest in parks, natural habitats and wildlife, broadens to the whole society the stakeholders with an interest in healthy soils and their sustainable management⁹⁵.

⁹² Gattinger, A. et al. (2012), [Enhanced top soil carbon stocks under organic farming](https://doi.org/10.1073/pnas.1209429109).
<https://doi.org/10.1073/pnas.1209429109>

⁹³ Krauss, M., et al. (2020), Enhanced soil quality with reduced tillage and solid manures in organic farming – a synthesis of 15 years. <https://doi.org/10.1038/s41598-020-61320-8>

⁹⁴ Communication from the Commission on an action plan for the development of organic production COM(2021) 141

⁹⁵ EASAC report on Soil Sustainability (2018)
https://easac.eu/fileadmin/PDF_s/reports_statements/Soil_Sustainability/EASAC_Policy_Report_on_Soil_Sustainability_September_2018.pdf

3.4.5. The role of soil biodiversity for above-ground biodiversity and human health

Soils are living ecosystems, approximately half air and water, 45% minerals, and 5% organic matter. Of that 5%, only 10% is alive, but that 10% contains some of the greatest biodiversity in the biosphere⁹⁶. Soil organisms include earthworms, mites, centipedes and millipedes, tardigrades, springtails, ants, ground beetles, nematodes, protists, fungi and bacteria, but by far the most abundant are microorganisms (fungi and bacteria) and microfauna (nematodes).

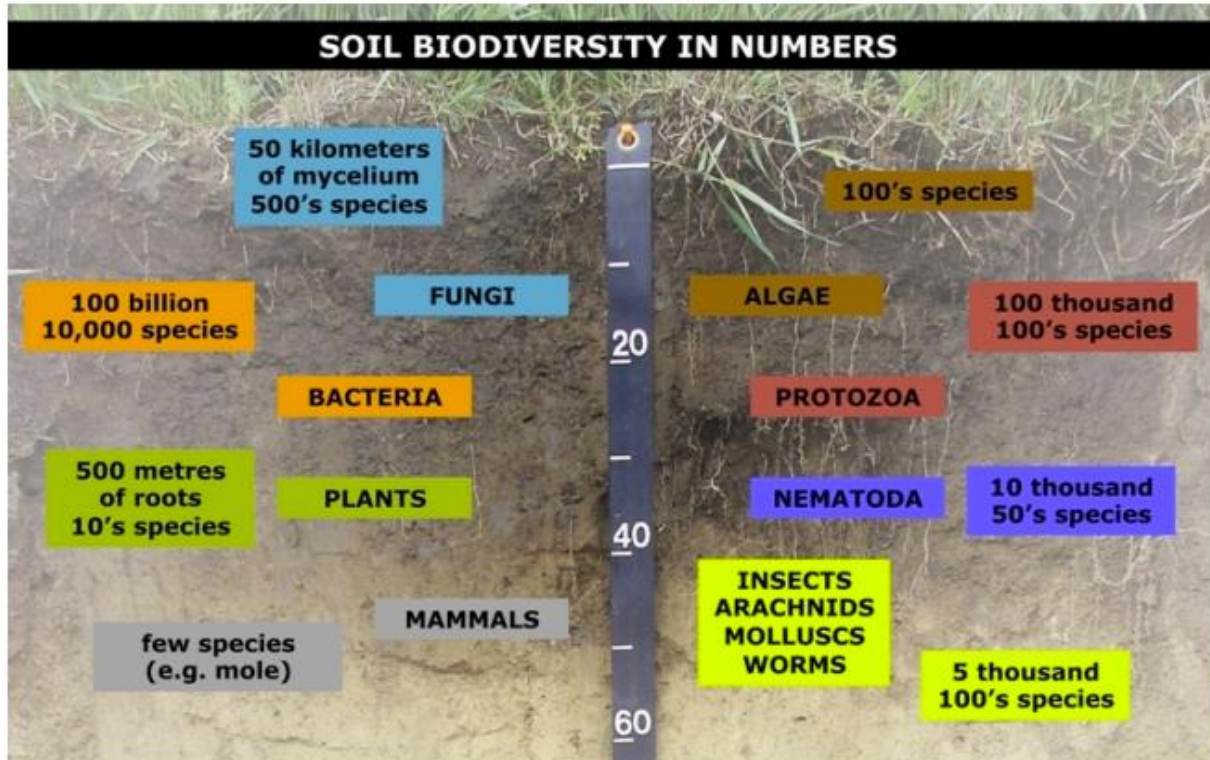


Figure 3: approximate number and diversity of organisms typically found in a handful of grassland soil⁹⁷

Soils are one of the main global reservoirs of biodiversity. By one set of estimates, they host one fourth of world biodiversity, while more than 40% of living organisms in terrestrial ecosystems are associated during their life-cycle directly with soils⁹⁸.

Soil organisms form food webs which drive soil ecosystem processes, including nutrient cycling, carbon sequestration, nitrogen storage and water purification⁹⁹. Soil organisms are also source of compounds for medical purposes. However, due to an increasing use of antibiotics for farming, the diffusion of antimicrobial resistance (AMR) in soil microorganisms (i.e. bacteria) is becoming an issue of relevance for animal and human health. Nonetheless, a complete understanding on large-scale distribution of soil AMR genes (i.e. genes that lead to antimicrobial resistance) is missing. Filling such knowledge gap could

⁹⁶ Dasgupta, P., [The Economics of Biodiversity: The Dasgupta Review – Full Report](https://www.gov.uk/government/publications/final-report-the-economics-of-biodiversity-the-dasgupta-review) <https://www.gov.uk/government/publications/final-report-the-economics-of-biodiversity-the-dasgupta-review>

⁹⁷ Joint Research Centre, [webpage “Soil Biodiversity”](https://esdac.jrc.ec.europa.eu/themes/soil-biodiversity) <https://esdac.jrc.ec.europa.eu/themes/soil-biodiversity>

⁹⁸ FAO (2020), [State of Knowledge of Soil Biodiversity](http://www.fao.org/documents/card/en/c/cb1928en/) <http://www.fao.org/documents/card/en/c/cb1928en/>

⁹⁹ FAO (2020), [State of Knowledge of Soil Biodiversity](http://www.fao.org/documents/card/en/c/cb1928en/) <http://www.fao.org/documents/card/en/c/cb1928en/>

assure for better development of risk assessments for AMR within agriculture, and risks analysis through the food chain to animals and humans.

Advances in environmental genomics have revealed the enormous diversity of fungi and bacteria associated with plant roots. They play diverse roles, for example promoting plant growth through enhancing plant nutrition and protecting plants from herbivores and pathogens¹⁰⁰ The total biomass belowground generally equals or exceeds that aboveground, whilst the biodiversity in the soil always exceeds that on the associated surface by orders of magnitude, particularly at the microbial scale¹⁰¹.

Soil biodiversity provides essential ecosystem services¹⁰² for human wellbeing:

¹⁰⁰ Orgiazzi, A. et al. (2018), [LUCAS Soil, the largest expandable soil dataset for Europe: a review](https://doi.org/10.1111/ejss.12499) <https://doi.org/10.1111/ejss.12499>

¹⁰¹ FAO (2020), [State of Knowledge of Soil Biodiversity](http://www.fao.org/documents/card/en/c/cb1928en/) <http://www.fao.org/documents/card/en/c/cb1928en/>

¹⁰² FAO (2020), [State of Knowledge of Soil Biodiversity](http://www.fao.org/documents/card/en/c/cb1928en/) <http://www.fao.org/documents/card/en/c/cb1928en/>

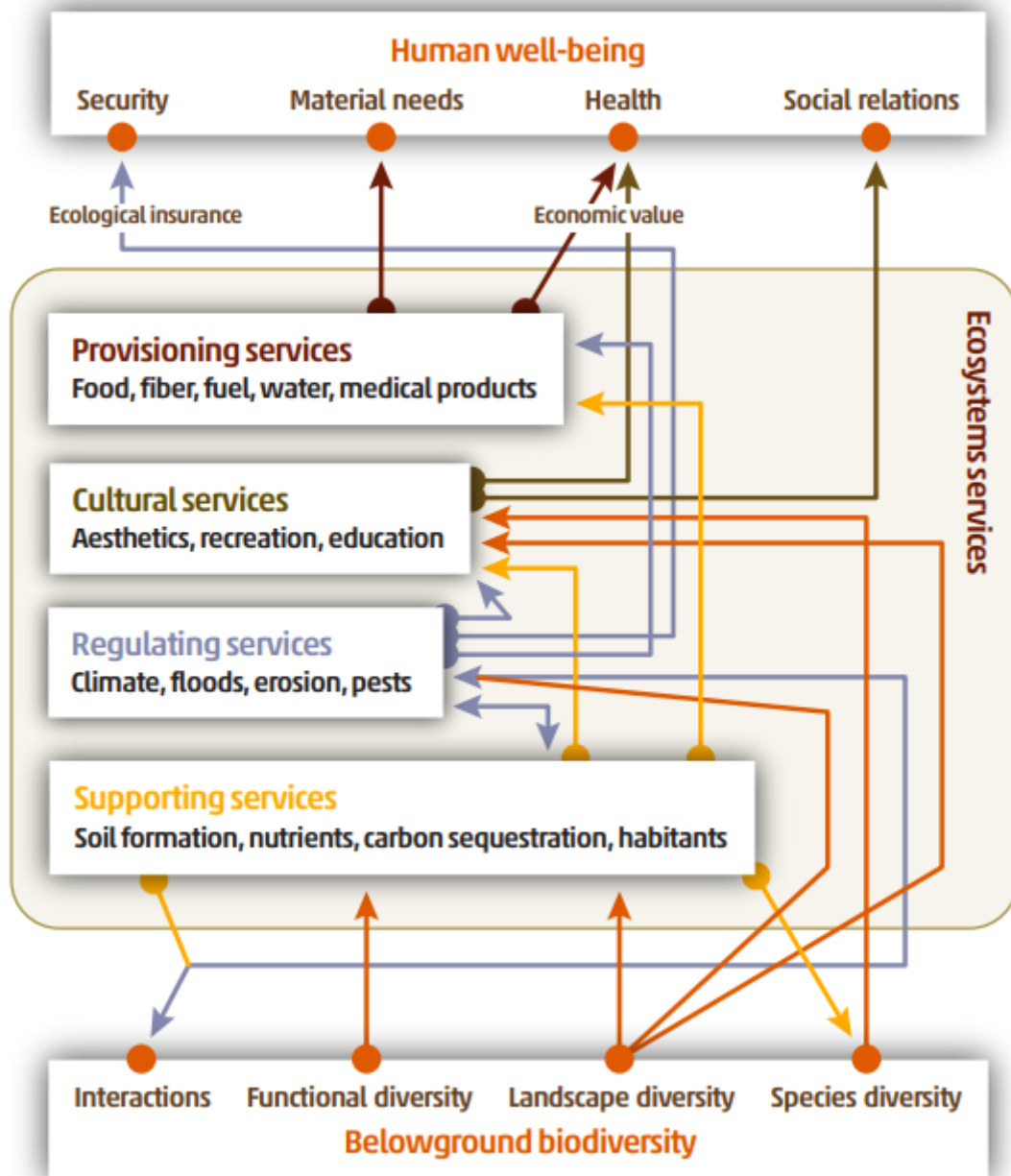


Figure 4: a conceptual scheme of the relationship between soil biodiversity, ecosystem services and human wellbeing¹⁰³

Three concrete examples of provisioning services:

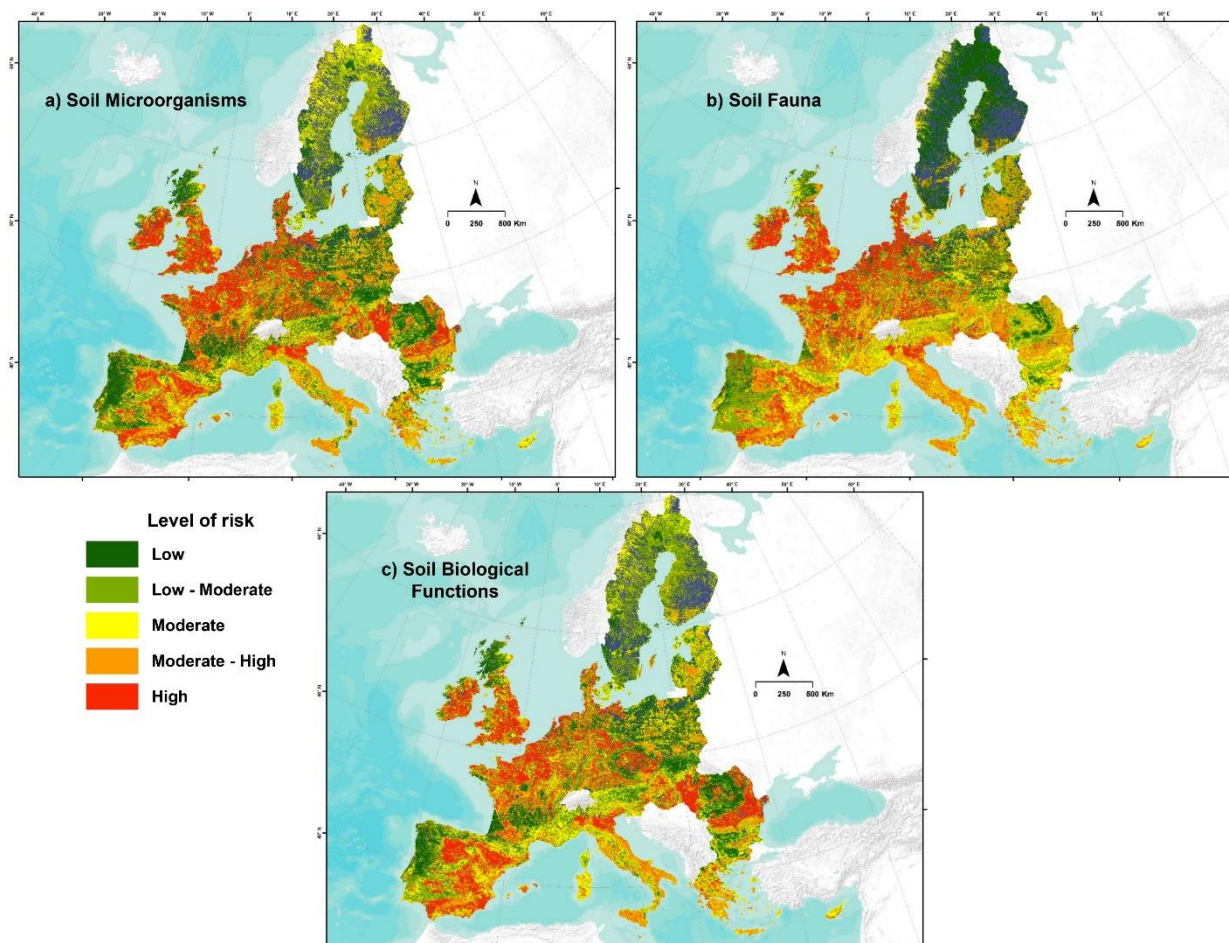
- The enormous network of fungi connects tiny roots (rootlets) to a wider array of soil nutrients (e.g. phosphorus) and water. This helps plants growing and is vital in the food chain.

¹⁰³ FAO (2020), [State of Knowledge of Soil Biodiversity](http://www.fao.org/documents/card/en/c/cb1928en/) <http://www.fao.org/documents/card/en/c/cb1928en/>, page 125

- Soils are also a major reservoir for medicines: over 75% of antibacterial agents and 60% of new cancer drugs approved between 1983 and 1994 had their origin in soils, as did 60% of all newly approved drugs between 1989 and 1995¹⁰⁴.
- Soil microorganisms, especially fungi, can be used for bioremediation purposes. Due to their capability to degrade toxic compounds and pollutants, they can be applied to (soil) restoration processes¹⁰⁵.

What leads to soil biodiversity loss?

Factors that lead to biodiversity loss include habitat fragmentation, invasive species, climate change, urban sprawl over soils, soil erosion, and soil pollution such as mineral fertilisers and pesticides.). These specific soil-related pressures are affecting organisms to an extent still difficult to be quantified. The rate of soil biodiversity loss and number of endangered species remain poorly investigated. The 2016 Global Soil Biodiversity Atlas¹⁰⁶ was the first attempt to map life in soil at a global scale. When threats to soil biodiversity are mapped, areas at high-risk often correspond with areas of highest soil biodiversity.



¹⁰⁴ P., [The Economics of Biodiversity: The Dasgupta Review – Full Report](https://www.gov.uk/government/publications/final-report-the-economics-of-biodiversity-the-dasgupta-review) <https://www.gov.uk/government/publications/final-report-the-economics-of-biodiversity-the-dasgupta-review>

¹⁰⁵ Thanner, S. et al. (2016), [Antimicrobial resistance in agriculture](https://doi.org/10.1128/mBio.02227-15). <https://doi.org/10.1128/mBio.02227-15>

¹⁰⁶ Joint Research Centre (2016), [Global Soil Biodiversity Atlas](https://doi.org/10.2788/2613) <https://doi.org/10.2788/2613>

Figure 5: map of the level of risk for soil biodiversity. The risk for soil biodiversity was generated by combining the threat associated to 13 possible stressors: climate change, land - use change, habitat fragmentation, intensive human exploitation, soil organic matter decline, industrial pollution, nuclear pollution, soil compaction, soil erosion, soil sealing, soil salinization, the use of GMOs in agriculture, and invasive species¹⁰⁷.

What happens when the diversity of life within soil is lost?

Reduction in soil biodiversity contributes to a loss of above-ground biodiversity, promotion of global warming and eutrophication of surface water. Decline in soil biodiversity causes reduced performance of essential processes, and land managers compensate this often by applying fertilisers at a significant economic and ecological cost. If soil biodiversity would be completely lost, the land-based food system would cease to function¹⁰⁸. In order to assess the status of soil biodiversity and halt its potential loss, an EU monitoring scheme on belowground life is critical. The Commission is currently assessing for the first time the presence of soil micro-organisms, veterinary antibiotics and antimicrobial resistance genes in European soils through the LUCAS soil survey. The results are expected in 2022.

Knowledge gaps on soil biodiversity

These are the main knowledge gaps identified on soil biodiversity:

- Assess vulnerability of soil biota under different environmental pressures, in natural, urban and agricultural ecosystems;
- Assess the role of soil biodiversity in the nutrient, carbon and water cycle and how land management affect this role;
- Develop methods and technologies for ensuring the recovery of soil biota;
- Support the creation and publication of training and information material on soil biodiversity and advice farmers on such practices;
- Assessment of the risks of soil contamination from hazardous chemicals on soil biodiversity.

3.4.6. Preventing soil contamination

The EU acquis is already relatively well equipped with legislation to prevent the release of emissions into the environment and soil. Several policies are in place for specific chemicals (e.g. mercury, persistent organic pollutants), product groups (e.g. pesticides, fertilizers, biocides, sludge, feed additives, manure), sectors (e.g. agriculture, industrial emissions, waste) or environmental media (air, water). Pharmaceutical and antimicrobial residues in the soil can have a negative impact on biodiversity above and below ground. Antimicrobial resistance is estimated to be responsible for more than 33,000 deaths per year¹⁰⁹ and costs about EUR 1.1 billion to the European health care system.¹¹⁰

¹⁰⁷ [Potential threats to soil biodiversity | EU Science Hub \(europa.eu\) https://ec.europa.eu/jrc/en/science-update/potential-threats-soil-biodiversity](https://ec.europa.eu/jrc/en/science-update/potential-threats-soil-biodiversity)

¹⁰⁸ Dasgupta, P. (2021), [The Economics of Biodiversity: The Dasgupta Review – Full Report](#)

¹⁰⁹ Cassini et al. (2018), Attributable deaths and disability-adjusted life-years caused by infections with antibiotic-resistant bacteria in the EU and the European Economic Area in 2015

¹¹⁰ OECD (2019), Antimicrobial resistance: tackling the burden in the EU

The Commission will revise the Industrial Emissions Directive by end 2021 and consider the possible extension of the scope. The Sustainable Use of Pesticides Directive will be revised by 2022 to significantly reduce use, risk and dependency on pesticides and enhance Integrated Pest Management. In the coming years, the Commission will also review the waste legislation and revise the Mercury Regulation, the Air Quality Directives, which will further contribute to the prevention of diffuse soil pollution and atmospheric deposition.

3.4.7. Remediation of soil contamination and brownfields

In accordance with the zero pollution hierarchy, soil remediation should be the solution of last resort, when prevention, minimization and source control of pollution has failed and when contaminants have been able to reach the soil and pose risks for the environment and human health. Local or point-source soil pollution is usually caused by industrial or commercial risk activities, inappropriate waste disposal, storage of hazardous substances but also by accidents, spills or military activities. The Industrial Emissions Directive and the Environmental Liability Directive contain important provisions to remediate new soil contamination caused by certain risk activities. The Commission will evaluate the Environmental Liability Directive and the provisions on land damage by 2023.

A recent exchange of information specifically on soil contamination with mercury, showed that the small country of Belgium was able to identify more than 1600 sites that are contaminated with mercury. On the other end of the spectrum, there are several Member States that claimed not to have any case of mercury contamination. There is no indication that Belgium is more “dirty” than other countries, but it has very stringent contamination laws in place with a systematic and mandatory soil investigation for all potentially polluting risk activities. Without such investigation, the land cannot be sold. Such systematic and stringent approach coupled to land transfer with a mandatory soil certificate to inform the buyer of land on the quality of the soil, is the key to success in Flanders and Brussels.

Implementation of EU-wide soil legislation with common soil investigation and remediation obligations could bring significant economic benefits and competitive advantages. Employment in the remediation sector could increase with 25000 jobs, while the turnover of the remediation industry could be boosted with 1.85 billion euro per year. Current differences between Member States in the level of ambition and the efforts to identify and register (potentially) contaminated sites result in legal uncertainty for companies because their cost base to deal with contamination and remediation depends on the Member State where their business is located. In this way, a high level of environmental protection could become a handicap instead of an advantage in the competition between Member States. At the same time, this leads also to national differences in the maturity levels of the remediation sector. In 2013, about half of EU Member States had a low to inexistent national remediation market. This is likely to have an impact for the entire European Union on the quality of the services, the price, the available expertise and the innovation potential of this economic sector.¹¹¹

Here after are presented the data on contaminated and remediated sites as reported by the Member States in 2018¹¹²

¹¹¹ Ernst & Young (2013). Evaluation of expenditure and jobs for addressing soil contamination in Member States. https://ec.europa.eu/environment/soil/pdf/Soil_contamination_expenditure_jobs.pdf

¹¹² JRC (2018). Status of local soil contamination in Europe. <https://publications.jrc.ec.europa.eu/repository/handle/JRC107508>; EEA Land and Soil Indicator Set LSI

Country	S Status 1 (estimated sites where polluting activities took place)	S Status 1 (registered sites where polluting activities took place)	S Status 2a (sites in need of investigation/ still to be investigated)	S Status 2b (sites under investigation)	S Status 3 (sites that have been investigated, but no remediation needed)	S Status 4 (sites that need or might need remediation or risk-reduction measures)	S Status 5 (sites under/with ongoing remediation or RRM)	S Status 6 (site remediation or RRM completed)	Artificial surface km ²
Austria	72 000	68 569	10 000	1 497	622	5 288	104	203	4 711.0
Belgium (Brussels-Capital)									136.3
Belgium (Flanders)	85 000	68 000	46 478	38 522	32 431	18 591	1 584	3 509	3 683.4
Belgium (Wallonia)	17 700	3 796	15 275	1 489	927			1 593	2 524.8
Bulgaria		26	4		2	1	2	20	5 321.2
Croatia		2 264	247			3	5	5	2 001.0
Cyprus		84	5			3	2	4	8 14.5
Czech Republic	20 000	9 300	828	405	543		106	257	5 194.9
Denmark	45 000	16 865	32 000	16 985	10 191	9 031	403	2 483	3 342.6
Estonia		300	70			78	4	110	988.6
Finland		26 200	17 700	2 200	660	29 850	300	5 700	4 722.8
France	300 000	6 478	514	1 194	796	1 708	924	3 054	30 717.8
former Yugoslav Republic of Macedonia		70	62			78	70	5	429.6
Germany	485 856	260 883			19 382	35 358	5 094	38 242	34 053.7
Hungary	778	5 375	2 071	1 587	145	649	398	347	5 753.1
Ireland						66			1 747.1
Italy		22 100	6 754	1 710	5 521	2 600	2 054	2 904	16 021.7
Latvia		3 574	2 637	115	692	245		44	1 291.2
Lithuania	50 000	12 341	4 621		460	800	92	96	2 114.8
Luxembourg		12 000		30	1 606	61	26	1 060	273.0
Malta	600	135	121	5	5	614	9	1	93.1
Netherlands		1 455	0	10	13	466	807	176	5 541.2
Norway		6 500	1 162			508		1 400	2 866.0
Poland									17 681.8
Portugal		181	21	3	53	37	10	83	3 602.2
Romania		210							12 722.4
Serbia	1 183	709	478	103		657	41	52	3 203.7
Slovakia	3 200	1 758	945	408	166	956	18	678	2 904.5
Slovenia		378		1			2		617.7
Spain	133 344	43 092	4 924	270	2 203	1 149	198	157	12 622.0
Sweden	(**)	83 000	25 000	4 108	1 775	16 116	1 520	1 930	6 532.6
Switzerland	(**)	38 000	6 700	9 600	6 900	4 300	180	1 000	2 823.0
United Kingdom (England) (*)	325 000	600				511	493	433	10 455.9

(*) Data for the United Kingdom corresponds to England only. Information for Wales, Scotland and Northern Ireland is not available.
(**) the registration of all polluted sites is completed. Empty fields correspond to information not provided by countries.

Table 3: summary of progress in the management of potentially contaminated sites, as declared by EEA countries¹¹³

3.4.8. Soil and the digital agenda

New techniques like artificial intelligence, machine learning, cloud computing and data cubes allow to process and analyse the exponentially increasing quantities of environmental data. The ongoing digital transformation should in the end result in impactful solutions, e.g. smart sensors, digital soil mapping, decision support systems, learning models and algorithms, or smartphone applications for use in environmental compliance, digital and precision agriculture, (citizen) science, foresight capability and policy information.

The Copernicus Earth Observation and Monitoring Programme is indispensable for providing geo-intelligence to the benefit of all European citizens. Based on satellite and in-situ observations, Copernicus services deliver near-real-time data on a global level, to help better understanding our soil and land and to sustainably manage the environment, as well as support the management of emergencies, environmental compliance and civil security.

The European Environment Agency will further develop the Land Information System for Europe (LISE), comparable to FISE for forests, WISE for water and BISE for biodiversity.

003 'progress in the management of contaminated sites. <https://www.eea.europa.eu/data-and-maps/indicators/progress-in-management-of-contaminated-sites-3/>

¹¹³ JRC Publications Repository - Status of local soil contamination in Europe: Revision of the indicator "Progress in the management contaminated sites in Europe" (europa.eu)

The system aims to be based mainly on the products of the Copernicus Land Monitoring Service and bring together all data on land use (change) and land cover. The LISE would be the counterpart for land of the EU soil observatory and build further *inter alia* on the interactive land take, soil moisture and imperviousness viewers, that give a good overview of the situation in EU and EEA-38. With the support of the European Environment Agency, in particular land take, land recycling, soil sealing and soil moisture will be monitored more frequently and in a more harmonized way. The LISE will indicate land under stress (or improvement) by providing geospatial and statistical information on the status and trends in the condition of our land resources. By identifying potential impacts of human activities, such as intensive land use or urbanisation, potential research needs can be identified and decision-makers may be empowered to take appropriate action. Remote sensing has demonstrated its capacities to map and monitor soil and soil related parameters such as soil moisture under the ESA Climate Change Initiative¹¹⁴ or soil water indices, land surface temperature, and land cover change, e.g. under the Copernicus land monitoring service¹¹⁵.

3.4.9. Soil monitoring

The EU Soil Observatory (EUSO)¹¹⁶ has been launched recently to inform policy-makers and stakeholders in a transparent, tailored and concise manner about the status and findings of the latest scientific evidence relating to soil. It is being designed to be a 'one-stop-shop' for soil information and includes communities of practice. The EUSO will support the Soil Strategy by being a reservoir of knowledge and data. The EUSO – supported and complemented by activities, funding and data generated under the Mission 'A Soil Deal for Europe' - will facilitate, together with Member States and the EEA, the establishment of an EU soil monitoring system using the principles of the INSPIRE Directive¹¹⁷ for building a shared data infrastructure, and for integrating existing initiatives such as the LUCAS Soil system, national reporting under the NEC Directive¹¹⁸ and LULUCF Regulation¹¹⁹. The EUSO will also develop cooperation and coordination on soil monitoring with international organizations. Based on monitoring and modelling activities, the EUSO will establish a dashboard of policy-relevant indicators to assess progress in soil restoration across the EU. Finally, with the Mission 'A Soil Deal for Europe', the EUSO will support increased efforts to raise soil literacy among diverse stakeholder groups and act as a repository of R&I actions under Horizon Europe.

¹¹⁴ <https://www.esa-soilmoisture-cci.org/>

¹¹⁵ <https://www.copernicus.eu/en/copernicus-services/land>

¹¹⁶ EU Soil Observatory (EUSO) | EU Science Hub (europa.eu) <https://ec.europa.eu/jrc/en/eu-soil-observatory>

¹¹⁷ Directive 2007/2/EC of the European Parliament and of the Council of 14 March 2007 establishing an Infrastructure for Spatial Information in the European Community (INSPIRE)

¹¹⁸ Directive (EU) 2016/2284 of the European Parliament and of the Council of 14 December 2016 on the reduction of national emissions of certain atmospheric pollutants.

¹¹⁹ Proposal for a revision of the LULUCF Regulation, COM(2021) 554, <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52021PC0554>



Figure 6: EU Soil Observatory connections

4. HOW TO ACHIEVE COMMITMENTS

4.1. A strategic approach

The Soil Strategy derives a long-term vision for soil from the ambition of the European Green Deal and lists the key existing objectives and targets for the medium and long term where soil policy is called to contribute. Consistently with the vision and the targets, the soil strategy then designs the set of actions to be implemented in the short and medium term to allow achieving the targets and ultimately the vision.

The actions set in the Strategy:

- Commit the European Commission to deliver on soil policy with both legislative and non-legislative instruments, and to mobilize societal efforts;
- Call for voluntary actions from Member States to provide essential contributions for achieving the goals.

While the actions are initiated at EU and national level, they require coordinated contributions from all societal actors to achieve the needed transformation.

The adoption of the EU Soil Strategy represents only the starting point of the transformation. The implementation will be the critical process determining the success in achieving the objectives and eventually the vision. The implementation of the strategy and its action plan will build on existing good practices and successful examples in order to optimise the chances of success and maximise the impact.

There exist already some collections of good practices related to soil, for example to achieve soil and land-related SDGs¹²⁰, on sustainable land management at global level¹²¹, or in the form of guidelines (e.g. the guidelines on best practice to limit, mitigate or compensate soil

¹²⁰ Keesstra, S.D. et al. (2020), [Providing support in relation to the implementation of soil and land related Sustainable Development Goals at EU level](https://edepot.wur.nl/531395). <https://edepot.wur.nl/531395>

¹²¹ UNCCD, [WOCAT SLM database](https://www.wocat.net/en/global-slm-database/). <https://www.wocat.net/en/global-slm-database/>

sealing¹²² or the Voluntary Guidelines for Sustainable Soil Management¹²³). Others will need to be built up, enriched or updated in support of action implementation.

Box 1 and 2 below present a selection of good practices of sustainable soil management for climate adaptation and concrete measures to address desertification.

Box 1: examples of sustainable soil management practises for climate adaptation

- The LIFE HelpSoil project implemented and tested innovative soil conservation practises to make agricultural systems more resilient to climate change in the Lombardia region¹²⁴. The practices improved soil characteristics, including SOC content and biological fertility, and led to a more efficient use of irrigation water, fertilisers and pesticides in the experimental plots.
- The pilot initiatives developed by the SOLMACC LIFE project confirmed the technical feasibility, climate mitigation and adaptation effects of climate-friendly farming practices implemented on 12 organic farms in Sweden, Germany and Italy¹²⁵.
- Agroforestry implementation in Montpellier resulted in a 40% productivity increase while improving soil, water quality and biodiversity¹²⁶.
- Using mycorrhizal fungi in degraded/damaged soils enables strong underground plant networks which grant resilience and enhance carbon sequestration¹²⁷.

Box 2: examples of concrete measures to address desertification

Internationally, programmes to combat desertification such as the Great Green Wall in Africa¹²⁸, mobilized attention and efforts to revert the negative trend, showing that positive results are possible and that locally adapted solutions are needed.

In the EU, there are local projects that have already shown successful results of concrete measures. Here are some examples:

- Planting bushes and tree in dry areas using the innovation proved successful by LIFE project “Cocoon”¹²⁹

¹²² European Commission Staff Working Document for information purposes on Guidelines on best practice to limit, mitigate or compensate soil sealing SWD(2012) 101

https://ec.europa.eu/environment/soil/pdf/guidelines/pub/soil_en.pdf

¹²³ <http://www.fao.org/land-water/land/land-governance/land-resources-planting-toolbox/category/details/en/c/1043063/>

¹²⁴ Perego A. et al. (2018), [Agro-environmental aspects of conservation agriculture compared to conventional systems: A 3-year experience on 20 farms in the Po valley \(Northern Italy\)](https://doi.org/10.1016/j.agry.2018.10.008), <https://doi.org/10.1016/j.agry.2018.10.008>

¹²⁵ SOLMACC LIFE project website. <https://solmacc.eu/>

¹²⁶ Climate-ADAPT Case study “Agroforestry: agriculture of the future? The case of Montpellier” <https://climate-adapt.eea.europa.eu/metadata/case-studies/agroforestry-agriculture-of-the-future-the-case-of-montpellier>

¹²⁷ Zhi-Gang Wang et al. (2016), [Arbuscular mycorrhizal fungi enhance soil carbon sequestration in the coalfields, northwest China](https://doi.org/10.1038/srep34336), <https://doi.org/10.1038/srep34336>

¹²⁸ Co-funded by the EU; see <http://www.grandemurailleverte.org/> <http://www.grandemurailleverte.org/>

¹²⁹ ‘Cocoon’ tree growing counters desertification in the Mediterranean <https://web.archive.org/web/20210413080432/https://ec.europa.eu/easme/en/news/cocoon-tree-growing-counters-desertification-mediterranean>

- A 20-year large-scale dryland restoration initiative to halt desertification and erosion and bring back prosperity in Southern Spain¹³⁰, with soil regenerative techniques and organic products.
- A forest fire prevention training program in Hungary (LIFE project) succeeded in reducing 5 times the extension of fires¹³¹
- The LIFE preparatory project NewLife4Drylands¹³² started in 2021 is developing a monitoring solution from satellite to assess the effectiveness of local measures implemented to address desertification.

4.2. Enablers

4.2.1. Funding

Soil degradation does not only aggravate climate change and biodiversity loss, but also threatens the economy and the future of the current and next generations. It represents considerable risks and costs, which are usually not properly reflected in the price of goods and services. Investing in soil health makes sound economic sense and comes with several co-benefits and long-term returns for the economy, the society and the environment.

The **LIFE programme** contributes to the protection, restoration and improvement of the environment including soils. It financially supports the development and demonstration of innovative solutions to reach the objectives of EU soil policy, and on the other hand, the development, implementation, monitoring and enforcement of relevant environmental policies. LIFE can act as a catalyst for large-scale deployment of successful technical and policy-related solutions for the prevention and restoration of soil degradation. A call for project proposals is launched every year based on the priorities set in the Multi-Annual Work Programme.

The **Common Agricultural Policy** with a yearly budget of 55.7 billion euro in 2021 contributes to the sustainable development of rural areas through improving the competitiveness of agriculture and forestry, by ensuring sustainable management of natural resources and soils, and by balanced territorial development of rural economies. Specific priorities and focus areas are defined by national and regional authorities in the Rural Development Programmes.

The **European Regional Development Fund (ERDF)** and **Cohesion Fund** with a total budget of 234 billion euro aim to strengthen the EU's economic, social and territorial cohesion by supporting the transition to a greener and carbon free Europe. This includes the protection of nature, biodiversity and green infrastructure including in cities, and the rehabilitation of contaminated land. Member States and regional authorities set out the priorities for their territory in the programmes. The ERDF also supports programmes for cross-border, transnational and interregional cooperation.

¹³⁰ COMMONLAND website. <https://www.commonland.com/landscapes/the-starting-point-is-inspiration-proving-change-is-possible/>

¹³¹ Project FIRELIFE website. https://ec.europa.eu/environment/life/project/Projects/index.cfm?fuseaction=search.dspPage&n_proj_id=5062

¹³² [NewLife4Drylands project website https://www.eepf.gr/en/project/actions/works-in-progress/newlife4drylands](https://www.eepf.gr/en/project/actions/works-in-progress/newlife4drylands)

The **Just Transition Fund** with a total budget of 17.5 billion euro enables regions and people to address the social, economic and environmental impacts of the transition towards a climate-neutral economy. Investments in regeneration and decontamination of sites, land restoration and repurposing projects are eligible when these help to achieve climate neutrality, e.g. the remediation of former coal mines that are put out of commission.

Recovery and Resilience Facility makes 672.5 billion euro (in 2018 prices) in loans and grants available to support Member States with the green transition, among others. One of the key requirements of the RRF Regulation is that 37% of the allocated funds in each recovery and resilience plan have to support climate objectives. Along with delivering on the climate ambition, the measures supported by the RRF will also ensure progress towards other environmental objectives such as reducing air pollution, promoting the circular economy or restoring and protecting biodiversity. Rehabilitation of industrial sites and contaminated land is also an eligible field of intervention. Additionally, every single reform or investment included in the Recovery and Resilience Plans will need to respect the ‘do no significant harm’ principle. This means that no measure will come at the detriment of any of the six environmental and climate objectives defined by the EU taxonomy, including land pollution prevention and the protection and restoration of biodiversity and ecosystems. The RRF will be supporting the soil improvement action in 6 Member States (AT, BE, DK, FI, IE and IT) and at least 2 Member States have come with reforms in this area (a legislative framework on sustainable nutrition of soil in ES and a soil protection strategy in AT).

The **Technical Support Instrument (TSI)** provides technical support to design and implement reforms in EU Member States. The support is provided upon request across a wide range of policy areas, such as the implementation of the EU Soil Strategy at Member State level in the context of EU priorities such as the green and the digital transition.

Horizon Europe is the EU’s funding programme for research and innovation with a total budget of 95.5 billion euro. It provides support to knowledge development to tackle global challenges and European industrial competitiveness. Cluster 6 of Horizon Europe (food, bioeconomy, natural resources, agriculture and environment) offers particular opportunities for soil-related research and innovation. Key orientations are set in the strategic plan, while the specific priorities are defined in work programmes. Calls for proposal are launched for very specific topics. The programme also allocates funding for the **Mission ‘A Soil Deal for Europe’**. The mission will be implemented around four building blocks including (1) an R&I programme with a strong social sciences component, (2) a network of living labs and lighthouses, (3) a soil monitoring programme and (4) training, communication and citizen engagement. While rooted in research, the Mission will connect with other funding programmes and policies. It will be implemented in collaboration across Commission services (the Mission Owners), led by the Mission Manager at DG AGRI and the Deputy Mission Manager at DG Research.

Horizon Europe intends to co-fund several **EU partnerships**, amongst others the partnership for the assessment of the risks of chemicals, the partnership on agro-ecology living labs and research infrastructures, the partnership Agriculture of Data, the partnership for rescuing biodiversity, the partnership for safe and sustainable food systems and the partnership for a circular bio-based Europe.

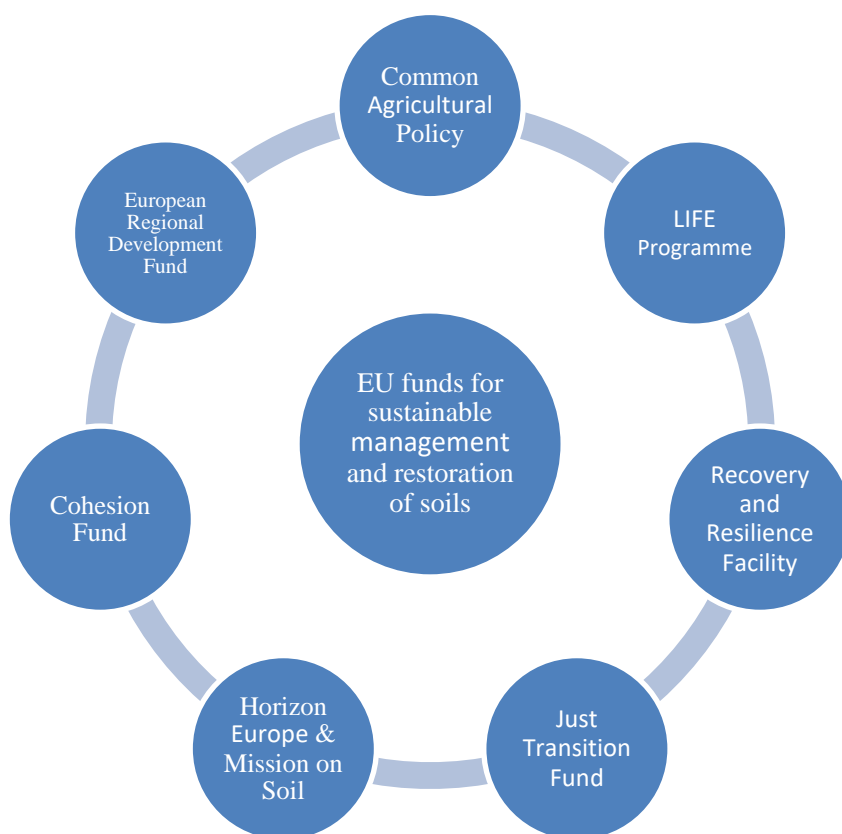


Figure 7: opportunities for funding sustainable management and restoration of soils at EU level

4.2.2. Governance

The current soil governance in the EU includes the following platforms and networks:

- The Commission Expert Group to implement the soil protection provisions of the 7th EAP¹³³ (in short EU Soil Expert Group), has been created in 2015 to “reflect with Member States on how soil quality issues could be addressed using a targeted and proportionate risk-based approach within a binding legal framework”. Since 2015 the group has allowed to exchange views between the Commission and EU Member States on how soil quality issues could be addressed.
- The European Environment Information and Observation Network (EIONET) is a partnership network of the European Environment Agency (EEA) and its member and cooperating countries. EIONET brings together experts from national institutions and other bodies involved in environmental information; it also includes seven European Topic Centres (ETCs) dealing with specific environmental topics¹³⁴. EIONET is the key actor to support the provision of comprehensive and harmonized information on soil from EU MS, which will allow an adequate policy monitoring tool for the

¹³³ European Commission webpage: “[Register of Commission Expert Groups and Other Similar Entities](https://ec.europa.eu/transparency/expert-groups-register/screen/home)”.

¹³⁴ EIONET Portal website. <https://www.eionet.europa.eu/> <https://www.eionet.europa.eu/>

implementation of the Soil Strategy, the achievement of soil objectives, as well as integrating soil information into the 8th EAP overall monitoring.

- The European Soil Partnership (ESP) is a regional structure of the Global Soil Partnership¹³⁵ at FAO. ESP works in close collaboration with FAO Regional Offices and establishing an interactive consultative process with national soil entities intending to actively contribute to sustainable soil management in Europe
- The EU Network for the Implementation and Enforcement of Environmental Law (IMPEL) consists of public authorities that implement and enforce environmental legislation. IMPEL facilitates exchange of knowledge and good practices, develops guidance documents and coordinates action between Member States. ‘Water and land’ is one of the focus areas of IMPEL where the network reflects on the implementation of the Soil Thematic Strategy, the Water Framework Directive and the Nitrates Directive.
- The Mission Board has been instrumental in developing the concept for the Horizon Europe Mission ‘A Soil Deal for Europe’. The current board will be renewed in 2022 and will support the Commission in monitoring and steering the roll-out of the mission. Close cooperation between the Board of the Soil Deal mission and the Soil Expert Group is essential for exchanging information and effective coordination of planned activities under the Mission and the Soil Strategy.

Furthermore, other EU platforms, such as the EU macro-regional strategies¹³⁶, support coordinated and joint actions also in the field of soil¹³⁷.

There are several examples of existing networks and initiatives that promote informed sustainable choices for soil health and reward sustainable soil management practices, such as European Soil Bureau Network, European Network on Soil Awareness (ENSA)¹³⁸, European Land & Soil Alliance (ELSA)¹³⁹, European Society for Soil Conservation (ESSC)¹⁴⁰, Soil Award¹⁴¹, Soil heroes foundation¹⁴², Soil index¹⁴³, Soilmates¹⁴⁴, Slow Food Foundation¹⁴⁵, Europe Soil Group¹⁴⁶, Solar Impulse Foundation¹⁴⁷, WWF Living Planet Report¹⁴⁸ or People4Soil¹⁴⁹, SoilCare¹⁵⁰, Friends of the Earth¹⁵¹.

¹³⁵ FAO, Global Soil Partnership website, <http://www.fao.org/global-soil-partnership/en/>

¹³⁶ https://ec.europa.eu/regional_policy/en/policy/cooperation/macro-regional-strategies/

¹³⁷ Example: The project “Impulse4Action”, developed in the framework of the EU Strategy for the Alpine Region (EUSALP) and co-financed by ARPAF (Alpine Region Preparatory Action Fund): <https://www.impuls4action.eu/home>

¹³⁸ JRC EUROPEAN SOIL DATA CENTRE website. <https://esdac.jrc.ec.europa.eu/event/european-network-soil-awareness-ensa>

¹³⁹ ELSA website. <http://www.bodenbuendnis.org/en>

¹⁴⁰ ESSC website. <http://www.soilconservation.eu>

¹⁴¹ ELO, Land and Soil Management Award website. <https://www.europeanlandowners.org/awards/soil-land-award>

¹⁴² Soil Heroes Foundation website. <https://www.soilheroes.com/the-foundation>

¹⁴³ Rabobank (2019), Soil health for stronger farms? We can measure that.

<https://www.rabobank.com/en/raboworld/articles/soil-health-for-stronger-farms-we-can-measure-that.html>

¹⁴⁴ Soilmates website. <https://soilmates.be>

¹⁴⁵ Slow Food Foundation for Biodiversity website. <https://www.fondazione Slow Food.com/en/our-themes/biodiversity/monitoring-biodiversity/the-soil-is-life-health-and-biodiversity-so-lets-save-it>

¹⁴⁶ Gruppo Suolo Europa website. <https://angelidelsuolo.wordpress.com>

¹⁴⁷ Solar Impulse website. <https://solarimpulse.com>: among the 1000+ solutions to protect the environment selected to be at the same time efficient and profitable, 4 concern soil health: microbial soil fertilisation, a

4.2.3. *Promoting and contributing to global action*

At international level there is growing awareness on land and soil degradation and the need to preserve and restore these essential natural resources. This evolution is reflected in the agenda of several international conventions and UN agencies, and is expected to have a big impact on the soil policy of the European Union and its Member States.

United Nations: the 2030 Agenda for sustainable development¹⁵².

Although “soils are not explicitly mentioned” in the Sustainable Development Goals (SDGs) and the UN agenda 2030, soil is addressed in and builds the basis of numerous SDGs even though involvement of soil scientists in articulating the SDGs has so far been limited¹⁵³.

steam technology as alternative to pesticides, a bio-solution for contaminated sites, mobile on-site soil and wastewater treatment machine; another one concerns reducing landfilling of excavated soils by reusing them.

¹⁴⁸ WWF, Living Planet Report website. <https://livingplanet.panda.org/en-US/about-the-living-planet-report>

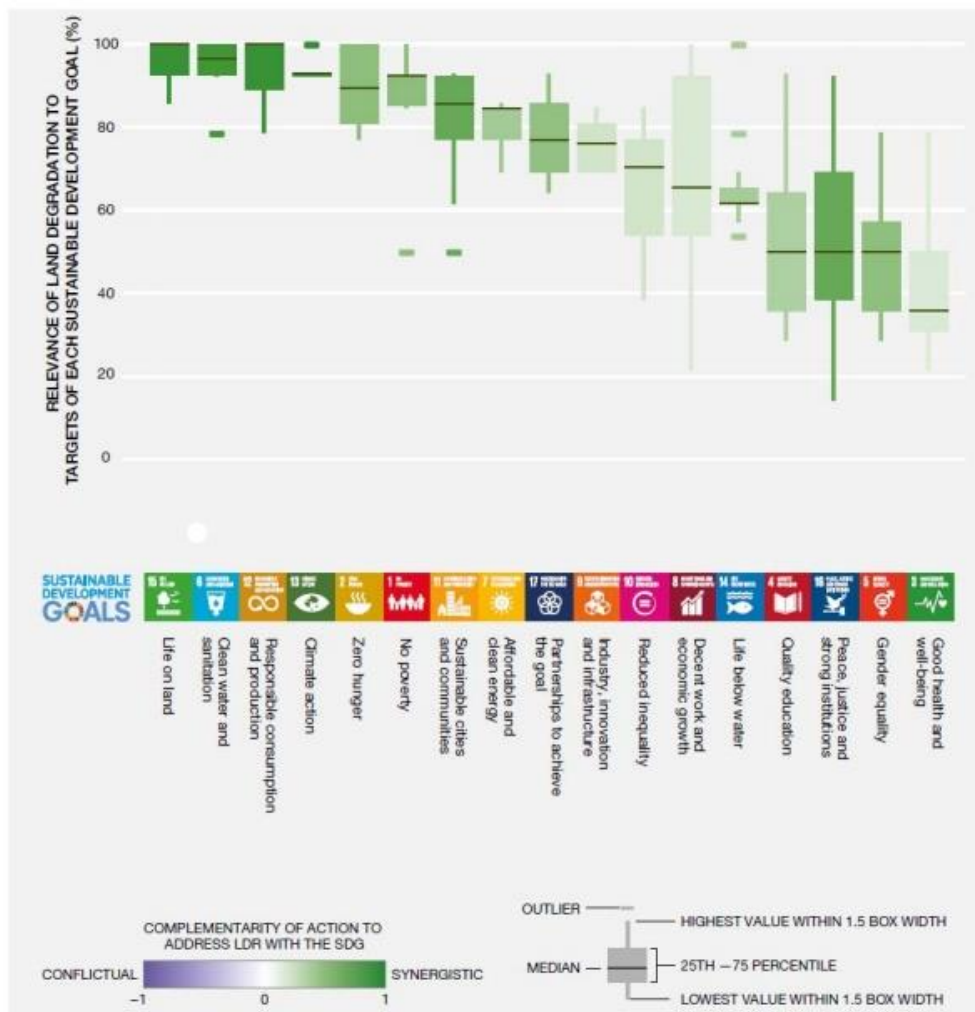
¹⁴⁹ The Environmental Pillar website. <https://environmentalpillar.ie/who-are-people4soil>

¹⁵⁰ SoilCare website. <https://www.soilcare-project.eu>

¹⁵¹ Friends of the Earth (2021), Soil Health & Pesticides Study. <https://foe.org/soil-health>

¹⁵² United Nations, [Transforming our world: the 2030 agenda for sustainable development](https://sdgs.un.org/2030agenda). <https://sdgs.un.org/2030agenda>

¹⁵³ Lal, R. et al. (2021), [Soils and sustainable development goals of the United Nations: An International Union of Soil Sciences perspective](https://doi.org/10.1016/j.geodrs.2021.e00398). <https://doi.org/10.1016/j.geodrs.2021.e00398>



Relevance of land degradation to targets of each SDG
 Vertical axis: % of experts indicating that halting land degradation and restoration is relevant to achieving that goal. Green colours: indicate the degree to which the targets are synergistic with progress to address land degradation: dark green = all targets are aligned, lighter green boxes = potential trade-offs between targets and efforts to address land degradation and restoration. Nowhere was the relationship between efforts to address land degradation and meeting the SDGs judged to be more conflicting than synergistic.

Figure 8: addressing soil and land degradation is relevant and synergistic in achieving all the SDGs¹⁵⁴.

Sustainable soil management practices are key factors in achieving SDGs 2 “Zero Hunger”, 6 “Clean Water and Sanitation”, 7 “Affordable and Clean Energy”, 13 “Climate Action”, and 15 “Life on Land” are especially interconnected with soil parameters and functions, while soils may also play a substantial role in others e.g. 3 “Good Health and Wellbeing”, 12 “Responsible Consumption and Production”, 14 “Life below Water” and SDG 1 “End Poverty”. SDG 12 is mentioned less often in connection with soil, although soil is central to this goal. Importance of soil is specifically mentioned in Target 12.2 (Sustainable

¹⁵⁴ Keesstra, S.D. et al. (2020), [Implementation of soil and land related Sustainable Development Goals at EU level. https://edepot.wur.nl/531395](https://edepot.wur.nl/531395)

management and use of natural resources), Target 12.3 (Global Food loss) and Target 12.5 (Substantially reduce waste generation)¹⁵⁵.

United Nations Convention to Combat Desertification (UNCCD)

Since its adoption in 1994 and entry into force in 1996, the UNCCD combats desertification and mitigates the effects of drought in countries experiencing desertification, particularly in Africa, through international cooperation and partnership arrangements. All 196 Parties have obligations in terms of the collection of information, research, capacity building and the financial support of countries affected by desertification. Thirteen EU Member States have declared themselves as affected by desertification, based on their own self-assessments: Bulgaria, Greece, Spain, Croatia, Italy, Cyprus, Latvia, Hungary, Malta, Portugal, Romania, Slovenia and Slovakia. These affected Parties have to develop and carry out national, sub-regional and regional action programmes in close cooperation with the local stakeholders. Several Member States are declared as affected parties. The UNCCD is active on the concrete development and the implementation of the land degradation-neutrality (LDN) principle enshrined in the SDG target 15.3. The LDN objective is to compensate losses with gains, and to achieve a position of no net loss of healthy and productive land.

Convention on Biological Diversity (Biodiversity Convention, CBD)

The Earth's biological resources are vital to our economic and social development but human activities are taking a toll on many animal and plant species. After its adoption in 1992 and entry into force in 1996, the Convention on Biological Diversity pursued the global protection of biodiversity and the sustainable use of biological resources, and also addressed soil biodiversity. The Conference of the Parties decided "to establish an International Initiative for the Conservation and Sustainable Use of Soil Biodiversity as a cross-cutting initiative within the programme of work on agricultural biodiversity, and invited the Food and Agriculture Organization of the United Nations, and other relevant organizations, to facilitate and coordinate this initiative". This cross-cutting initiative aims to increase the recognition of the essential services provided by soil biodiversity across all production systems and its relation to land management, to share information, and to increase public awareness, education and capacity-building.

United Nations Framework Convention on Climate Change (UNFCCC)

The UNFCCC was adopted in 1992 and aims to achieve stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Such a level should allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner. Today there are 197 parties to the Convention as it is probably the best known international environmental treaty. The Convention contains the basic framework for climate agreements like the Kyoto protocol or the Paris Agreement. In the context of UNFCCC soil carbon sequestration is recognised as an important way to mitigate and adapt to climate change. At COP 21 in 2015 in Paris, an

¹⁵⁵ Lal, R. et al. (2021), [Soils and sustainable development goals of the United Nations: An International Union of Soil Sciences perspective](https://doi.org/10.1016/j.geodrs.2021.e00398). <https://doi.org/10.1016/j.geodrs.2021.e00398>

initiative was launched by the French government to increase the global soil carbon stock with 4 % annually, in order to stop the increasing CO₂ accumulation in the atmosphere.

Global Soil Partnership (GSP)

The Global Soil Partnership (GSP) has been established, following intensive preparatory work of the United Nations Food and Agriculture Organization (FAO) in collaboration with the European Commission, as a voluntary partnership coordinated by the FAO in September 2011. The GSP is open to all interested stakeholders: governments (FAO Member States), universities, research organizations, civil society organizations, industry and private companies. It is a voluntary partnership aiming to provide a platform for active engagement in sustainable soil management and soil protection at all scales: local, national, regional and global. For the implementation, the GSP relies on the Regional Soil Partnerships, the European Soil Partnership being one of them. Meantime, the GSP, together with its regional partnerships and the Intergovernmental Technical Panel on Soil (ITPS) is well recognized for its actions and expertise on soil at global level with the adoption of a revised World Soil Charter, the publication of the Status of the World's Soil Resources report and the Voluntary Guidelines on Sustainable Soil Management. The GSP also developed a Global Soil Organic Carbon map based on national data inputs, in order to highlight the importance of the sequestration of carbon for the climate system, agriculture, human health, agriculture, etc.

UN Decade on Ecosystem Restoration 2021-2030

The UN Decade on Ecosystem Restoration aims to prevent, halt and reverse the degradation of all ecosystems. Running from 2021 until 2030, the UN Decade launches a global movement to restore ecosystems worldwide. An area that has scope for restoration can be fully restored to its natural state, or be rehabilitated to serve a specific land use. Restoration can provide co-benefits for food security by safeguarding ecosystem services, such as soil protection, pollination, nutrient cycling and soil water-holding capacity. Restoration is essential for keeping global temperature rise below 2°C, ensuring food security for a growing population and slowing the rate of species extinctions. It helps to achieve multiple global goals, including the Post-2020 Global Biodiversity Framework under the CBD, the Paris Agreement under the UNFCCC, the Sustainable Development Goals (SDGs) under 2030 Agenda and the Land Degradation Neutrality targets under the UNCCD. Commitments by more than 115 governments to restore a total of nearly 1 billion hectares of land, almost the size of China, now need to be delivered.¹⁵⁶ Almost half of the restoration commitments are found in Sub-Saharan Africa, followed by Central and South America, China and South Asia. Relatively few commitments have been made by countries in North America, Europe, Russia, Central Asia, the Middle East and North Africa.¹⁵⁷

¹⁵⁶ United Nations Environment Programme (2021), *Becoming #GenerationRestoration: Ecosystem restoration for people, nature and climate*. <https://www.unep.org/resources/ecosystem-restoration-people-nature-climate>

¹⁵⁷ Sewell, A. et al. (2020), *Goals and Commitments for the Restoration Decade: A global overview of countries' restoration commitments under the Rio Conventions and other pledges*. <https://www.pbl.nl/sites/default/files/downloads/pbl-2020-goals-and-commitments-for-the-restoration-decade-3906.pdf>

PART II: SYNOPSIS REPORT OF THE OPEN PUBLIC CONSULTATION

1. CONSULTATION STRATEGY

The EU Biodiversity Strategy for 2030¹⁵⁸ announced the update of the 2006 EU Soil Thematic Strategy to address soil and land degradation in a comprehensive way and to help achieve land degradation neutrality by 2030.

The Commission committed that the update of the 2006 Soil Thematic Strategy will be supported by a broad consultation of stakeholders, including Member States, businesses, land managers, farm advisors, urban planners, rural and landscape developers, agro-, food- and beverage industry, research and academia, non-governmental organisations (NGOs) and other organisations dealing with environmental and nature protection, and general public.

The consultation activities were conducted through the Commission's "Have your say" website available in all 24 official EU languages and included a public consultation, a consultation of Member States through the EU expert group on soil protection, and dedicated outreach activities (e.g. campaign on social media, focused stakeholder meetings, etc.).

A series of dedicated discussions in concerned experts groups and committees consisting of experts from EU Member States, member countries of the European Environment Agency, etc. were also organised from October 2020 to early summer 2021.

2. ROADMAP

2.1. Introduction

The Commission uses a roadmap to define the scope of major new policy initiatives. Roadmaps describe the problem to be tackled and objectives to be met, explain why EU action is needed, outline policy options and describe the main features of the consultation strategy. The feedback period on the roadmap "New Soil Strategy - healthy soil for a healthy life" lasted from 05 November to 10 December 2020.

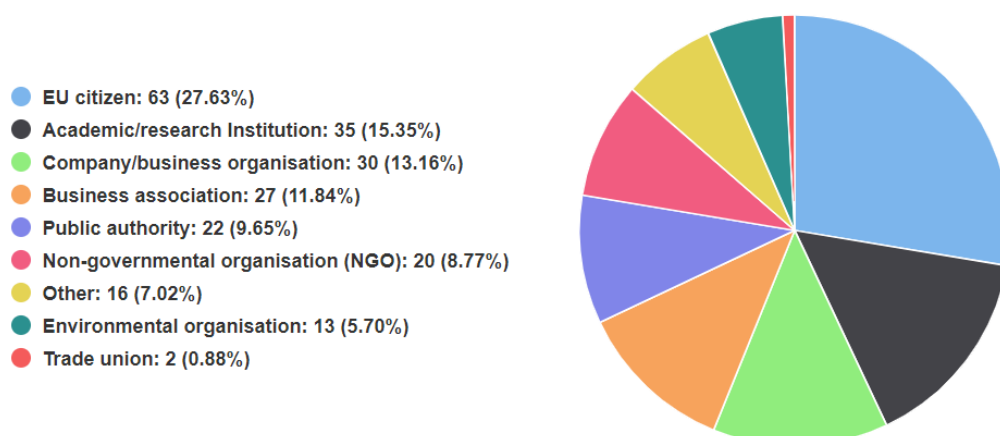
2.2. Overview of the feedback received

A total of 228 responses to the roadmap were received which are available online¹⁵⁹.

¹⁵⁸ Communication from the Commission "EU Biodiversity Strategy for 2030 - Bringing nature back into our lives" COM(2020)380 final

¹⁵⁹ Healthy soils – new EU soil strategy https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12634-Healthy-soils-new-EU-soil-strategy_en

By category of respondent



In their feedback, environmental NGOs and the ones promoting organic and sustainable agriculture mostly requested binding regulations and targets on soil, in the form of a new framework directive. They expected coherent timelines and consistency for the Green Deal targets and strategies. They consider that the focus should be on enhancing soil organic matter and soil biodiversity, addressing erosion, acidification, compaction, land take, soil sealing and diffuse pollution, protection of peatlands pastures, organic and intact soils but also on counteracting land degradation.

Governmental organisations and agencies considered in particular ensuring soil ecosystem services to be the strongest argument in favour of an EU regulation. Promoting research and innovation programs on harmonized soil monitoring methods and good practices to increase organic matter are also vital. Protection of soil of forests, permanent grasslands and peatlands and their carbon stock are also needed. Making the distinction between urban, forest and agricultural soils requirements should be sought. Soil contamination at EU scale must be reduced for providing healthy food in line with the Farm to Fork strategy and contributing to the European research alliance “Towards a chemical pesticide-free agriculture”. The role of soils in ecology of urban areas should also be highlighted. The spillover of land degradation due to imported goods should be addressed and an increased attention to soil compaction and its structural quality is required.

Roadmap participants from academia solicited in particular definitions of healthy soils and key indicators, which are needed for monitoring the target 2030 of 75% healthy soil in each Member State proposed by the Mission ‘A Soil Deal for Europe’¹⁶⁰. The need to fill the knowledge gaps was also highlighted, while soil biodiversity should be integrated into EU policies on agriculture (CAP), forest, industry and urban. Academia considers the priorities concerning soil to be the protection of organic soils and related ecosystems (peatlands, pastures, prairies, etc.) and the prevention of desertification and forest fires. An improved management of nutrients, a circular approach for biowaste and regenerative agriculture techniques, that also support carbon sequestration. The contribution to soil degradation caused

¹⁶⁰ Mission ‘A Soil Deal for Europe’ https://ec.europa.eu/info/research-and-innovation/funding/funding-opportunities/funding-programmes-and-open-calls/horizon-europe/missions-horizon-europe/soil-health-and-food_en

indirectly by EU policies and the functionality of urban soils should be addressed while nature-based solutions should be promoted.

Stakeholders from the innovative industrial sector active in the bioeconomy, circular economy, energy, water, buildings sectors requested regulations on soil and a level playing field to develop business on a EU scale, or to redevelop their decommissioned production sites (e.g. old fossil energy plants) to investments aligned with the Green Deal. Soil ‘re-carbonization’ and related initiatives (carbon pricing schemes, etc.) and techniques (regenerative agriculture, use of cover crops, organic fertilizers and biowastes) should be promoted while setting quality standards for soil amendments and fertilizers, and rules for re-use of soils that have been contaminated by former industrial activities (such as the Germany model). Homogenous criteria for soil decontamination should be provided at EU level and more attention given on problems such as soil acidification. Soil friendly projects should also be encouraged.

Stakeholders in the traditional industrial and primary sectors (agriculture, minerals) tend to reject EU binding regulations and deny the trans-boundary effects of soil degradation. Invoking the subsidiarity principle and the property rights on soil, they consider agricultural soil protection a matter of farmers and land owners, covered by the CAP ruled and national framework. They express worries of new bureaucratic burdens and standard EU rules not taking into account the diversity of regional situations and soils. However, they welcome the positive efforts to protect soil fertility via a good practices exchange platform and a EU soil database, useful for implementation of precision farming. Policies should focus on other sectors, in particular the building one, to reduce land take (farmers). Miners suggest to change the target of ‘no net land take’ to ‘sustainable soil use’.

3. OPEN PUBLIC CONSULTATION

3.1. Introduction

All citizens and organizations were invited to contribute to this consultation. The questionnaire, available in all EU languages, included 12 questions with multiple choice, plus an additional question for question 7 available only to the respondents who did not select the option “EU level: sufficiently”. For question 8 there was also the possibility to explain the choice with free text. Respondents had the opportunity to provide additional free text in the form of final remarks and to include position papers. The public could fill the questionnaire 02 February and 27 April 2021, via the website of the European Commission.¹⁶¹

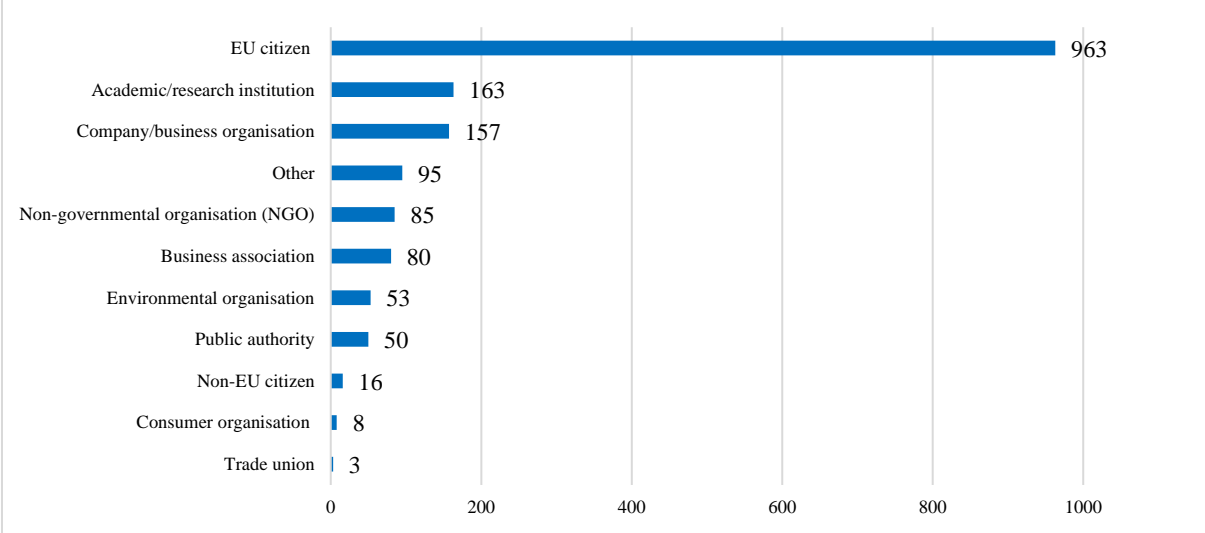
For the launch of the public consultation a news release was published by the Commission and widely shared with the press, relevant stakeholders and expert groups¹⁶². Intensive social media activities related to this public consultation were also conducted during the period in which the public consultation was open (e.g. Instagram, Twitter, Facebook).

¹⁶¹ Healthy soils – new EU soil strategy https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12634-Healthy-soils-new-EU-soil-strategy/public-consultation_en

¹⁶² Commission consults on new EU Soil Strategy https://ec.europa.eu/environment/news/commission-consults-new-eu-soil-strategy-2021-02-02_en

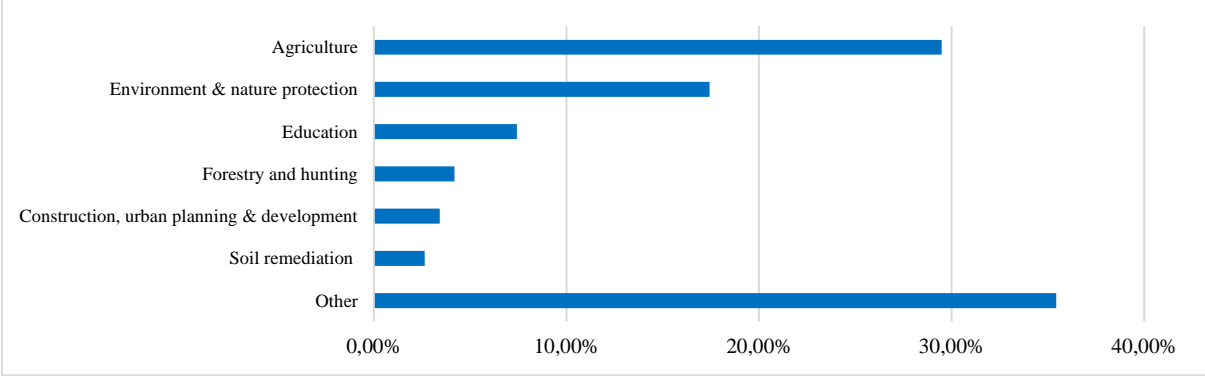
In total 1.673 responses to the questionnaire were received by the Commission, out of which 4 were submitted by email. In terms of categories of respondents, more than half of the responses to the questionnaire were provided by individual EU citizens, followed members of academia/research institutions and by representatives from companies/business organisations.

Categories of respondents:



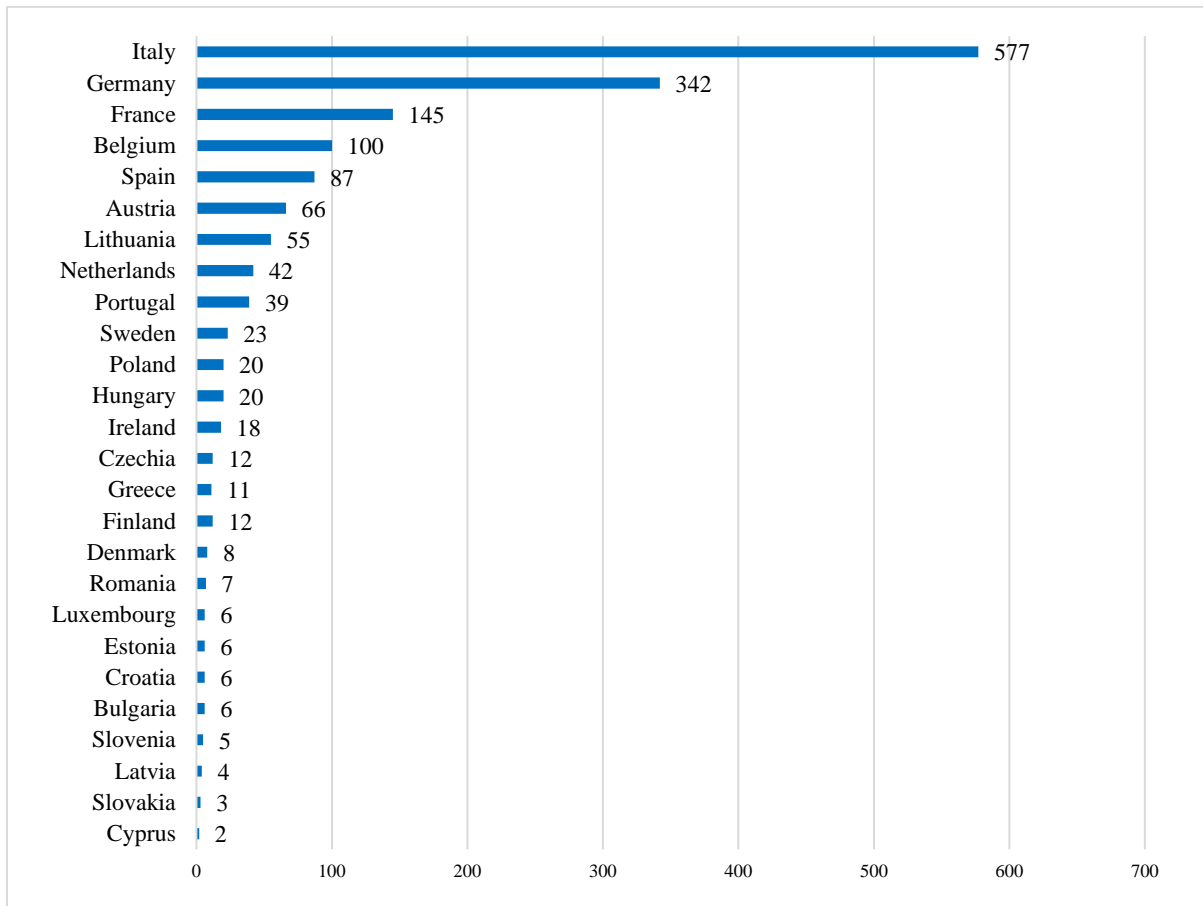
In terms of sectors, about 30% of inputs came from the agriculture sector, followed by environment and nature protection with about 17% and education with around 7 %, while all other sectors represented in total 45% but each with percentages below 5%.

Sectors the respondents belonged to:



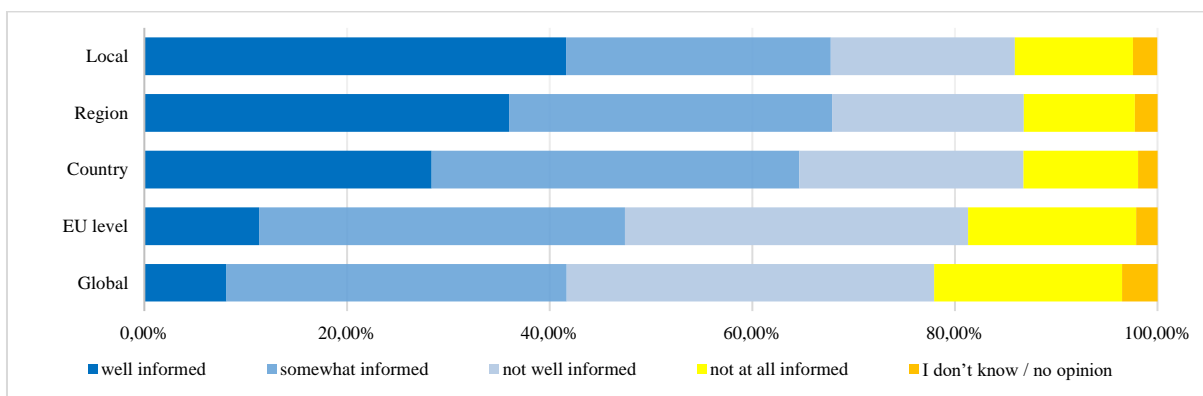
Responses received came from all EU Member States, excepting Malta. In terms of origin of the respondents, over a third of the responses came from Italy (ca. 34%) followed by Germany (ca. 20%) and France (ca. 9%). Responses from Italy and Germany combined represent more than half of the survey results (around 55%). The majority of the answers in Italy (ca. 70%) and Germany (ca. 60%) came from individual citizens. Additionally, mainly individuals, but also companies or organisations from 22 non-EU countries expressed their views on the Soil Strategy public consultation (3% of the total).

EU Member States the respondents belonged to:



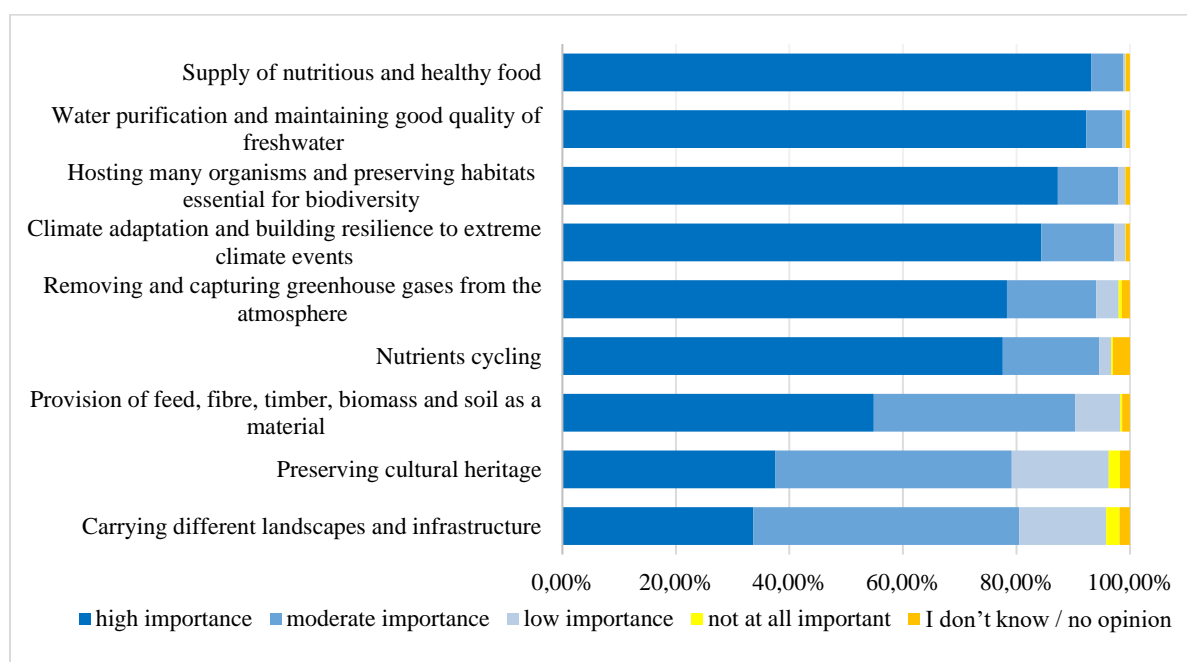
3.2. Summary of the replies

Question 1. How well do you consider yourself informed about the quality of soils in your local area, region or country, at EU or global level?



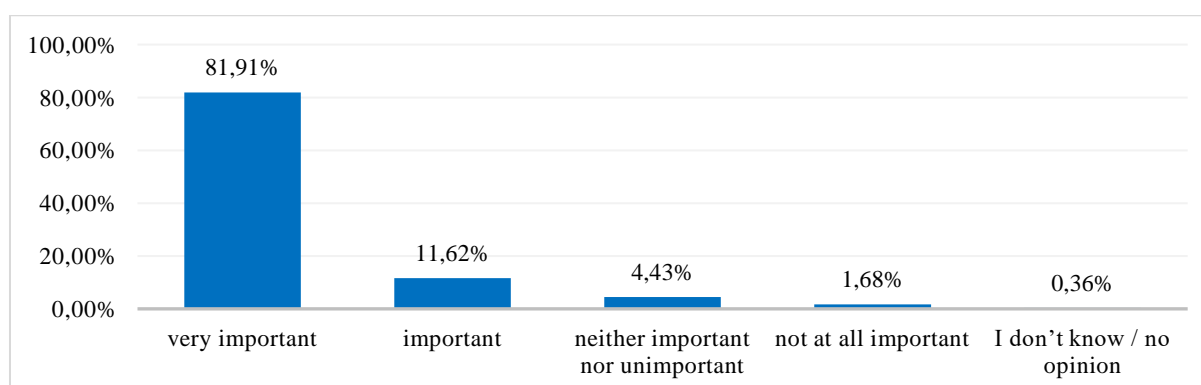
Most of the respondent seem to be quite informed about soil quality, especially at local, regional and national level, as over 60% of them consider themselves either well informed or somewhat informed. The knowledge on soil quality appears to decrease moving to the EU and global scale. Public authorities and environmental organisations are the respondents overall best informed about the quality of soils in their local area, region and country.

Question 2. Which soil ecosystem services do you consider as the most important?



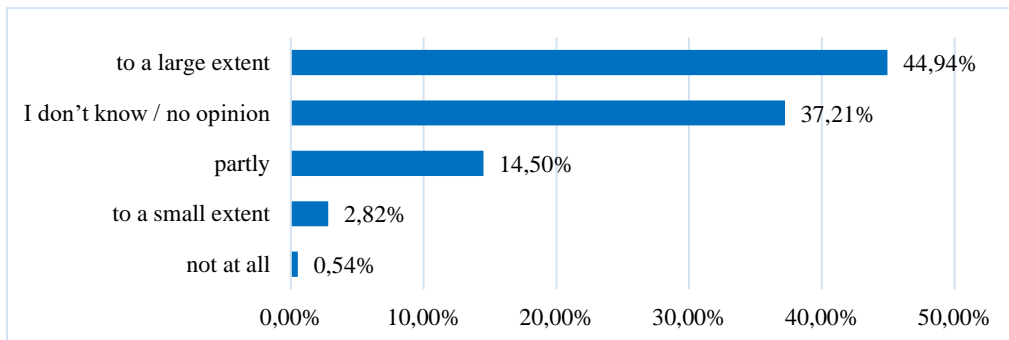
The supply of “nutritious and healthy food” is considered as the most important ecosystem service provided by soil according to over 90% of respondents. “Water purification and maintaining good quality of freshwater including ground and drinking water” is the second most important service, followed by the role of soil in maintaining habitats essential for biodiversity and by its role in climate adaptation and resilience. For over 60% of the respondents the role of soil in the preservation of cultural heritage and carrying landscapes and infrastructure are ecosystem services of moderate or low importance. There was no significant difference in this reply on the basis of the sector of the country of origin of the respondents.

Question 3. How would you rank the importance of protecting soil health/quality and its restoration at EU level?



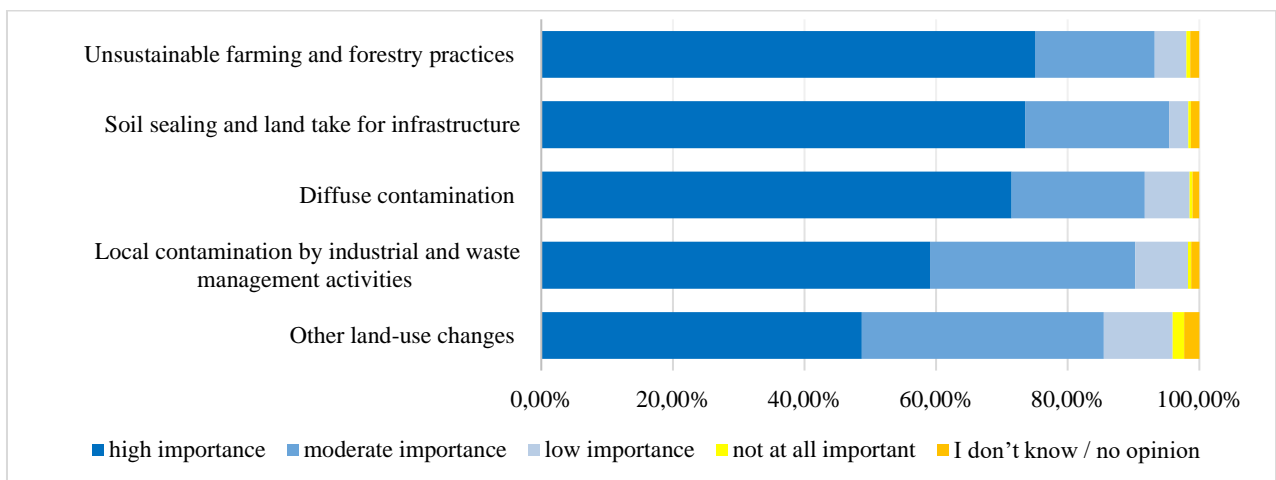
There seems to be a strong support for policy action at EU level among the respondents, as the need to restore and protect soil health and quality at EU level is considered very important (82%) or important (12%) by the survey participants, while only less than 2% believe it is not a priority.

Question 4. For those respondents who are land users (who regularly undertake activities related to management of land and soil, e.g. farmers and foresters), to what extent do soil health/quality considerations influence your activities and management choices?



About 45% of respondents consider soil health/quality to a large extent when making activities and management choices, while less than 1% do not consider soil health/quality implications.

Question 5. Soils are fragile and take hundreds of years to form but can be degraded in hours. To the best of your knowledge, which of the following human-activities contribute most to soil and land degradation?

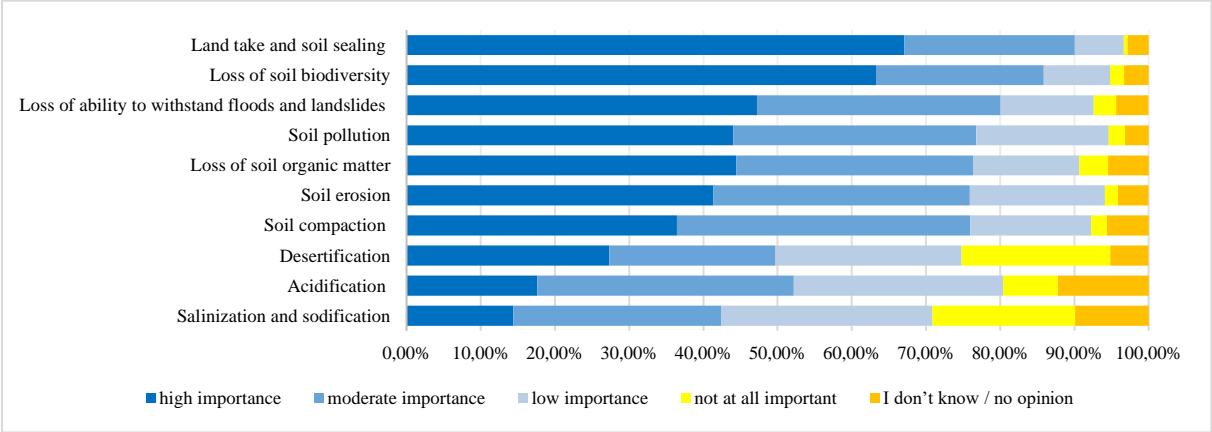


For the majority of the respondents (70% or more) the following 3 human activities are the most important threats to soil: unsustainable farming and forestry practices (such as over-intensive use of soils such as harmful soil practices, mono-cropping and intensive livestock production); soil sealing and land take for infrastructure construction (such as house building, industrial/commercial buildings, roads and motorways, parking lots, airports); and diffuse contamination (due to overuse of pesticides, nutrient pollution from excess use of fertilizers, microplastics, air depositions of pollutants).

For business associations' representatives, "soil sealing" ranks first and only about half consider "unsustainable farming practices" to be of high importance. For respondents from academic and research institutions, the least important are "local contamination" and "other land-use changes" although they are both of high and moderate importance for about 50% of contributors. Similarly, for representatives of companies and business organisations, "local

contamination” and “other land use changes” are the least important. Individuals consider other land use changes to have the lowest importance. Local contamination is the least important threat for the NGOs (about 50% consider it of moderate to low importance).

Question 6. To the best of your knowledge, which of the following soil and land degradation processes are the most acute in your country?



“Land take and soil sealing”, and the “loss of soil biodiversity” are considered by the respondents on average the most acute degradation processes. Land take and soil sealing is considered of high importance by roughly 67% of respondents, while loss of soil biodiversity is believed to be of high importance for over 60% of respondents.

Some country-specific differences emerged in the replies. Respondents from Germany and Austria seem to consider “land take and soil sealing” as the main degradation process in their country, while respondents from Ireland, Latvia and Finland consider “loss of soil biodiversity” as the main degradation process in their country.

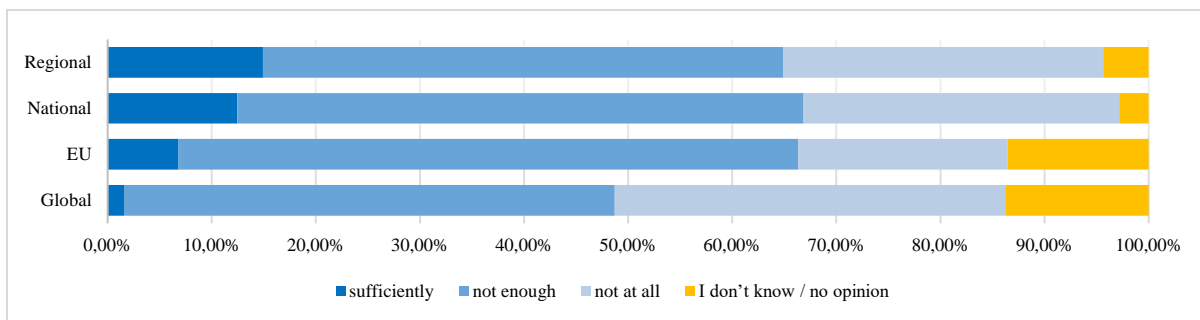
Desertification, acidification and salinization are degradation processes considered less acute in their country (less than 20% consider them of high importance). Only Polish and Lithuanian respondents perceive soil acidification as an acute problem in their country.

Desertification is considered of high importance by at least 50% of respondents from the following countries: Bulgaria, Greece, Portugal, Romania and Spain.

No respondent from EU countries identifies salinization and sodification as an acute degradation problem of high national importance.

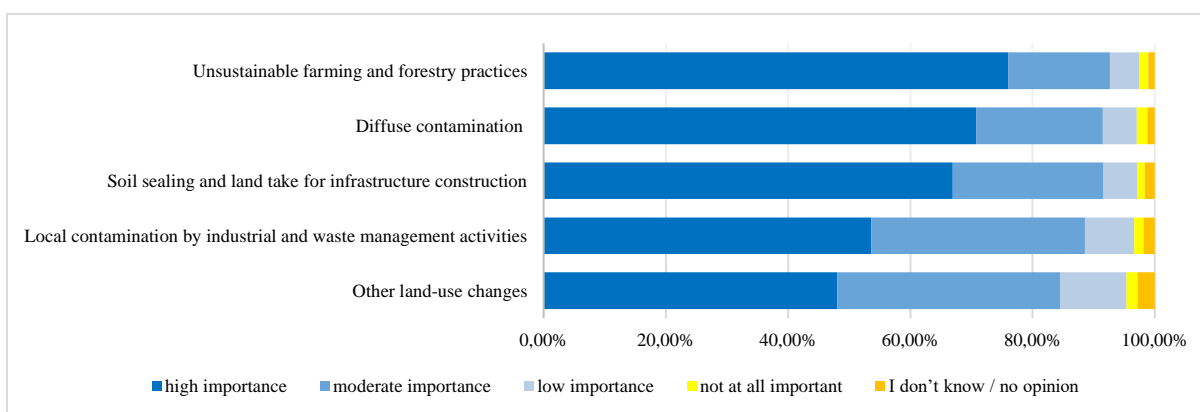
Business associations considered “land take and soil sealing” and the “loss of soil biodiversity” the least acute degradation processes in their country

Question 7. To the best of your knowledge, are the causes of soil and land degradation sufficiently addressed?



The vast majority of respondents believe that further policy action is needed as they consider that the causes of soil and land degradation are not sufficiently addressed at regional, national, EU and global level. Only 15% or less consider them sufficiently addressed, and, in particular, only 6.7% of respondents consider them sufficiently addressed at EU level. This seems quite a consensual assessment as no significant difference was noticed in terms of country or sector of the respondents.

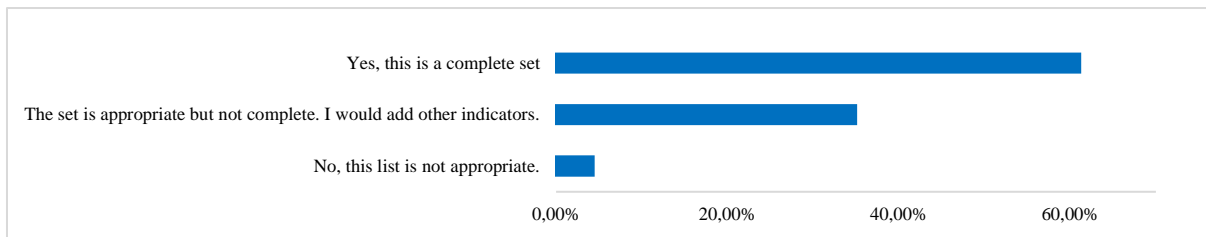
Question 7a. If you think that the causes of soil and land degradation are not properly addressed, which of the following elements do you think should be addressed better at EU level? (Number of answers = 1565)



This optional question was available only to the respondents who indicated in the previous question that the causes of soil and land degradation are not properly addressed (i.e. available to 93.5% of respondents).

According to more than two thirds of respondents the following causes of soil and land degradation should be better addressed at EU level: unsustainable farming and forestry practices (e.g. over-intensive use of soils such as harmful soil practices, mono-cropping and intensive livestock production), followed by diffuses contamination (e.g. due to overuse of pesticides, nutrient pollution from excess use of fertilizers, microplastics, air depositions of pollutants) and soil sealing and land take for infrastructure construction (e.g. house building, industrial/commercial buildings, roads and motorways, parking lots, airports).

Question 8. Do you think that this set of criteria is appropriate to ascertain soil health?

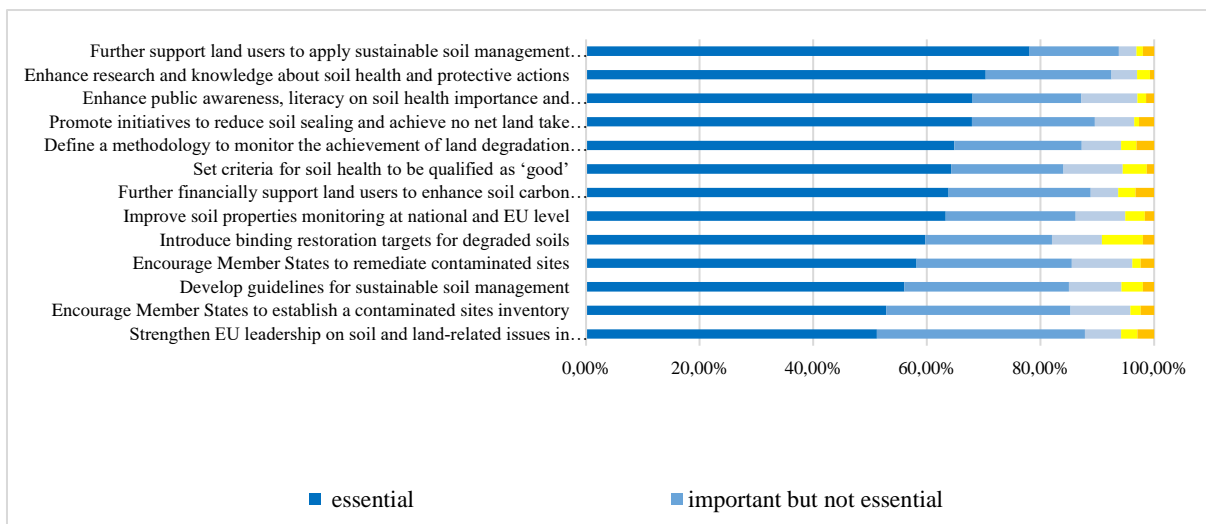


The question listed the following criteria to ascertain soil health proposed by the experts in the context of the Horizon Europe Mission 'A Soil Deal for Europe': (1) Presence of pollutants, excess nutrients and salts in the soil, (2) soil organic carbon content, (3) soil structure including medium soil density and absence of soil sealing or soil erosion, (4) soil biodiversity, (5) soil nutrients and acidity (pH), (6) vegetation cover, (7) landscape heterogeneity, (8) forest cover.

Over 60% of respondents believe the criteria listed above are appropriate to ascertain soil health, while about 35% of them consider the list incomplete. 65 respondents (about 4%) considered that the list is not appropriate to ascertain soil health, indicating criteria 6 to 8 as not relevant and considering criteria mentioned in 1 to 5 should have been separated.

Those who considered the set appropriate but incomplete (531 respondents, ca 35% of the total), suggested a number of additional indicators for assessing healthy soils, which can be grouped into six main categories: physical (coastal erosion, topography, landslides, water-wind erosion and sedimentation, soil texture and porosity, soil stability, soil extraction and excavation, soil thickness, soil subsidence, air conductivity), chemical (nutrient availability and deficiency, nutrient balance, cation exchange capacity, heavy metals such as lead, waste residues, radioactivity), biological quality (soil carbon stocks, humus quantity and quality, soil pathogens and pests, nematodes, earthworms, microbial respiration, diversity and activity, bacteria to fungi ratio, beta glucosidase activity, anti-microbial resistance and antibiotic residues), water indicators (groundwater quality and quantity, groundwater extraction and exploitation, water infiltration and drainage, soil moisture, water retention capacity, water conductivity, soil-water balance), land use indicators (vegetation type, landscape features, land management, agricultural and farming practices, landscape connectivity and fragmentation, population density, land use change, re-use and recycling), or others (soil diversity (pedodiversity), soil functions and ecosystem services, soil fertility, soil productivity, index for land degradation neutrality, desertification, soil type such as histosols, soil age, soil resilience, soil health).

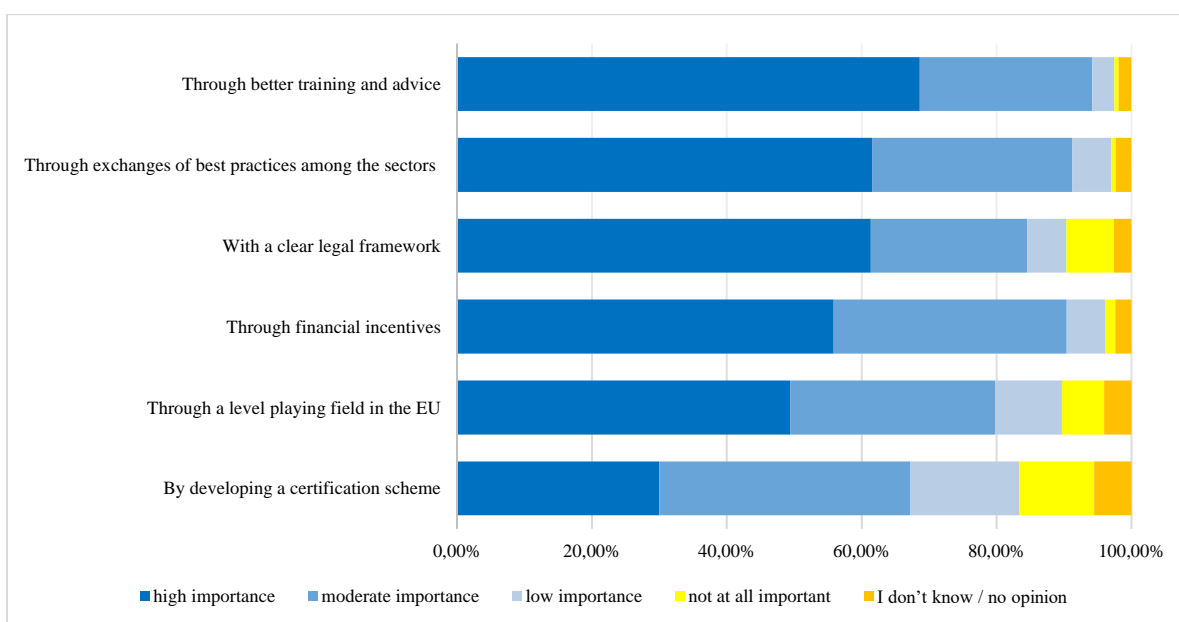
Question 9. What are your views on the following possible actions to be explored under the new EU soil policy framework?



At least 50% of survey participants consider all proposed actions to be essential aspects of the new EU soil policy framework. However, almost 80% of respondents consider essential the continuous support for farmers, foresters and other land users to apply sustainable soil management practices (e.g. through the EU’s Common Agricultural Policy and the farm advisory), followed by enhanced research and knowledge about soil health and actions to protect it, and enhancing public awareness (e.g. through school education, soil sustainability labels) and the literacy on the importance of soil health and actions to protect it.

The action perceived as the least essential compared to the others is strengthening EU leadership on soil and land-related issues in international fora, including through policy dialogue and technical support to partner countries.

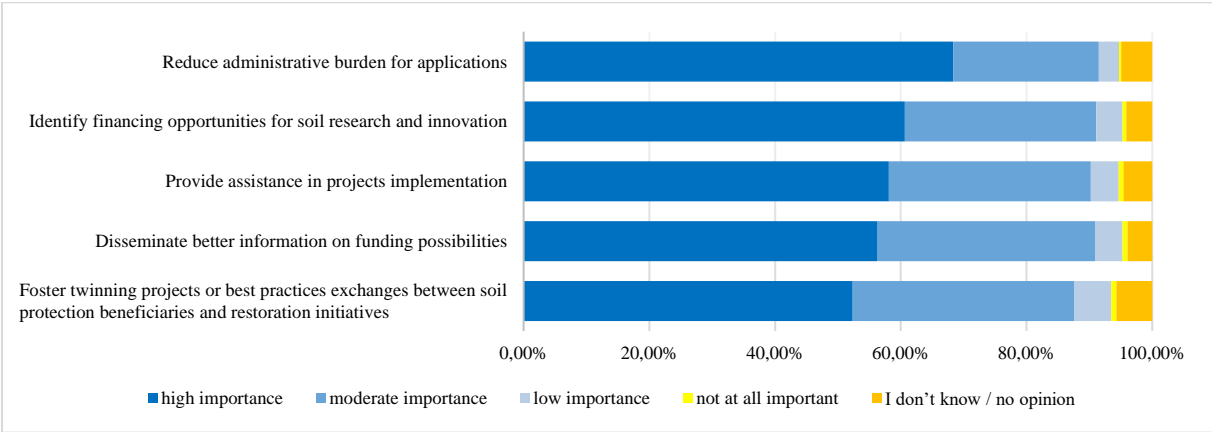
Question 10. How can the EU better support farmers, foresters and other land users to apply sustainable soil management practices?



In terms of supporting farmers, foresters and other land users to apply sustainable soil management practices, over two thirds of the respondents consider that this should be made

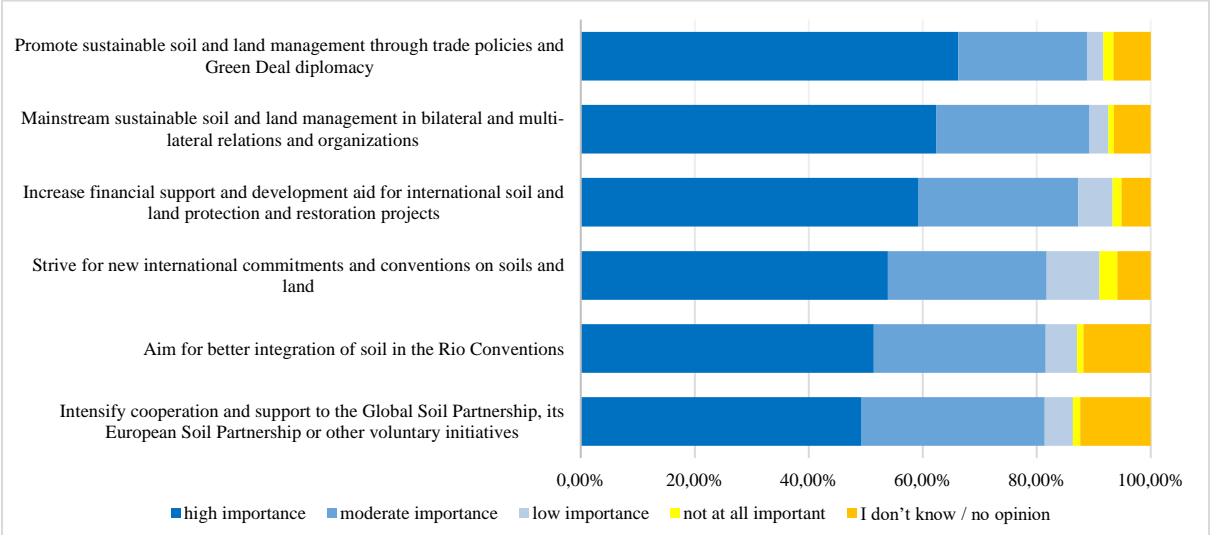
through better training and advice (69% indicated a high importance), followed closely by the exchanges of best practices (62%) and providing a clear legal framework (61%). Less than 30% believe a certification scheme for soil would be highly important in supporting land users to apply sustainable soil management practices.

Question 11. How can the EU increase the uptake of existing funding (from the EU’s Common Agricultural Policy, regional funds, research funds e.g. Horizon Europe, the LIFE programme) for soil protection and restoration in the EU?



To increase the uptake of existing EU funding for soil protection and restoration, 70% of respondents consider it is necessary a reduction in administrative burden for the applicants. While all the options described were considered as highly important by more than 50% of the respondents, the one scoring less among those offered is the fostering of twinning projects or best practices exchanges between soil protection beneficiaries and restoration initiatives.

Question 12. How can the EU steer global action on soil and land protection and restoration?



Here again at least half of the respondents consider that all the actions listed are of high importance for the EU in steering global action on soil and land protection. However, the priority action is considered to be the “promotion of sustainable soil and land management through trade policy and Green Deal diplomacy”, followed by “mainstreaming sustainable

soil and land management in various relations and organisations”. The action considered to be of highest importance for environmental organisations and companies or business organisations was to “increase the financial support and development aid for international soil and land protection and restoration projects”. Business associations considered “mainstream sustainable soil and land management in bilateral and multi-lateral relations and organizations” to have the highest importance.

3.3. Analysis of the replies to the open question

About 40% of respondents (663) provided an optional short text contribution within the scope of the questionnaire. The answers can be grouped into the following categories: welcoming the new Soil Strategy, suggestions for the new Soil Strategy, positive examples on soil protection, regulation, arguments in favour of an EU Soil regulation, negative examples of practices leading to soil degradation, examples of best and worst farming practices, arguments in favour of or against an EU Soil legislation, positive or constructive remarks on the questionnaire.

3.4. Position Papers

The Commission received 183 contributions as position papers through the possibility to upload it in the questionnaire for the public consultation. Four were submitted separately by email to DG ENV.

Of these position papers, 12 were submitted by public authorities, 13 by academic/research institutes, 14 by environmental organisations, 23 by NGOs, 24 by business associations, 28 by companies and business organisations. 52 by EU-citizens and 4 by non-EU citizens, 13 by “others”. The “others” category was merged with similar sectors. Some of the provided position papers were identical.

3.4.1. Public authorities

The stance expressed in most position papers is the need of a legally binding instrument for soil protection within a coherent regulatory framework and guidelines across the EU, which mainly contains targets and allows for flexible implementation in every Member State, being inclusive of the subsidiarity principle. Consistency among EU policies is expected, with the CAP playing a major role in sustainable soil management. Some contributions from Nordic public authorities considers that restoring wetlands and peatlands should be addressed at a national level. The submissions highlight also that soil protection means (ground)water protection, climate protection/mitigation/resilience, maintaining biodiversity and human health, provision of food. Soil organic carbon and biodiversity are interlinked. The new Soil Strategy should focus on better protection and restoration of soils, especially the ones high in carbon storage capacity. Other recommendations include nature-based solutions, improving/restoring soil fertility, enhancing/protecting soil biodiversity, stopping soil degradation, counteracting desertification; organic farming, mixed/poly crops, sustainable soil management, nutrient recycling crop rotation, reuse of water, reduced chemical applications, addressing erosion, compaction. Case studies and good working models for ensuring or monitoring healthy soils were presented, notably from Austria (Styria), Belgium(Flanders), Germany, Poland and UK. The Open Soil Index was proposed by one authority as a scientific assessment tool for soil quality and management. Involving citizens and raising awareness is one of the main common points throughout the position papers. A better understanding of the key terms and definitions is often mentioned, such as “degradation”, “soil quality”, “good

ecological status”. Furthermore, improved monitoring across the EU is requested to be in shared, coordinated, transparent way, with a standardized, accessible data collection. the Open Soil Index as a scientific assessment tool for soil quality and management. Soil knowledge and research should be encouraged but cooperation and knowledge exchange could be improved. One authority suggested the establishment of a soil certificate that provides soil quality information. The most acute concerns for soil health flagged in the written submission by the public authorities are unsustainable or intensive agricultural practices, soil sealing, soil pollution and contamination. They consider the EU should strive to develop adequate efforts to address the global challenge of halting soil and land degradation and provide a harmonized soil pollution risk assessment approach.

3.4.2. NGOs and environmental organizations

In their written inputs, the NGOs and environmental organisations explicitly welcomed the initiative, recognizing the urgent need for protecting and restoring soils by setting clear and concise targets and milestones. Although the subsidiarity principle should be considered, soil protection has to be transboundary to ensure we are on track for the agreed EU and global targets. In this context, a new Soil Framework Directive should be developed, with specific EU-wide binding targets (quality requirements), regulations on land use, measures and support programs. Even if soil diversity is high and measures cannot be equally imposed throughout the EU, common targets and milestones can exist. The new Soil Strategy represents an opportunity to fill in current gaps in EU environmental policy and to strengthen coherence and deliverables by joint action between soil protection, nature conservation, agriculture, forestry, H2O management. The strategy must have concrete objectives, measures and dedicated funding, cover all soils, address agricultural practices and contribute to protection and restoration of carbon-rich ecosystems. Over 30% of position papers in this category emphasized that wetland/peatland are heavily endangered and should be restored and legally protected as much as possible, especially due to their sequestered carbon. Soil loss/degradation is considered a source of emissions that contributes to climate change. Consequently, carbon sequestration payments would be opportunities for farmers to benefit from the emerging carbon market. The new Soil Strategy should highlight that the climate and biodiversity crisis concur and have the same solutions: good agricultural practices that focus on preventive and restorative measures such as organic farming, agroforestry, regenerative farming or agroecology, mixed crop-livestock farming, precision farming, reduced pollution. Concerning soil restoration, protection is better and more cost-effective than remediation. The strategy must not forgo urban areas. The desired output of the Soil Strategy should include: encouraging soil knowledge and research, improving public awareness, soil education, cooperation and knowledge exchange, providing common definitions, clear indicators, a monitoring system and a soil data platform. The relationship between producers and consumers should be strengthened. Regarding circularity, reuse of resources should be considered. Since current farming practices prevent accumulation of organic materials in soil, agricultural practices (e.g. CAP) must adopt and implement sustainable production that minimizes soil degradation. Other proposals for soil protection in the new Soil Strategy include nature-based solutions, a better integration of soils as part of geoheritage conservation, a "soil protection passport", rooftop compensation of open/green spaces lost to buildings, creating a soil and landscape red list; counteracting desertification, calculation of “soil balance”, promoting soilless growing of food, lower land-use footprint, insisting on the importance of fungal networks. For soil monitoring, the following were proposed: digital water solutions, permanent observation and monitoring plots must be established across the EU, setting uniform standards and appropriate soil indices.

3.4.3. Companies, business organisations and associations

Several position papers included further comments related to the questionnaire questions. Over 80% of companies/business organisation and business associations, which were represented by farmers, agrochemical and mining companies, do not see the need for specific soil regulation at EU level. The main arguments emphasize the subsidiarity principle and the high soil variability in Europe and also mention the numerous soil legislative acts and mechanisms already present in various Member States. Accordingly, the expectations for the new Soil Strategy are placed on encouraging research and digitalization programs, promoting sustainable soil management practices in line with the subsidiarity and proportionality principles, promoting initiatives (such as carbon farming), ensuring production sites are operating at highest standards, continuing the use of existing programs and policies (CAP, Horizon, LIFE etc.). Further key areas to be addressed should be soil pollution, improved monitoring, controlled soil footprint outside EU, intelligent spatial planning, platform for quantity and quality of soil data and information, the proper documentation of soil sealing and land consumption, contamination sites, establishment of methodologies. Although the Soil Strategy should consist of precautionary aspects, direction and support to Member States, some clear objectives should be placed on soil/land sealing/take and contamination. Ensuring consistency among EU policies is mandatory, thus overlapping objectives should be avoided. Companies or businesses representing farmers stressed that the European farmer should play a key role in the Soil Strategy as it is at the centre of climate change mitigation efforts and a soil health guardian. Thus, land payment schemes in CAP should be dynamic enough to allow farmers to cooperate and conduct soil health experiments under supervision. Agrochemical companies asked for farmers to be trained and better informed on the beneficial potential of bio-based fertilisers, organic amendments, biostimulants. One position paper requested for a holistic view on agriculture and asked for breakdown of intensive farming. An impact assessment of specific actions is considered necessary for any binding targets or commitment and possible goals or indicators must be technically comprehensible and realistic. Interlinking of the different EU environmental policies and their further updating with a focus on Green Deal deliverables is considered a good alternative to a Soil Directive. Further suggestions include prioritizing biodiversity, focusing on soil multifunctionality, encourage precision farming, reconciling ecological and socio-economical expectations. A mining company suggested a shift from “no net land take” to “sustainable land use”. Less than 20% of position paper in this category, belonging mainly to the farming, water and waste, and agri-environmental consultancy sectors, support or ask for a regulatory EU framework on soils in order to harmonize national legislations, fill in existing policy gaps and prevent further contamination and deterioration of soil quality, functions and biodiversity. The potential EU soil regulation, which must contain clear goals and guidelines (including for soil excavation), should be first and foremost be flexible and consistent with other policies. In this context, a revision on CAP eco-schemes and measures is warranted, and organic/regenerative farming practices, which reverse soil degradation and increase soil organic carbon sequestration, should be encouraged and incentivized. Last but not least, healthy soils to play a vital role for the circular economy.

3.4.4. Academic and research institutions

About 50% of position papers included references and/or case-studies to assist decision making. One such reference showed that the driving force in smaller farms is profitability rather than environmental or social advantages. Concerns were raised about modern agriculture being climate-smart by one paper. One contribution considered a lack of

biodiversity focus in the 2006 Soil Strategy. Another position paper suggested the integration of soil multifunctionality notion (including for Horizon 2020) and two new pillars for the new strategy, namely international issues and hotspot issues, which would require immediate action. The majority of position papers requested the development of a standardized EU data infrastructure, which includes soil mapping and monitoring. Stressing the soil links to water quality, food production, biodiversity and carbon sequestration were requested in the position papers. A common message was a revision of CAP to guarantee coherence with the future Soil Strategy, but also establishing good agricultural practices and ensuring their consistency with other EU policies. One position paper suggested that 4 per 1000 initiative is not feasible, carbon farming is not necessarily sustainable and only humus certificates are climate relevant resulting in CAP having to encourage humus build-up and soil fertility. A paper included a proposal for a successful implementation of a Soil Directive by identifying existing measures, collecting them and generating a global framework on soils would bring consistency and improve the implementation without increasing the number of legally binding obligations. One paper stated that current EU directives have not been adequately implemented and the Soil Strategy must have more ambitious objectives, including binding commitments and guidelines of the directives with direct repercussions on Member States that do not attain the targets on soil quality and conservation. Setting a timeline to cut-off funding for unsustainable agriculture through the CAP was also suggested. Overall, more investing in research and innovation were recommended, especially in order to scientifically support the Soil Strategy and identify best practices to reconcile soil productivity and sustainability. Last but not least, public awareness must be increased.

3.4.5. EU citizens

Over 20% of EU citizens demanded a transition to agroecology, increased support for smallholder farmers and local communities and a dedicated legally binding framework for EU soils. About 30% of EU citizens, all representing Italy, stated that the EU is not doing enough to reach its soil commitments and keeps policies directly linked to soil degradation (such as CAP) and the European institutions must fully commit to the soil-related targets of the Green Deal strategies. About 10% of position papers considered EU is not on track with 2030 UN Agenda as 1/4 of European soils are exposed to severe degradation and desertification risks and also identified CAP as a contributor. The main issues the Soil Strategy should address are soil/land consumption rates, waterproofing, (subsidizing) agricultural practices that contribute to soil degradation, biodiversity and soil fertility loss, including the capacity to store organic carbon. Proposed solutions to these problems are: regenerative farming, agroecological transition, a legislative framework with incentives for specific, quantifiable and binding targets, more research, dedicated funding, sustainable production, a stronger bond between producers and consumers, a focus on soil multifunctionality (include it as a Horizon research topic), access to soil information, sustainable soil management methods, soil education and awareness, a rewarding system for sustainable small scale agriculture. The new Soil Strategy should establish mandatory objectives on soil conservation and improvement, by implementing common definitions and improved monitoring via a soil data platform. Some positions on restoring soils, indicate a mentality shift is needed and the Soil Strategy should be ambitious and aim to revolutionize agriculture. The EU should keep its engagement in international initiatives. Expectations of the new Soil Strategy include a higher level of commitment and ambition, guidance on soil management and best practices. The strategy should be more global, integrative and transversal, while maintaining coherency and synergy among policies and a focus on preventing soil degradation and soil loss (proposed sequence: avoid-reduce-compensate). Challenges of the Soil Strategy would be making globally valid

formulas for the diverse EU soils and conditions, limit impacts of policies with (negative) trade-offs on soil health. One paper detailed on how CAP encourages and supports detrimental practices, which lead to soil degradation and proposed a different CAP design. Another citizen suggested for an individual ecological footprint (barcode), which follows every product and action and determines our taxes.

3.4.6. *Non-EU citizens*

Four non-EU citizens added position papers to their submission, all demanding a transition to agroecology and a dedicated legal framework for EU soils to efficiently address soil degradation and practices that negatively impact soil and replace them with sustainable alternatives.

4. OTHER CONSULTATIONS OF MEMBER STATES AND STAKEHOLDERS

4.1. Consultations of Member States through the EU Expert Group on Soil Protection

In line with the commitments agreed by the EU in the 7th Environment Action Programme¹⁶³ (7th EAP) and in light of the worrying situation and trends portrayed by the European Environment Agency (EEA) 2015 State of the Environment Report¹⁶⁴, the Commission had established in 2015 an **Expert Group with Member States on Soil Protection** to "*reflect as soon as possible on how soil quality issues could be addressed using a targeted and proportionate risk-based approach within a binding legal framework*"¹⁶⁵. All Member States nominated one or several experts (summing 55 experts) to support the Commission in the work of this group.

The Commission has discussed since 2015 on a regular basis with Member States the policy gaps and the policy actions needed at EU level on soil protection, to prepare the new policy framework, including its legally-binding elements.

The first meeting of the EU Expert Group on Soil Protection took place on 19 October 2015. It was attended by 50 participants of which 40 Member State experts from 25 countries. 3 Member States were not represented in the meeting (LT, MT, HR). Some countries sent several participants (AT, BE, DE, DK, ES, FR, PL and UK).

The objectives for this first meeting were 1) to take stock of recent developments at global, EU and national levels, and 2) to agree on the objectives and *modus operandi* of a new permanent channel of communication between Member States and the Commission to implement the soil protection provisions of the 7th EAP. Discussion was organized on the basis of a background paper sent one month in advance, to which 8 Member States (AT, BE, CY, ES, FI, IT, MT and NL) had replied in writing before or after the meeting.

¹⁶³ DECISION 1386/2013/EU of the European Parliament and of the Council of 20 November 2013 on a General Union Environment Action Programme to 2020 "Living well, within the limits of our planet"

¹⁶⁴ [SOER 2015 — The European environment — state and outlook 2015 \(europa.eu\)](https://www.eea.europa.eu/soer/2015)
<https://www.eea.europa.eu/soer/2015>

¹⁶⁵ [Register of Commission expert groups and other similar entities \(europa.eu\)](https://ec.europa.eu/transparency/expert-groups-register/screen/home)
<https://ec.europa.eu/transparency/expert-groups-register/screen/home>

The 2nd meeting of the EU expert group on soil protection took place on 26 April 2016. 25 experts from 16 Member States, together with officials from the European Commission (DG ENV, JRC), from the EEA and members of the consortium in charge of the contract for the inventory of EU and national soil-legislation, attended the meeting. The main topic discussed was the development of a comprehensive inventory in wiki-format of soil policy instruments at EU and national level, a work led by an external contractor¹⁶⁶.

The 3rd meeting of the EU Expert Group on soil protection took place on 18-19 October 2016. Its main objective was to present the first outcomes of the inventory of soil policy instrument and gap analysis, collect feedback from Member States and discuss the way forward to complete the gap analysis. The consolidated outcomes of the study were presented at the soil stakeholders' conference organised by the Commission on 5th December 2016. The objective of the inventory of EU and national policies was to commonly agree on the baseline and gaps. It was also discussed with Member State experts how to identify the main gaps on soil protection in EU policies for the 'agriculture and forest' cluster.

The 4th meeting of the EU expert group on soil protection took place on 25 April 2017 and focused on the preparatory work for a possible Impact Assessment towards EU soil policy development. The Commission presented the impact assessment rules and procedures and the contribution of the soil expert group to the preparation of an Impact Assessment was discussed. The Commission provided a document with first thoughts and an approach for a way-forward regarding the environmental problem that was sent to the experts for feedback. The Commission drafted and circulated also a questionnaire related to the problem definition of the Impact Assessment, as well as a tentative timeline for the whole process. Member States were also able to comment on the conclusions of the inventory report via their answer to the questionnaire.

The 5th meeting of the EU expert group on soil protection took place on 24 October 2017 and the main objective was to discuss the distributed documents and questionnaire on the problem definition. The Commission presented also a new report on local soil contamination in the EU, based on the replies by Member States, which would contribute to the problem definition. The following issues were discussed in depth with the experts: global soil degradation, data and monitoring of land and soil degradation in the EU, causes and drivers of land and soil degradation, effects and impact of land and soil degradation, and the costs of soil degradation. The importance to first define the policy gaps and failures and then to assess the need for filling these at the EU level was also highlighted by the Commission.

The 6th meeting of the EU expert group on soil protection took place on 17 April 2018 and focused on the replies provided by Member States to the questionnaire on the problem definition that was distributed in autumn 2017, with an ultimate deadline to reply by February 2018. The Commission received replies from 18 Member States (AT, BE, CZ, DE, EE, ES, FI, FR, HR, IT, LT, LU, NL, PL, PT, SE, SI, SK). 10 Member States did not reply (BG, CY, DK, EL, HU, IE, LV, MT, RO, UK). The Commission encouraged the ten Member States that had not replied to the questionnaire, to still do so, and especially to share their opinion on the policy gaps.

¹⁶⁶ [Soil inventory report https://ec.europa.eu/environment/soil/pdf/Soil_inventory_report.pdf](https://ec.europa.eu/environment/soil/pdf/Soil_inventory_report.pdf)

The EU added value and policy objectives of a new policy framework for soil protection were also discussed. The Commission explained the principles of subsidiarity and proportionality, and the division of competences between the Member States and the EU. Any new soil protection initiative should comply with the general objectives of article 191 of the TFEU. Additional specific objectives should be SMART and broad enough in order not to pre-empt a specific policy response or option. The Commission announced a new questionnaire to be distributed among the experts to allow Member States to provide their inputs on the EU added value and the policy objectives.

The 7th meeting of the EU expert group on soil protection took place on 22 October 2018 and focused on discussing the replies of Member States' experts to the questionnaire on EU added value. Before the meeting, the Commission received 15 replies to the second questionnaire (AT, BE, CZ, DE, ES, FI, HR, IE, LU, NL, PT, RO, SE, SI, SK). 13 Member States did not reply or replied very close to the date of the meeting (BG, CY, DK, EE, EL, FR, HU, IT, LT, LV, MT, PL, UK). Member States that had not yet replied, were given the opportunity to send their contributions by 6 November 2018. In their replies, all Member States agreed to some extent or fully agreed with the described transboundary impacts. Some Member States made a few additional suggestions to consider: e.g. N₂O emissions, salinization, biodiversity, climate adaptation and the evidence base after Brexit. Some Member States raised also doubts about the uniform application of targets across the EU, because the situation is highly dependent on soil characteristics and texture; not all land and soil degradation processes are equally relevant across Member States due to the heterogeneity of the conditions of the soil.

The Commission presented also the summary of replies to the second part of the questionnaire on the risk of failing European and international commitments. Most Member States agreed in their replies that there is a risk of failing, but their opinions varied on the responsibility for failing and taking action. One Member State answered that Africa and Asia are confronted with more pressing and challenging soil degradation issues than the EU. Several Member States asked not only to focus on negative trends, but also to acknowledge positive evolutions such as the progress made in the EU with the management of contaminated sites, the increased application of organic farming practices or the protection and restoration of forests and landscapes.

Finally, the Commission presented the replies on the absence of a level playing field and the presence of market disturbing forces. Almost all Member States recognized in their replies that there is a lot of variety between national legislations. One Member State pointed out that the main objective of environmental policies should be environmental protection and not market regulation. In their replies Member States agreed on the lack of data and quantifications and expressed the need for additional research and knowledge. The lack of a common legal framework and targets impedes systematic data collection and knowledge development at EU level.

The discussion continued on the policy objectives that linked the problem analysis to the policy actions and resulted from the analysis of the soil policy inventory, the gap analysis and the replies to the first questionnaire. The potential overall scope and specific policy objectives for a possible new EU policy initiative were also presented in the questionnaire.

The 8th meeting of the EU expert group on soil protection took place on 4 April 2019 and discussed various policy developments relevant for the new policy framework, including the

Special Report of the European Court of Auditors on Desertification and Land Degradation in the EU, criticizing the lack of an adequate policy framework at EU level to tackle the problem. The experts continued also the discussion on the policy objectives of the future EU policy framework, on the basis of the replies to the questions and information sent earlier to the Member States.

The 9th meeting of the EU expert group on soil protection took place on 26 November 2019. The Commission presented the approach to meet the recommendations of the European Court of Auditors (ECA), notably that all ECA recommendations were accepted and would be addressed in the soil policy framework under development, and that the experts could help by sharing best practices from Member States in the context of the study on the implementation of soil and land-related SDGs in the EU.

The 10th meeting of the EU expert group on soil protection took place on 23 September 2020. The main focus of the discussion were the new policy developments linked to the EU Green Deal and notably the announced intention to adopt a new Soil Strategy in 2021. Its objectives were discussed, notably to stop soil and land degradation in line with the international commitments to reach land degradation neutrality, but also to contribute to a proposal for legally binding EU nature restoration targets in 2021 to restore degraded ecosystems.

The 11th meeting of the EU expert group on soil protection took place on 30 September 2021. The Commission presented the main building blocks and policy context of the new Soil Strategy, as well as the timing and process towards adoption. In general, the presentation was well received and several Member States explicitly congratulated the Commission with the presentation and approach. Member States especially appreciated the holistic, transversal and integrated view, the linkage with societal challenges and the positive framing of soil as part of the solution.

In terms of process the Member States were informed about the consultation documents related to the new Soil Strategy which were released by the Commission on 5 November 2020: the Roadmap, a general document which explains to the public the act of preparing a new strategy (what, why and how the Commission is going to take action), and the open online consultation to be launched in all EU official languages to give experts, citizens, stakeholders and any interested person the opportunity to comment on the initiative. The soil experts were regularly informed in writing of all relevant policy developments related to soil in the follow up of the EU Green Deal and about the publication of the roadmap and the online consultation.

The Commission asked through the CIRCABC online discussion forum to the Member States what the ten most urgent actions for soil policy were. The Commission presented the summarized inputs received from the Member States (AT, FR, NL, PL, and PT) and emphasized that further engagement, input and views of other Member States would be highly welcomed. The following specific points were discussed with the soil experts: significant progress on restoring degraded soils, defining the conditions for their good ecological status, introducing restoration objectives, development of a policy instrument to reach land degradation neutrality (SDG 15.3), increase the safe, sustainable and circular use of excavated soils, significant progress on improving the monitoring of soil quality, horizontal policy issues, significant progress in identification and remediation of contaminated soil sites,

efforts to reduce soil pollution, zero net land take by 2050, funding issues, global action, communication, awareness, engagement, literacy, and knowledge and research.

4.2. Dedicated workshops and conferences

The European Commission organized a **high level conference on "Land as a resource" on 19 June 2014** in Brussels¹⁶⁷, bringing together 340 participants from European institutions, national and regional authorities, research centres and stakeholders. This conference was a first step towards a new policy initiative on land and soil to ensure that EU land management is based on sustainable principles, responding to the political mandates of the 2011 Roadmap for Resource-Efficient Europe (COM(2011) 571) and the 7th Environment Action Programme (Decision No 1386/2013/EU).

A dedicated **EU Soil stakeholders' Conference was organised by the Commission on 5th December 2016** in Brussels¹⁶⁸. The objective of the conference was to present and discuss with stakeholders the inventory of soil-related legislation at EU and national level and gap analysis, as well as the first outcomes of the MAES Soil pilot¹⁶⁹, in order to prepare further policy developments. The conference consisted of two plenary sessions and four parallel working sessions. Keynote speakers and panellists were invited to share their views on the way forward for EU soil policy. The parallel working sessions were interactive, in small groups with a moderator and rapporteur for each group. The themes of the parallel sessions were horizontal (session I identifying challenges and opportunities for further policy development, session II considering the potential of ecosystem services approach) and thematic (session III on soil contamination, session IV on sustainable management of agriculture and forest soils).

A specific **conference on "Brownfield redevelopment in the EU"**¹⁷⁰ was organised on **5 April 2019** by the Commission together with the European Committee of the Regions, as a solution to limit urban sprawl, land take and soil sealing. Inspiring policies and good practices were presented by European, regional and local stakeholders, and the potential offered by EU funds were explored.

A **conference on "Soil and the SDGs: Challenges and need for action"**¹⁷¹ was organised by the Commission on **25 November 2019** at the start of the mandate of the new Commission to provide policy makers, experts and stakeholders the opportunity to discuss the priorities of the new Commission for soil and land, and to exchange knowledge and practises on the implementation of soil and land related Sustainable Development Goals in the EU. The conference was interactive with the some 200 participants and included two panel discussions: 'A growing sense of urgency for healthy soils', and 'The way forward'.

¹⁶⁷ "Land as a resource" Conference, 19 June 2014

https://ec.europa.eu/environment/land_use/pdf/final%20report%20conference.pdf

¹⁶⁸ Soil Stakeholders Conference, 5 December 2016 <https://www.ecologic.eu/1450>

¹⁶⁹ [Mapping and Assessment of Ecosystems and their Services - MAES \(europa.eu\)](https://ec.europa.eu/environment/nature/knowledge/ecosystem_assessment/index_en.htm)

https://ec.europa.eu/environment/nature/knowledge/ecosystem_assessment/index_en.htm

¹⁷⁰ [Brownfield redevelopment in the EU | European Commission](https://ec.europa.eu/info/events/brownfield-redevelopment-eu-2019-apr-05_en) https://ec.europa.eu/info/events/brownfield-redevelopment-eu-2019-apr-05_en

¹⁷¹ "Soil and the SDGs: challenges and need for action" Conference, 25 November 2019

https://ec.europa.eu/environment/soil/pdf/conference_report.pdf

Following the adoption of the EU Biodiversity Strategy to 2020, a dedicated **session on soil biodiversity was organised on 22 October 2020** by the Commission during **EU Green Week 2020** (Session 5 .3 It's Alive! Why Soil Is The Most Important Habitat)¹⁷², to offer a broad overview of the issues at stake, looking at areas where greater efforts are required to protect and restore soils in the EU. Indeed, healthy soils are key to achieve the objectives of the European Green Deal such as climate neutrality, zero pollution, sustainable food systems and a healthy and resilient environment.

During the **EU Green Week 2021 on 2 June 2021**, the Commission organised a **session “Dirty footprints on the magic carpet – the impacts of soil pollution on human health”**.¹⁷³ Speakers from the World Health Organization, Wageningen University and the Italian Institute for Health discussed the zero pollution ambition for soil and the link with human health. MEP Martin Hojsik presented the Resolution of the European Parliament on soil protection.

¹⁷² [EU Green Week 2020 - Session 5 .3 It's Alive! Why Soil Is The Most Important Habitat - YouTube video](https://www.youtube.com/watch?v=4_5_0Lp0qII)
https://www.youtube.com/watch?v=4_5_0Lp0qII

¹⁷³ [Dirty footprints on the magic carpet – the impacts of soil pollution on human health | EU Green Week 2021](https://www.eugreenweek.eu/virtual-conference/dirty-footprints-magic-carpet-impacts-soil-pollution-human-health)
<https://www.eugreenweek.eu/virtual-conference/dirty-footprints-magic-carpet-impacts-soil-pollution-human-health>