

CULTURECOVERY – THE BALATON ECOMUSEUM  
Conference and Training Programme  
Hotel Yacht

**SOIL CONSERVATION AND REMEDIATION  
AS A PREREQUISITE FOR CONSERVATION  
OF AGRICULTURAL HERITAGE AND  
DEVELOPMENT OF HEALTHY AGRO-  
ECOSYSTEMS**

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UNIVERSITÀ  
DEGLI STUDI  
DI PALERMO

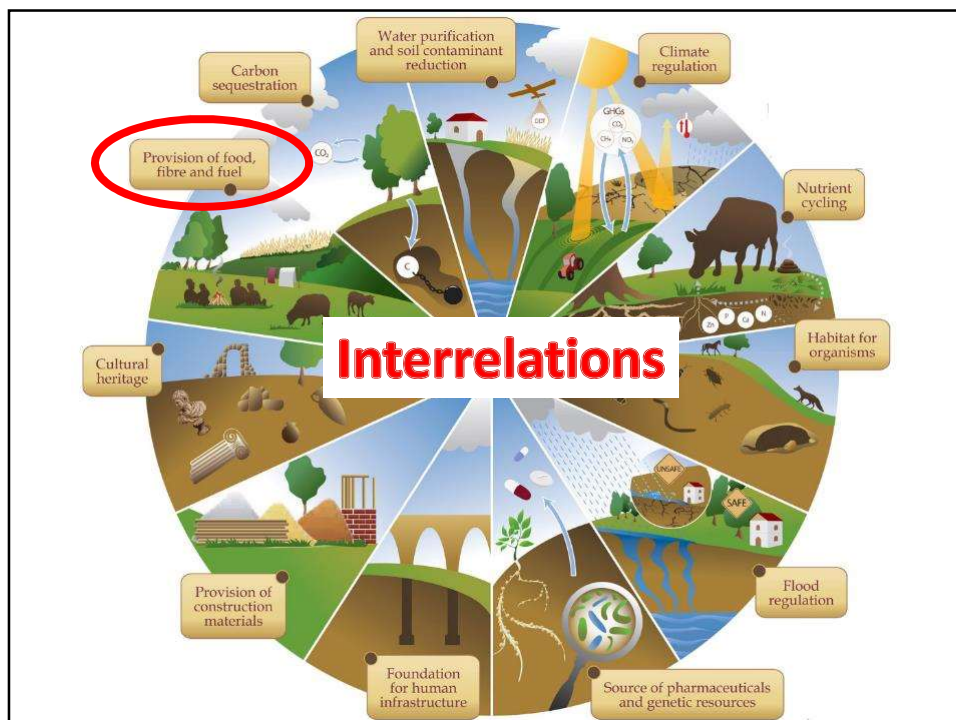


## Soil is a natural body



## Soil is non-renewable resource

*meaning its loss and degradation is not recoverable within a human lifespan*









## **Some key elements**

- **Healthy soils are the basis for healthy food production.**
- **Soils are the foundation for vegetation which is cultivated or managed for feed.**
- **Soil is a non-renewable resource; its preservation is essential for food security and our sustainable future.**

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.

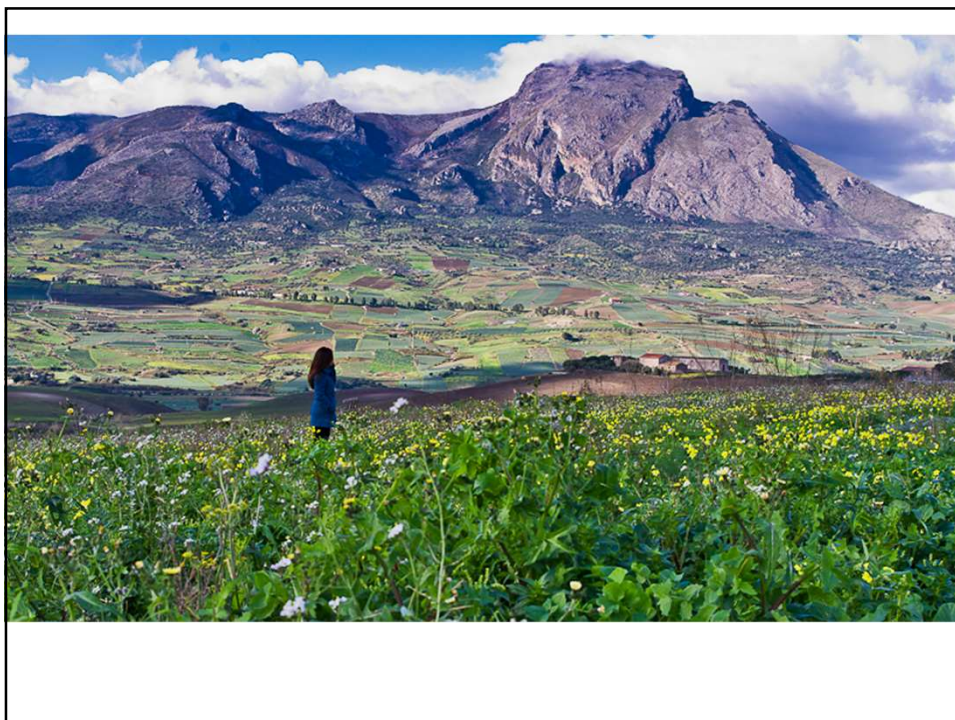


While rock is hard and durable, and water fluid and transitory, soil represents the most plastic and dynamic aspect of the landscape. Distinctive landscapes are therefore most usually formed from particular soil modelling processes.

**When soils are subjected to human impact  
they assume the value of cultural  
landscape**











**Soils have been a vital part of the earth for millions of years and for several thousand years have supported the developments of humankind.**

## **Soil Use**

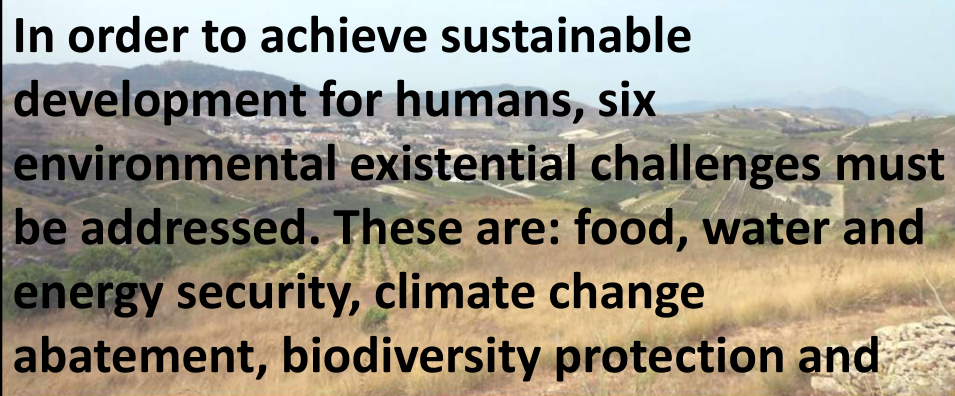


**Soil is a resource having finite nature  
(0.00003% of the total mass of earth)**

The rate of soil development is extremely slow, certainly in terms of human timescale

(centuries or millennia)

## **Sustainable Soil Use**



**In order to achieve sustainable development for humans, six environmental existential challenges must be addressed. These are: food, water and energy security, climate change abatement, biodiversity protection and human health.**

**Soil plays a pivotal role in each of these:  
for example,**

- soils contain more than twice as much carbon as the atmosphere;
- 98% of the world's food comes from agricultural soils;
- and over 98% of terrestrial biodiversity is found within soil.

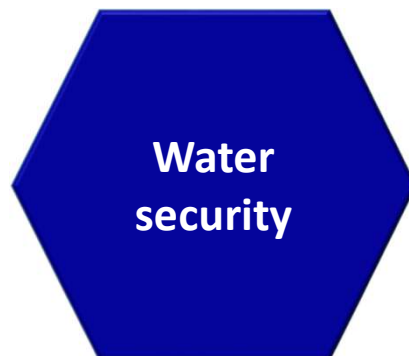
## **Global Existential Challenges**







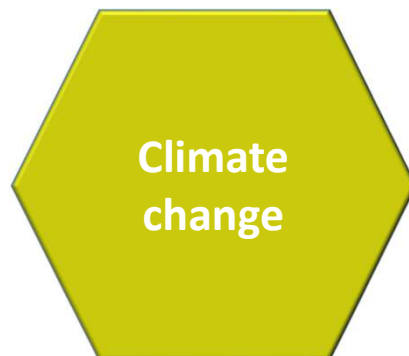
- **The biggest challenge?**
- **9 billion+ by 2050**
- **Soil-limited - space, appropriate soil, degradation**



- **A fast-growing challenge?**
- **Agriculture uses ~70% fresh water**
- **Soil can store (30,000 km<sup>3</sup>) ~2% but much of agricultural use goes through soil**



- **A fading challenge perhaps?**
- **Agriculture via soil can produce renewable energy**
- **Solution of one global challenge can compromise others**



- **Need a sustainable solution**
- **Soil can mitigate greenhouse gases**
- **Soil stores twice carbon (2700Pg) of atmosphere (780Pg) and biomass combined (575Pg) but has been dropping**
- **Soil is a buffer against extreme climate events**





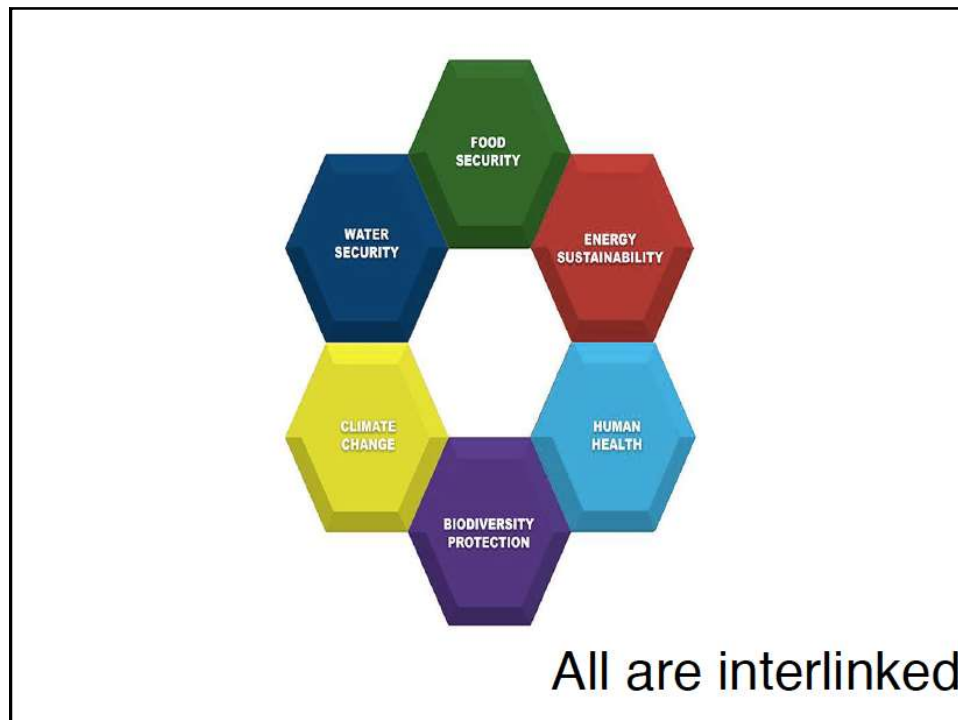
## Human health

- **Improve left expectancy and quality of life**
- **Nutrition - link to human nutrition largely trace elements**
- **Disease prevention - Soil recycling services**

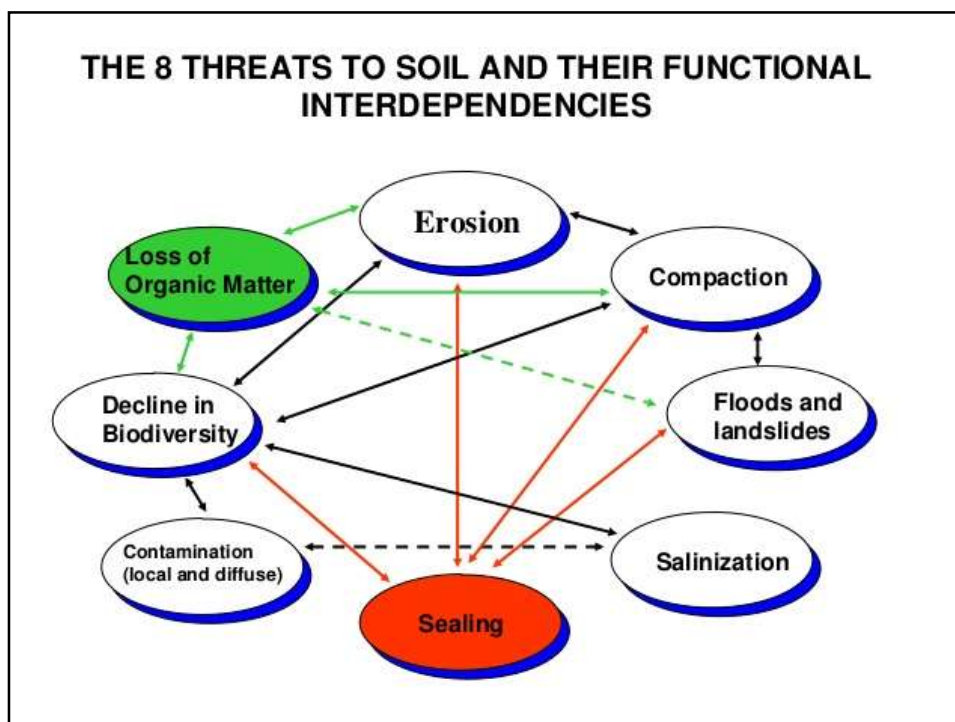


## Biodiversity protection

- **Future options and resilience**
- **25+% of biodiversity in soil**
- **Soil is the refugia ...**
- **How much undiscovered biodiversity has been lost already?**







**Soil erosion**

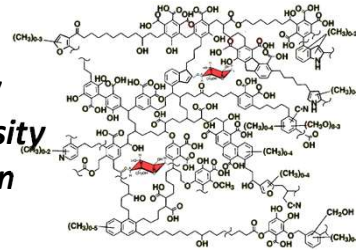






**Organic matter** is the most active and vital component of the soil because of its role in the chemical, physical and biological processes. Its main functions in soil concern:

- *nutrient supplying*
- *pH buffering*
- *increasing water-holding capacity*
- *improving soil structure and porosity*
- *limiting of erosion and compaction*
- *reducing surface crusting*
- *degrading and filtering pollutants.*

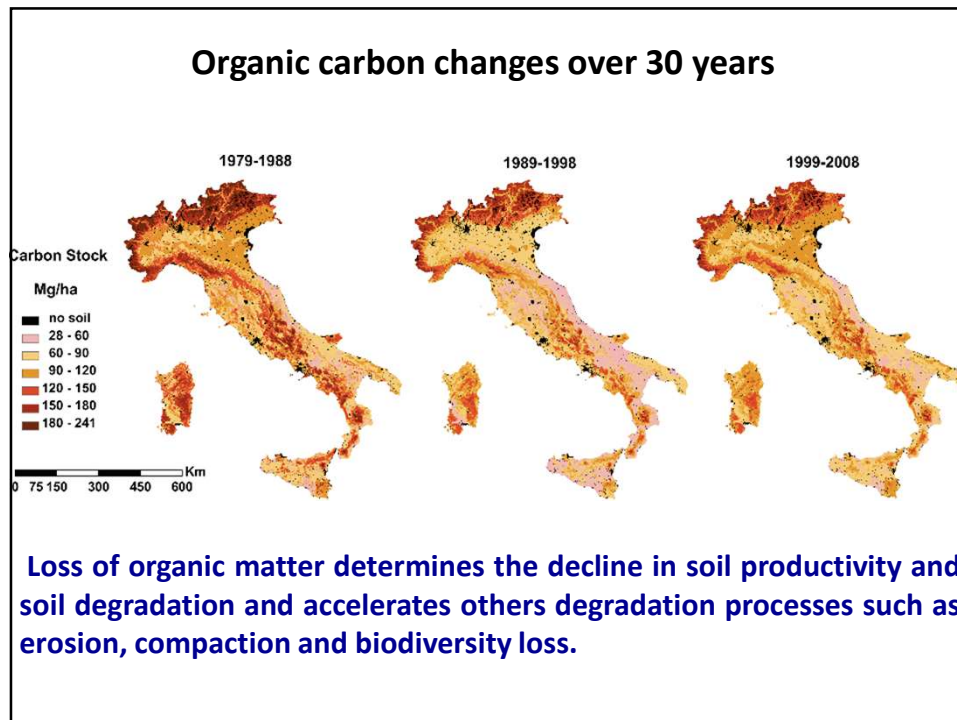


Nevertheless soils have been recognized as one of the best planetary systems for carbon sequestration for its high sink capacity (more than half of the global capacity) and for its high stability of some organic matter components.

The decline in the content and stock and/or quality of organic matter represents a serious soil threat causing a deterioration or loss of one or more important soil functions

To limit these effects, many practices are available and have been adopted:

- reincorporation of straw
- applying of farmyard manures and organic fertilizers
- cover crops
- crop rotations
- adopting minimum or no tillage systems
- returning to natural pastures or forest where possible



**Soil biodiversity** is a general term used to describe the variety of life below ground. The concept is conventionally used in a genetic sense and denotes the number of distinct species (richness) in a system and their proportional abundance (evenness), but may be extended to encompass phenotypic, functional, structural or trophic diversity.

On a microbial scale, the total below-ground biomass generally equals or exceeds the above-ground biomass

Agricultural soil usually may contains about **3,000 kg** of living biomass (fresh weight) per hectare, (**55 and 98%** of the Earth's total biodiversity is in the soil).

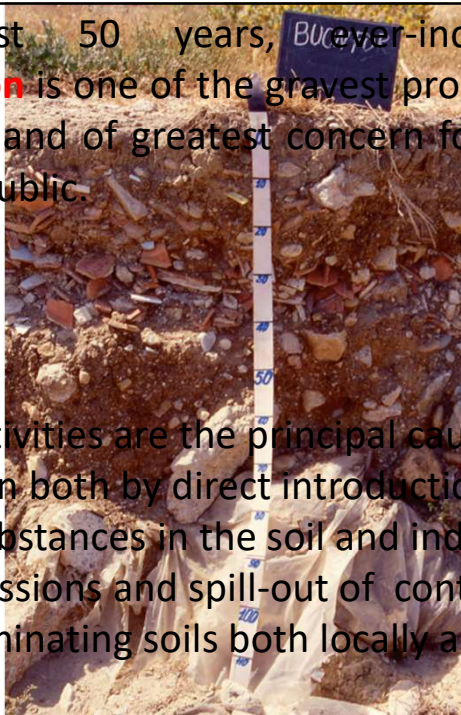
Many of the functions performed by soil microorganisms can provide essential services to human society: agricultural production and food processing depend heavily on this **“hidden” biodiversity**, and plants and animals cannot grow optimally without them.

**Microorganisms are primary agents of:**

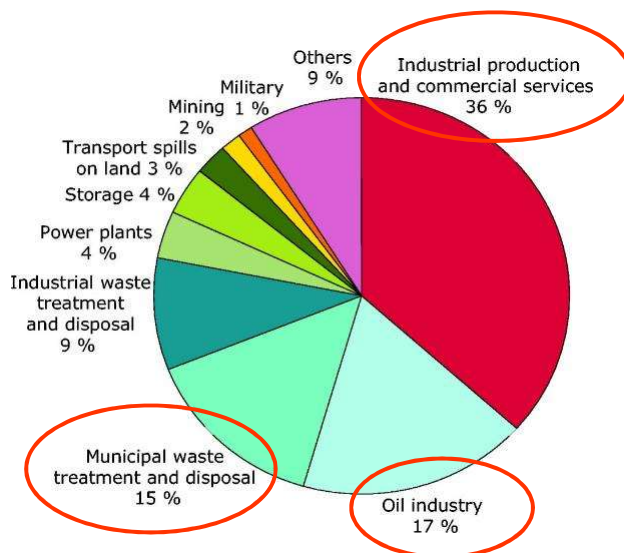
- *nutrient recycling*
- *greenhouse gas emission mitigation*
- *soil structure*
- *nutrient acquisition by plants*
- *providing primary metabolites that act as mediators for the production of commodities and fine chemicals used in agriculture and play a key role in other biotechnological applications, involving bioremediation of polluted sites o soil restoration.*

In the last 50 years, **Bucuresti** ever-increasing **soil contamination** is one of the gravest problems existing on the earth and of greatest concern for science and the general public.

Industrial activities are the principal cause of soil contamination both by direct introduction of xenobiotic substances in the soil and indirectly by fallout of emissions and spill-out of contaminated water, contaminating soils both locally and diffusely.



## Soil Pollution



39

**Technogenic  
Soils  
=  
Soil wasting**





**Sometimes  
urban wastes  
are buried  
(?)**



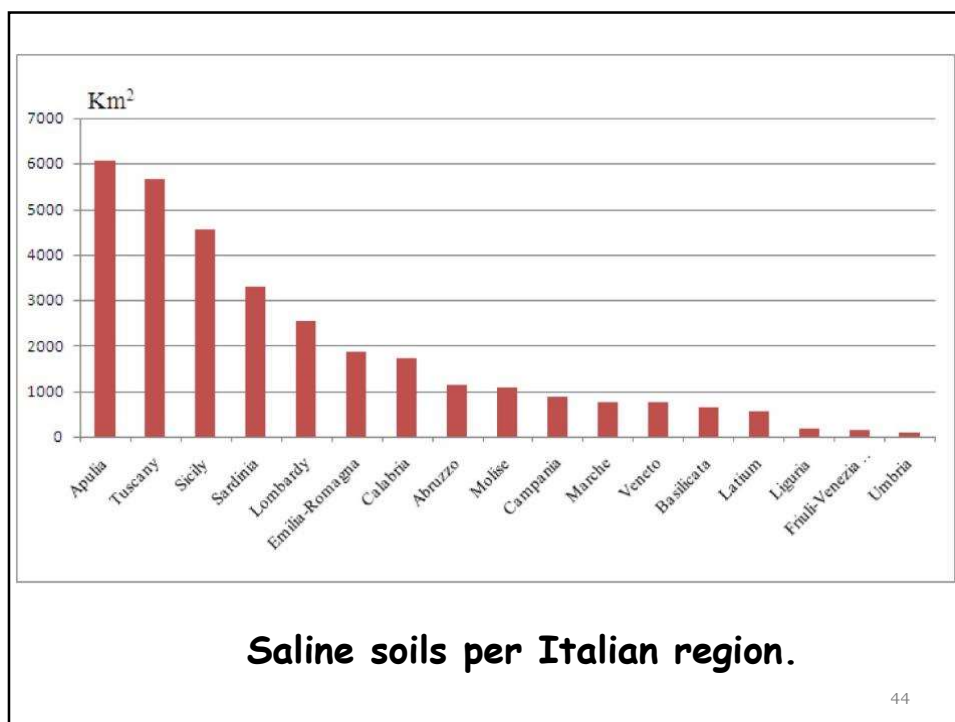
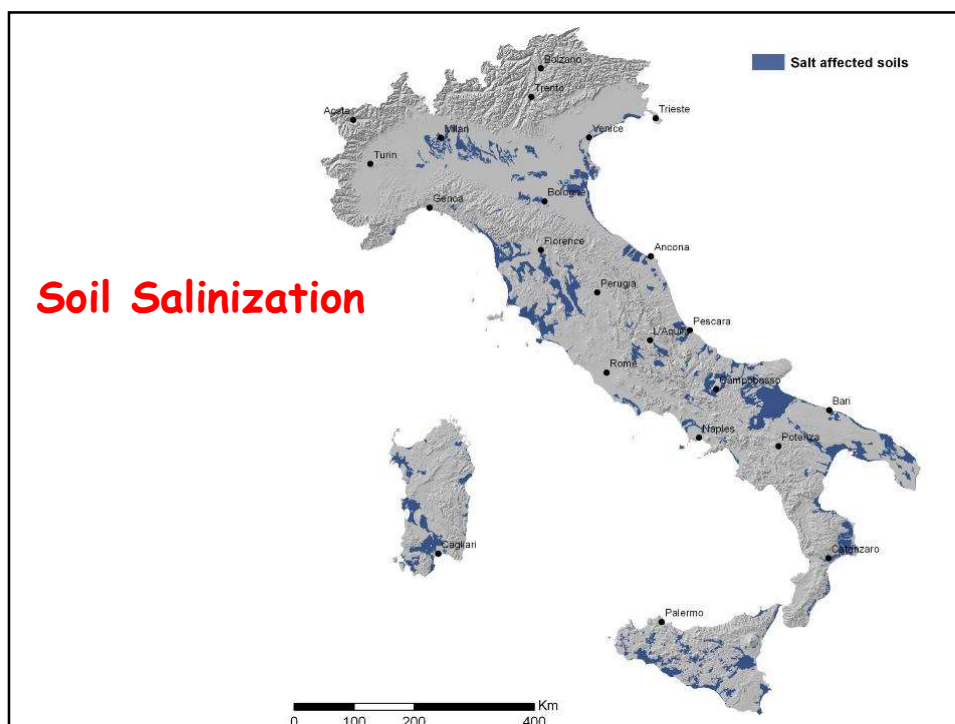
**The most prominent group of organic contaminants are:**

- Hydrocarbons
- polynuclear aromatic hydrocarbons (PAHs)
- polychlorinated biphenyls (PCBs)
- chlorinated aromatic compounds
- dioxins and dioxin-like compounds
- detergents and pesticides

**Inorganic contaminants are:**

- Nitrates
- phosphates and heavy metals (such as cadmium, chromium and lead)
- inorganic acids
- radionuclides (radioactive substances)









### Soil Sealing







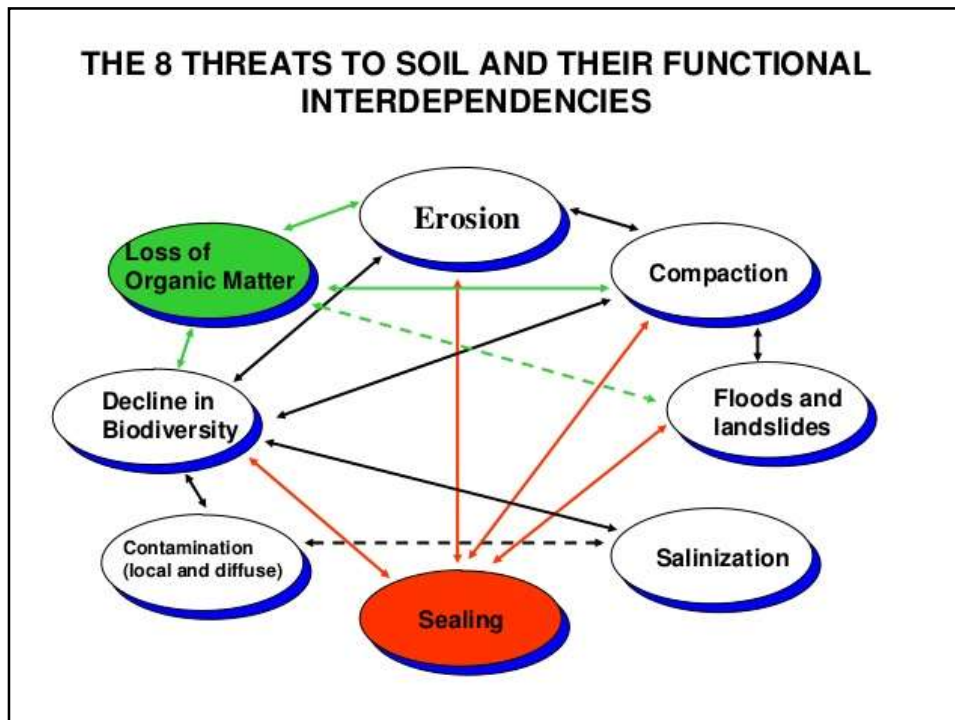






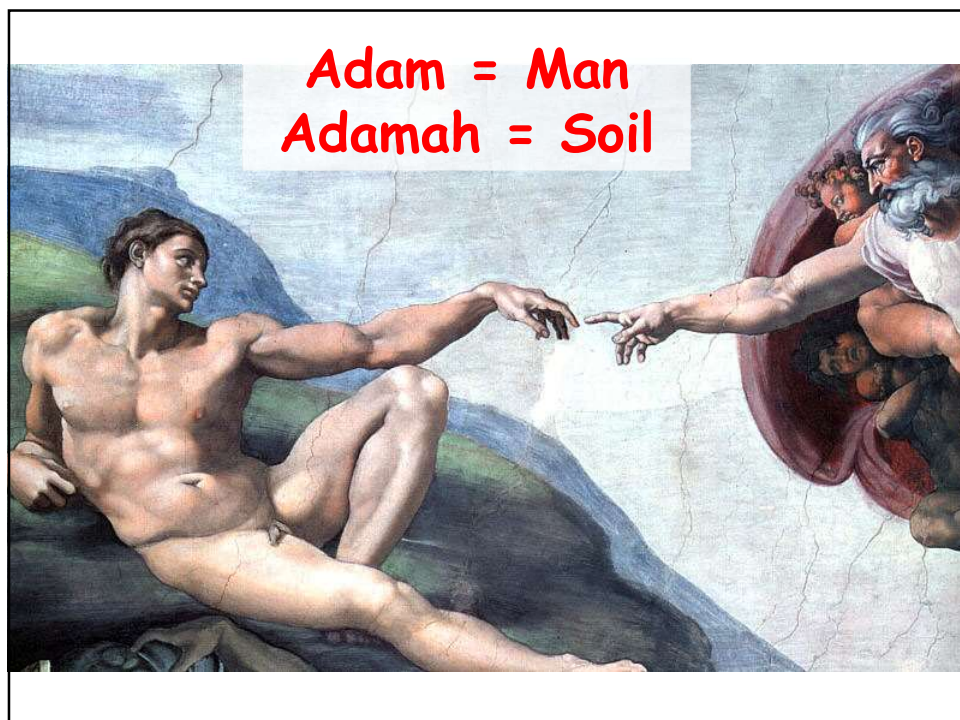
Soil degradation processes are interlinked and often triggering in a fast-acting chain reaction.....





**Wich is the most dangerous  
degradation process?**









## Environmental Emergency

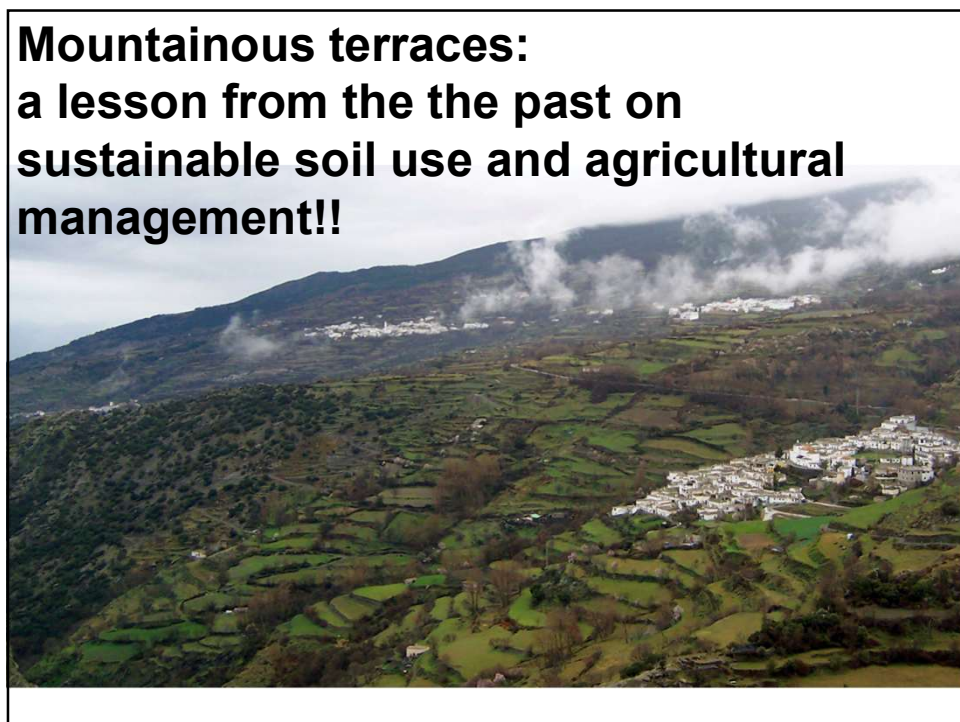
57



## Environmental Emergency

58

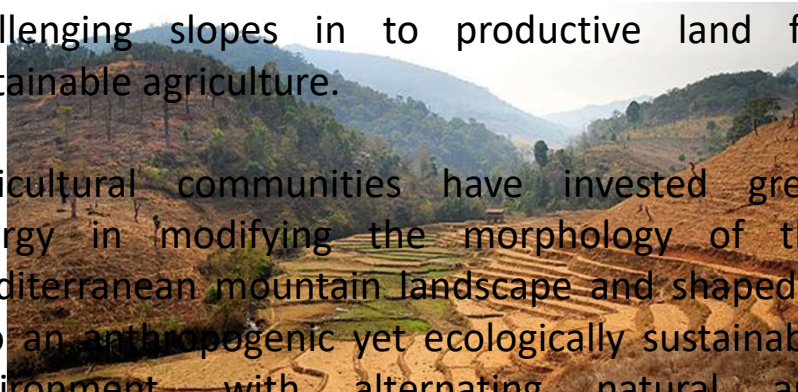






Maintained generation after generation, have shown their utility over time in transforming challenging slopes in to productive land for sustainable agriculture.

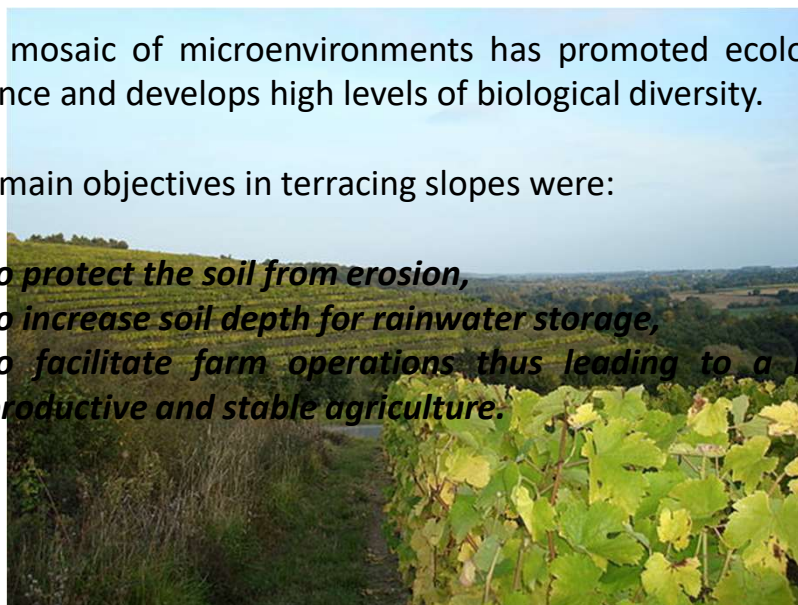
Agricultural communities have invested great energy in modifying the morphology of the Mediterranean mountain landscape and shaped it into an anthropogenic yet ecologically sustainable environment, with alternating natural and cultivated areas.



This mosaic of microenvironments has promoted ecological balance and develops high levels of biological diversity.

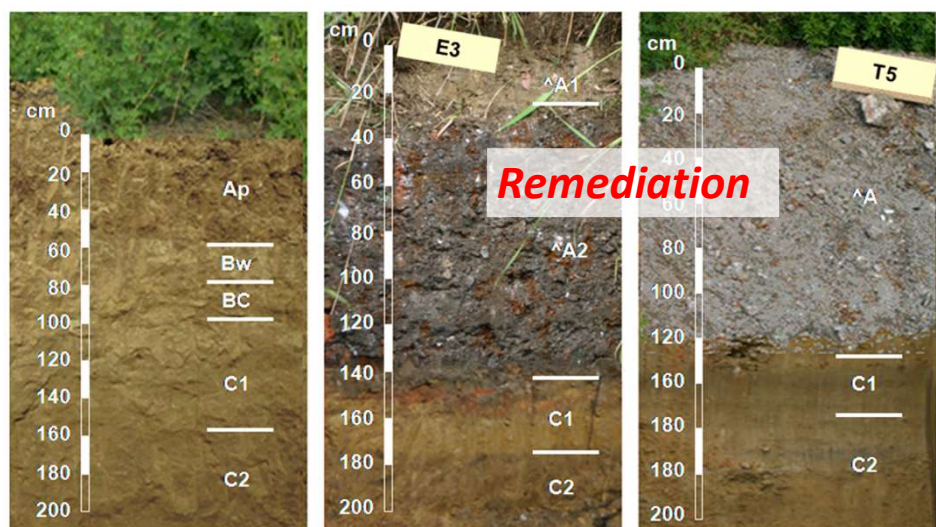
The main objectives in terracing slopes were:

- ***to protect the soil from erosion,***
- ***to increase soil depth for rainwater storage,***
- ***to facilitate farm operations thus leading to a more productive and stable agriculture.***





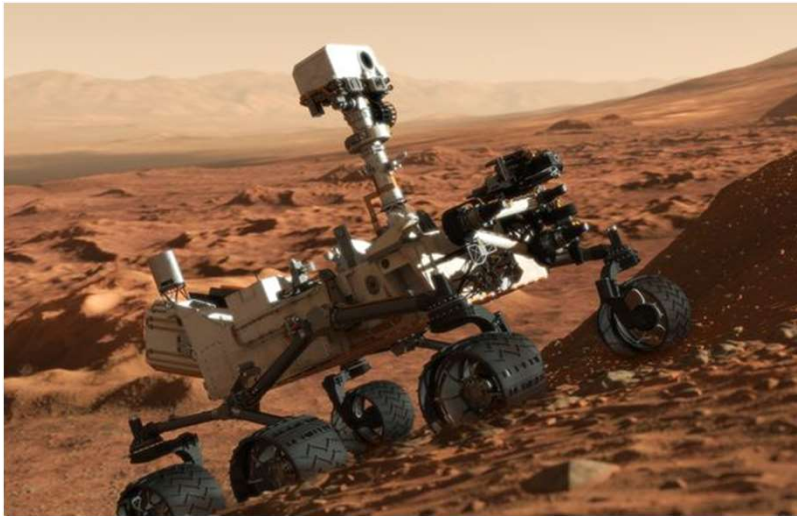
## *New techniques of soil remediation*



**Fluvic Cambisol (siltic)**

**Spolic Technosol (ecotoxic)**

**Spolic Technosol (calcaric, eutric)**



**NASA's Curiosity rover explores Mars' soils**

67



Philae separating from Rosetta and descending to the surface of comet 67P/Churyumov-Gerasimenko in November 2014

68



We know more about  
the movement of  
celestial bodies than  
about the soil  
underfoot.

Leonardo Da Vinci

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*The Nation that destroys its  
soil  
destroys itself.*

Franklin D. Roosevelt

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