EUROPEAN

# POLICYBRIEF

## SOIL AS ENVIRONMENTAL AND CULTURAL HERITAGE AND THE IMPORTANCE OF SOIL PROTECTION.

MEDITERRANEAN MOUNTAINOUS LANDSCAPES
an historical approach to cultural
heritage based on traditional agrosystems
MEMOLA

This policy brief summarises recently developed perspectives on soils that have emerged from the findings of the **MEMOLA project**. The critical environmental dependency of soils is well-established yet to date soils have been undervalued and poorly recognised as cultural materials. MEMOLA has demonstrated that soils are an extensive cultural resource and form part of Europe's rich cultural heritage. This brief stresses the need for a comprehensive European policy for soil protection and management that recognises the complex nature of soil and seeks to promote an awareness of soils as having a dual inheritance that stems from both cultural and natural processes.

The Italian Soil Science Society (SISS) and the European Society for Soil Conservation (ESSC) collaborated in writing this policy brief and is supported by the UK Soil Association.

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## INTRODUCTION

**Soil-*a vital resource***

Soils support life in all its forms by playing a key role in all major earth cycles (Carbon, Nitrogen, Oxygen, Phosphorus, Sulphur and Water and Rock). Simply stated, it is Earth's life support system. Soils are not simply substrates composed on minerals and chemicals though. They are a living medium that is home to a myriad of microorganisms, fungi, animals and plants that are bound in system of co-dependency. Many soil deposits have developed over centuries and millennia and under highly specific local conditions which has in turn produced diverse soil ecosystems that are specific to particular regions.

Human impact on soil systems has increased with the gradual intensification of agriculture since the start of the Holocene (~10,000BP). Soils have not only been used and modified to support the shift to agriculture, but also as resources for building (adobe, piso and cob), material culture (clays for ceramics, pigments, mordants), and even as medicines (poultices, skin protection and more recently alternatives to antibiotics and existing immune suppressants –i.e Rapamycin). The long-established historic relationships that traditional communities have established with their environments has furnished us with a rich soil diversity that is the result of the complex interplay of specific regional environmental factors and culturally specific soil and land management strategies. MEMOLA has worked intensively to document the extent and character of this

diversity and to establish the cultural, historic and environmental dependencies that have developed in one specific European landscape type, namely, Mediterranean Mountainous zones.


FIGURE 1 - Soils deliver ecosystem services that enable life on Earth (From FAO, 2015)

**In recognising soil as** the basis for plant growth and agriculture, and as a reservoir or information about specific cultural and environmental relations, MEMOLA has sought to understand both the contemporary and historic maintenance of both natural and managed landscapes. The culturally specific management of soil has not only given rise to distinct floral agricultural traditions but has in turn developed regionally distinct faunal dependencies that now constitutes Europe's diverse livestock heritage (Biodiversity Brief 10—ref at https://ec.europa.eu/europeaid/sites/devco/files/publication-biodiversity-in-development-brief-10-2001_en.pdf). Soils are the foundation to culturally distinctive plants and animals that together give rise to EU *geographical indications* (see WIPO952 SCT/3/6), distinctive signs that signify regional quality and reputation and collectively define Europe in terms of its distinctive agricultural and gastronomic character. The effective management and maintenance of these important resources is therefore central to the sustainability of a diverse European identity that in many cases has been established over centuries.

**Main soil functions** are:

- Food and biomass production
- Environmental Interactions: storage, filtering and transformation
- Biological habitat and gene pool
- Source of raw materials
- Support platform for man-made structures
- Archival record of environmental and historic processes

**Soils as cultural heritage**

Soils have been a vital part of the earth for millions of years and for several thousand years have supported the developments of humankind. Soils may be thought of as being "cultural" by virtue of the evidence they bear of past human activities both in terms of their composition, the specific types of soil deposit, and the material culture and architecture often held within the soil matrix. These latter cultural deposits are well-recognised by archaeologists and cultural resource managers and existing policies at both National and European levels are in place to offer guidance on the effective management of these explicitly cultural resources.

However, MEMOLA has highlighted how the continued fertility of many soils bears testimony to the long-established and on-going maintenance of soils by traditional communities. As such, large expanses, if not entire landscapes, are constituted by human-influenced soils as the result of manuring, irrigation, land-contouring, settlement, craft activities, and agricultural practices. The result is that these soils are complex mediums that support specific ecosystems that have been established through enduring yet changing human-

environmental relationships. A landscape feature that unites the study regions within the MEMOLA project is the use of terracing, often in connection with irrigation systems.

Terracing represents a major energy investment in landscape management and can be thought of as an architectural device for soil containment and management. They are characteristic features of many Mediterranean landscapes and have played a central role in maintaining a culturally distinct and recognisable landform. They have also created the conditions under which particular soil types have developed and in turn permitted distinct modes of agriculture for both plants and animals. In addition to pursing conventional archaeological methods to establish the conditions that allowed certain types of human-environment relations to develop, MEMOLA has also made great effort to progress a range of methods and approaches that aim to establish a more detailed understanding of the cultural character of soils.

In and around settlements and for agricultural soils, humans have been the principal factor of soil formation, creating or deeply modifying soils for purposes such as those outlined earlier. MEMOLA has recognised that this modification may take place physically, chemically (elemental and molecular), and biologically. As such MEMOLA has developed innovative approaches that have characterised anthropogenic soils chemically using High Definition Chemical analysis using HHpXRF and through the extraction of biomolecules, including DNA, and through pedological characterisation. These novel methods have allowed MEMOLA to establish empirical data that expands our recognition of soils as cultural materials and to identify distinct anthropogenic signatures within the soil matrix.

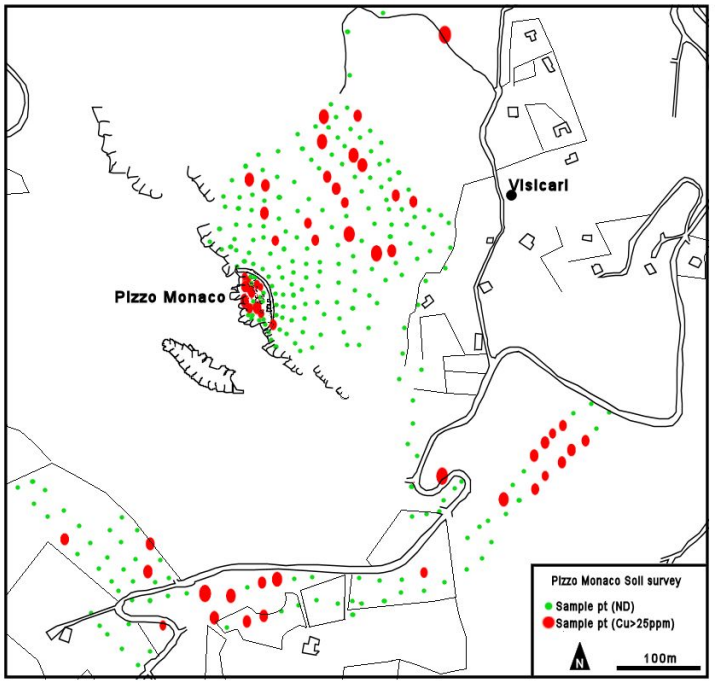


FIGURE 2- Map showing geochemical variability (Cu) in soil around the fortified granary of Pizzo Monaco. Soil copper varied from below detection limits up to structured anomalies of approximately 60ppm). The location of the granary and associated settlement (now agricultural area) are clearly marked by elevated levels of soil copper.

In recognising soils as cultural materials they must be acknowledged as a significant part of Europe's Cultural Heritage, indeed, we might say they are the foundation material from which so much cultural diversity flows. While it is timely to acknowledge soils as part of our Cultural Heritage it is important to acknowledge that soils are also quite different from conventional cultural resources. Unlike architectural monuments or the material culture that sits in the cabinets of our great museums, soils remain in the landscape as a living medium. More than most materials they exhibit a dual inheritance from both cultural and natural processes yet they rely on the sustained practice and "traditional ecological knowledge" (Berkes 1999) of local communities to maintain their regionally specific character. Rapid changes in economics and demography have fragmented and disrupted many of the communities that have sustained these vital cultural materials for centuries. Recognising the cultural value of these resources is then the first step in a complex challenge to establish how these fundamental and vital resources might be suitably managed so that they and the relations they support can thrive.

FIGURE 3 & 4 - Examples of pottery fragments and seeds discovered in the soil during the MEMOLA archaeological excavations.

**Why do soils need protection?**

The rate of soil development is extremely slow, certainly in terms of human timescale with many extant soils having developed over centuries or millennia. This coupled with the relatively shallow deposits of soils emphasises the finite nature of soil resources (0.00003% of the total mass of earth). Unfortunately, the ubiquity of soil means that this precious and finite resource is only recognised to be in peril once significant degradation is well under way.

Soil functions are threatened globally by a wide range of processes, and in Europe, a number of threats have been identified: **soil erosion (by water and wind), decline in soil organic matter, compaction, sealing, contamination, salinization, desertification, acidification, flooding and landslides, and decline in biodiversity**. Many other soil degradation processes even less visible and less known than those mentioned above are affecting the European soil resources, among them, the **loss of the cultural value of soil**, which is often accompanied by the decrease in pedodiversity, and the loss of traditional landscapes. The direct annual costs of the main soil degradation processes are estimated to be over **38,000,000,000 € per year in Europe** as a whole (European Commission, 2006). Unfavourable climate quality and climate changes, unsustainable intensification of agricultural activities, and the pattern of population growth are the processes considered to play the most important role in determining vulnerability to soil and land degradation in Europe, especially in Mediterranean areas.

**European soil policy: from missed strategies to new opportunities for soil protection**

In 2002, the European Commission presented its approach to soil protection in a communication that was titled "**Towards a Thematic Strategy on Soil Protection**". The main threats that lead to soil degradation, earlier mentioned, were taken into account. Some soil degradation processes such as floods and landslides were later addressed in a separate Directive on flood risk management prevention (2007/60/EC) and have therefore been excluded from the Thematic Strategy on Soil Protection. The Commission stressed the importance of integrating soil aspects into other directives, but also indicated the need for legislation that focuses exclusively on soil. As an interim measure in European environmental legislation and to provide a more holistic approach to soil protection in the EU, the European Commission presented a new policy in 2006 that was titled "**Thematic Strategy for Soil Protection**" which included a proposal for a Soil Framework Directive. The proposal had been pending since 2006 and was finally withdrawn in May 2014.

The EU policy still recognises that the maintenance of soil resources plays a vital role. The **Seventh Environment Action Programme**, which entered into force on 17 January 2014, recognises that soil degradation is a serious challenge. It provides that by 2020 land is managed sustainably in the Union, soil is adequately protected and the remediation of contaminated sites is well underway. It also commits the EU and its Member States to increasing efforts to reduce soil erosion, increase soil organic matter, prevent loss of biodiversity and remediate contaminated sites. However all these soil threats were covered in existing legislation that addresses soil functions individually in various directives thus failing to account for the multi-functionality of soils. Soil degradation has not been halted in Europe, suggesting that existing policies are not sufficient for maintaining soil functions. Therefore, there is an urgent **need for a new and comprehensive soil conservation policy at the European level**.

## Evidence and Analysis

**Soil as the basis of cultural landscapes**

Since soil is a fundamental resource playing a key role in ecosystems, it must be considered an essential element in any landscape, indeed, soil alongside rock and water, is the major material dimension of any landscape. While rock is hard and durable, and water fluid and transitory, soil represents the most plastic and dynamic aspect of the landscape. Distinctive landscapes are therefore most usually formed from particular soil modelling processes. When soils are subjected to human impact they assume the value of cultural landscape. The reworking of soils is the most tangible means through which human activity is worked into the landscape, from field boundaries, clearances, pathways and settlements the accumulation of land forming processes materialises distinctive cultural landscapes. A central technique in the repertoire of archaeological methods is the ability to "read" the successive traces of human activity across a landscape. It is such features that provide time-depth to a location and communicate a sense of place.

MEMOLA's landscape and soil survey findings, integrated with cultural, archaeological, hydrological and vegetation studies, have shown that behind the complexity of cultural landscapes there are high levels of soil diversity (i.e. pedodiversity) both among and within regions demonstrating great spatial variability of soil properties. This variability is not random but rather structured by the activities of past communities; as such the pedodiversity recognised by MEMOLA's work can be seen as the identification of specific cultural signatures held in the soil of local landscapes. Thus, **pedodiversity is part of our natural and cultural (total environment) heritage**.

However, the pedosphere is subject to many risks and only in recent years has there been a growing recognition that conservation and effective management are desirable as part of our biological, geological and cultural heritage. While recognising soils as a record of past climatic and environmental information, this brief highlights the ability to unite paleoenvironmental data with the study of traditional agricultural practices in an integrated methodology. Integration of these datasets allows for the understanding of entire landscapes from a relational perspective that reveals the response and impact of historic communities on landscapes in light of environmental change. As such cultural landscapes can be recognised as a valuable source of information about human-environment interaction and contribute to on-going and emerging research concerning global change. Much of the data employed by the Global Change Research Community results from Polar or Oceanic monitoring well away from centres of human settlement.

In contrast the datasets emerging from the MEMOLA project offer detailed and contextual landscape histories that document changing subsistence strategies under historical processes that include climate change and wide-scale migration, both aspects that resonate with the challenges that we face today. From this perspective cultural landscapes should be recognised as holding evidence that can inform us about the strategies employed, both successful and failed, by communities in the face of a changing world.

FIGURE 5 & 6 - Mountainous landscape in Vjosa Valley(Albania) and diversity of soils surveyed in the area.

**Mediterranean mountainous terraces: historic and contemporary usage**

A common historical cultural landscape found in the MEMOLA study areas is composed of terraced agro-ecosystems. In agriculture, terracing slopes have played an important role in land use and space organization since antiquity. Maintained generation after generation, this mode of landscape management and the hydraulic structures associated with it have shown their utility over time in transforming challenging slopes in to productive land for sustainable agriculture. Agricultural communities have invested great energy in modifying the morphology of the Mediterranean mountain landscape and shaped it into an anthropogenic yet ecologically sustainable environment, with alternating natural and cultivated areas.

This mosaic of microenvironments has promoted ecological balance and develops high levels of biological diversity. The main objectives in terracing slopes were to protect the soil from erosion, to increase soil depth for rainwater storage, and to facilitate farm operations thus leading to a more productive and stable agriculture. Terracing provides the conditions that allow soils to be modified especially in terms of their fertility. The control of erosion encourages longer term investment in manuring and associated practices to maintain fertile and productive soils supporting increasingly diverse crops.

FIGURE 7 - Terraced slopes in Sierra Nevada (Spain).

Evidences from the MEMOLA soil surveys have shown the importance of the environmental function that these terraces play in slope stability through erosion control and rainfall management, limiting landslides, optimizing water resource use for irrigation, increasing soil quality and enhancing soil ecosystem functions. In contrast, problems come with **terrace abandonment**: abandonment of cultivation and its soil conservation practices have led to many cases of erosion and have given rise to soil degradation processes.

Terracing is a highly visible form of agriculture and while the maintenance of soil conditions was no doubt at the forefront of agriculturalists concerns the effect of landform modification was to create landscapes that were culturally recognisable and confirmed the active presence of specific communities. Terracing therefore testified to their investment in their locale and in turn the productivity they controlled. As such terraces act as more than devices to maintain fertility and productivity of the land, rather they simultaneously become cultural markers of a community's commitment to a place. This highlights other ecological impacts, concerning the abandonment of terraced landscapes, namely the loss of: i) an important architectural and cultural heritage, in most cases more than four hundred years old and ii) the multifunctional character of the Mediterranean landscape, considering at the same level agricultural practices, environmental safeguard and cultural heritage.

## POLICY IMPLICATIONS AND RECOMMENDATIONS

There is currently no legislation at the European level that focuses exclusively on soil conservation management. Many soil threats, such as erosion, decline in organic matter, loss of biodiversity and contamination, have been addressed in the diverse, existing legislation, but only a few directives provided targets for reducing the soil threats. Moreover there are very few directives for improving soil functions. Probably, addressing soil functions individually in various directives fails to account for the multi-functionality of soil. MEMOLA research findings suggest that existing policies are not sufficient for limiting soil risks and maintaining adequate soil function.

The scientific results generated by the MEMOLA project suggest the following recommendations should be considered;

- Common European soil conservation policy legislation should be consolidated in the form of a Soil Framework Directive.

- Weak points of the previous political course in providing common soil conservation legislation should be taken into account to prevent possible new failures. Among these: i) imprecise quantification of expected costs and administrative burdens; ii) lack of clarity regarding the value that the new policy could add to existing EU legislation; iii) incomplete Impact Assessment in support of the Directive providing little evidence of the impacts of soil threats; iv) speculative estimates of the costs of soil degradation and soil threats at the European level and v) incorrect assessment and quantification of direct and indirect benefits that a Directive on soil protection would provide to European citizens.

- Policy legislation should be developed alongside methods for attributing value to the non-economic functions of soil. Emerging policies should therefore be able to demonstrate how they connect with metrics that attribute costs and values to the environment from a holistic perspective

- It is very important that **policies must address soil threats and functions directly** to ensure that the threats and functions are targeted by new sustainable soil management practices. Sustainable land use is often based on the multi-functionality of soil and is intended to maintain all soil functions.

- A firm recognition of soils as a discrete class of cultural materials that provide the conditions for maintaining and developing distinct European traditions (i.e. Geographic indicators and regional specialities). Soils should be considered as a dynamic element of cultural landscapes that furnishes Europe with a unique character and provides the conditions for regional distinctiveness. Policy legislation should consider historical cultural landscapes as part of common heritage while recognising soil as a living medium that requires special conditions of sustainable management. Demanding actions for soil protection and sustainable soil uses at national, regional or local level, tailored for the specificity of the natural and cultural/human features of the landscape (Council of Europe Faro Convention 2005). This recognition should be also incorporated in the national and regional policies on which land-use plans are based to ensure adequate protection.

- It is also necessary to promote actions to increase the awareness of economical and not-economical benefits for human well-being produced by conserving and protecting soils. The value should be established following the concepts of "functioning ecosystem" (Naeem et al. 1995) and the cultural elements, including "traditional ecological knowledge" (Berkes 1999), which provide an integrated framework to assess a landscape by its supported diversity including historically aware pedodiversity.

## RESEARCH PARAMETERS

The MEMOLA project analyses the cultural landscapes of Mediterranean mountainous areas, taking as a central axis the diachronic study of the relationship between human populations and natural resources, in particular soil and water. To understand the landscape it is necessary to investigate the historical processes that have led to a specific relationship with the environment, aimed at the extraction and use of resources in certain social contexts. These uses have deeply moulded the environmental context, generating not only its forms, but also the cultures that made it possible, its management and maintenance until today.

The implementation of a multidisciplinary approach (widening the range of specialists involved in cultural heritage study to agronomist, hydrologists, botanists, pedologists and hydro-geologists) allows the proper hybridization between the human and environmental sciences. The project focuses on the study of four Mediterranean European mountainous landscapes: Sierra Nevada (Spain), Vjosa Valley (Albania), Trapani Mountains and Colli Euganei (Italy), in the period between Late Antiquity and present time.

Under the context of this Policy Brief, the following specific objectives included within the Work Packages should be noted:

- Study and evaluation of soils in cultural landscapes
- Interpreting and mapping past landscapes
- Mapping current landscapes
- Provide support for the decision making process in land evaluation and conserving and/or planning new sustainable landscapes having strong economic and social impact.
- Promotion and development of new study methodologies for cultural landscapes that will be fuelled by an interdisciplinary research team, combining the principles and methods of archaeology with modern hydraulic and soil analysis techniques
- Analysis of the productivity and resource (water and soil) use efficiency in the study areas
- Analysis of the ecosystem services associated with the agro-ecosystems in the Mediterranean mountainous landscapes. Trace an historical trajectory of agro-ecosystems leading to the creation of a “High Nature Value farmland” (Parachini et al 2006).
- Proposals for improving resources-use efficiency and conservation of cultural landscapes associated with traditional agricultural and livestock activities, in order to contribute to a sustainable development of the study areas from a social and environmental point of view, while enhancing their heritage and natural values.

## PROJECT IDENTITY

**PROJECT NAME**

MEditerranean MOntainous LAndscapes: an historical approach to cultural heritage based on traditional agrosystems (MEMOLA).

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**DURATION**

January 2014 – December 2017 (48 months).

**BUDGET**

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**WEBSITE**

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**NOTES**

The following scientific societies have collaborated and approved this policy brief:

Italian Soil Science Society – SISS (http://www.scienzadelsuolo.org)

European Soil Society for Soil Conservation – ESSC (www.soilconservation.eu)

The Soil Association (www.soilassociation.org)