Conférence Parmenides IX – GID-CIHEAM – Bari – octobre 2021
Gestion durable des bassins versants méditerranéens face aux impacts des changements sociétaux et climatiques

Pandi Zdruli

Indicators of soil quality

Summary

The European Union has set the ambition to become the first climate-neutral continent by 2050 thanks to the implementation of the European Green Deal objectives. To reach this target, the European Commission has prepared a comprehensive package of measures in the context of the Biodiversity Strategy 2030, the Farm to Fork and the European Climate Law that include concrete action to protect and conserve EU soils. The Farm to Fork strategy addresses soil pollution with 50 % reduction in use of chemical pesticides by 2030 and aims 20% reduction in fertilizer use plus a decrease of nutrient losses by at least 50%. The Biodiversity Strategy has the ambition to set a minimum of 30 % of the EU's land area as protected areas, limit urban sprawl, reduce the pesticides risk, bring back at least 10 % of agricultural area under high-diversity landscape features, and strengthen progress towards the remediation of contaminated sites, reducing land degradation and plant more than three billion new trees. Furthermore, the Farm to Fork strategy will convert up to 25 % of the EU's agricultural land as organically farmed. Other important actions include the maintenance of wetlands and the enhancement of soil organic carbon as addressed in the context of the European Climate Law. To support these actions the EC established in December 2020 the new EU Soil Observatory that will be collecting policy relevant soil data and develop indicators for the regular assessment and monitoring of soil health towards the ambitious targets of the Green Deal. The EU has proposed the creation of the Soil Deal for Europe mission that will open new opportunities for sustainable soil management. A set of soil quality indicators has been proposed to monitor the success and the performance of these ambitious targets.

GID- CIHEAM
Parmenides IX Conference
Bari, ITALY, 19/20/21 October 2021

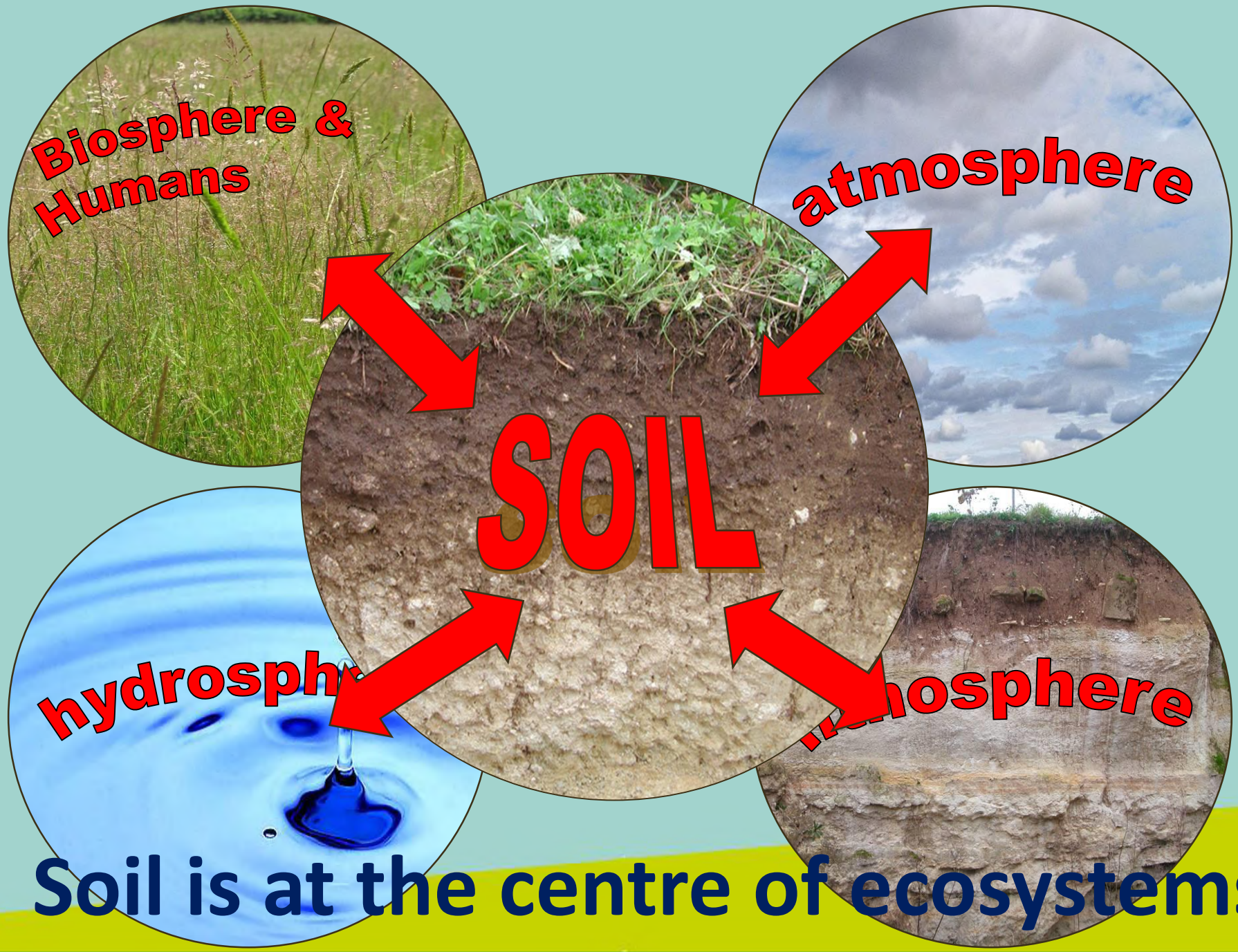
Sustainable management of Mediterranean watersheds faced with the impacts of societal and climate changes

SESSION 2: ROUND TABLES ON VULNERABILITIES (9:00-12:30)

Indicators of vulnerability, water and soil quality

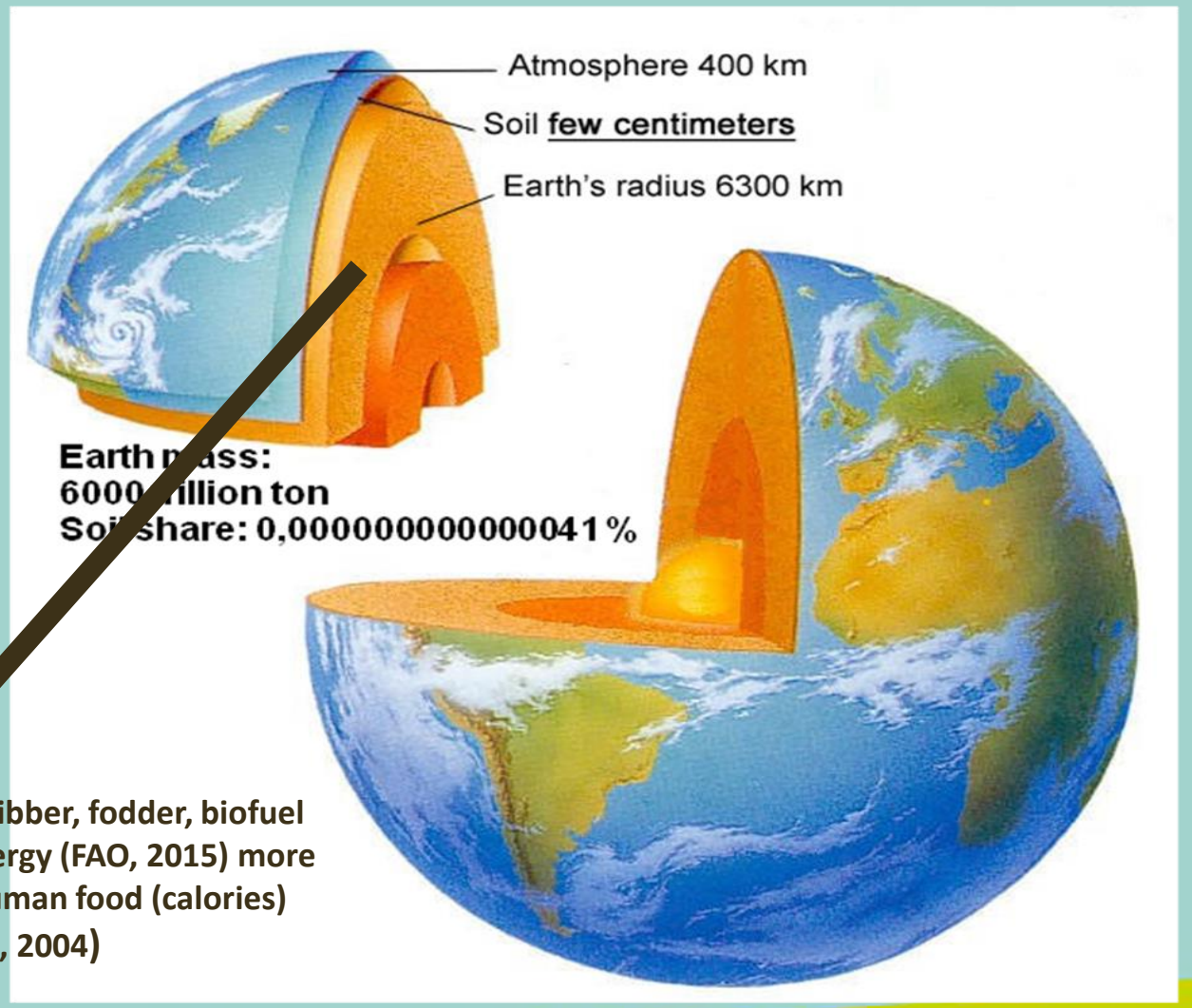
Soil functions and indicators of soil quality in a Mediterranean watershed

Prof. Pandi Zdruli
CIHEAM Bari, Italy



Soil is at the centre of ecosystems

Soil's "share" on Earth's mass: such a thin skin to feed us



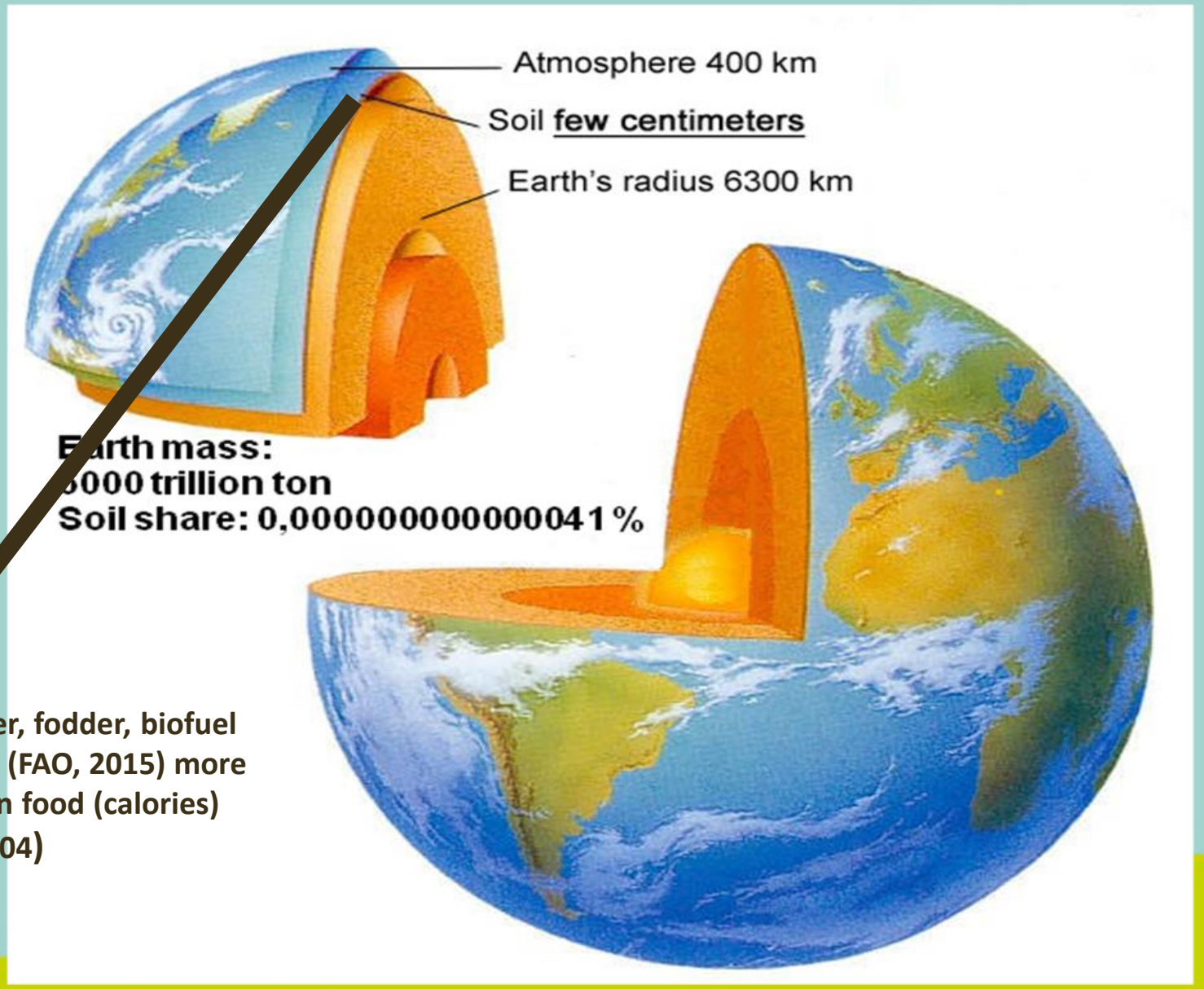
95% of the food, fibber, fodder, biofuel and renewable energy (FAO, 2015) more than 99.7% of human food (calories) (FAO, 2004)

Land and soil are not the same. The EU Thematic Strategy for Soil Protection (European Commission, COM (2006) 231final) describe **soil** as "***the top layer of the Earth's crust, formed by mineral particles, organic matter, water, air and living organisms. It is the interface between Earth, air and water and hosts most of the biosphere***" .

Land is "the terrestrial bio-productive system that comprises **soil,** vegetation, other biota, and the ecological and hydrological processes that operate within the system" (UNCCD).

Source: J. Luis Rubio (2010)

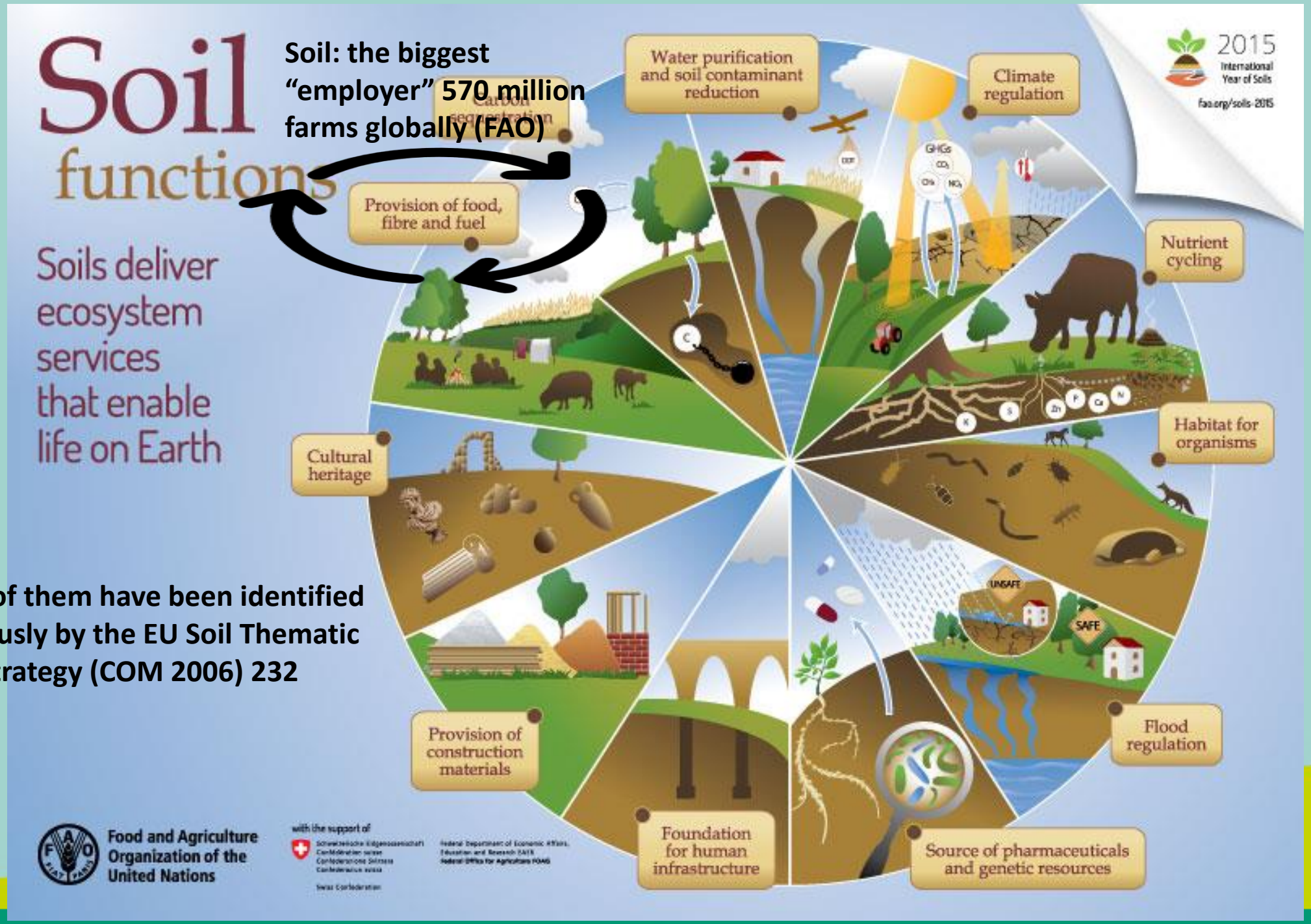
Soil's "share" on Earth's mass: such a thin skin to feed us



95% of the food, fibber, fodder, biofuel and renewable energy (FAO, 2015) more than 99.7% of human food (calories) (FAO, 2004)

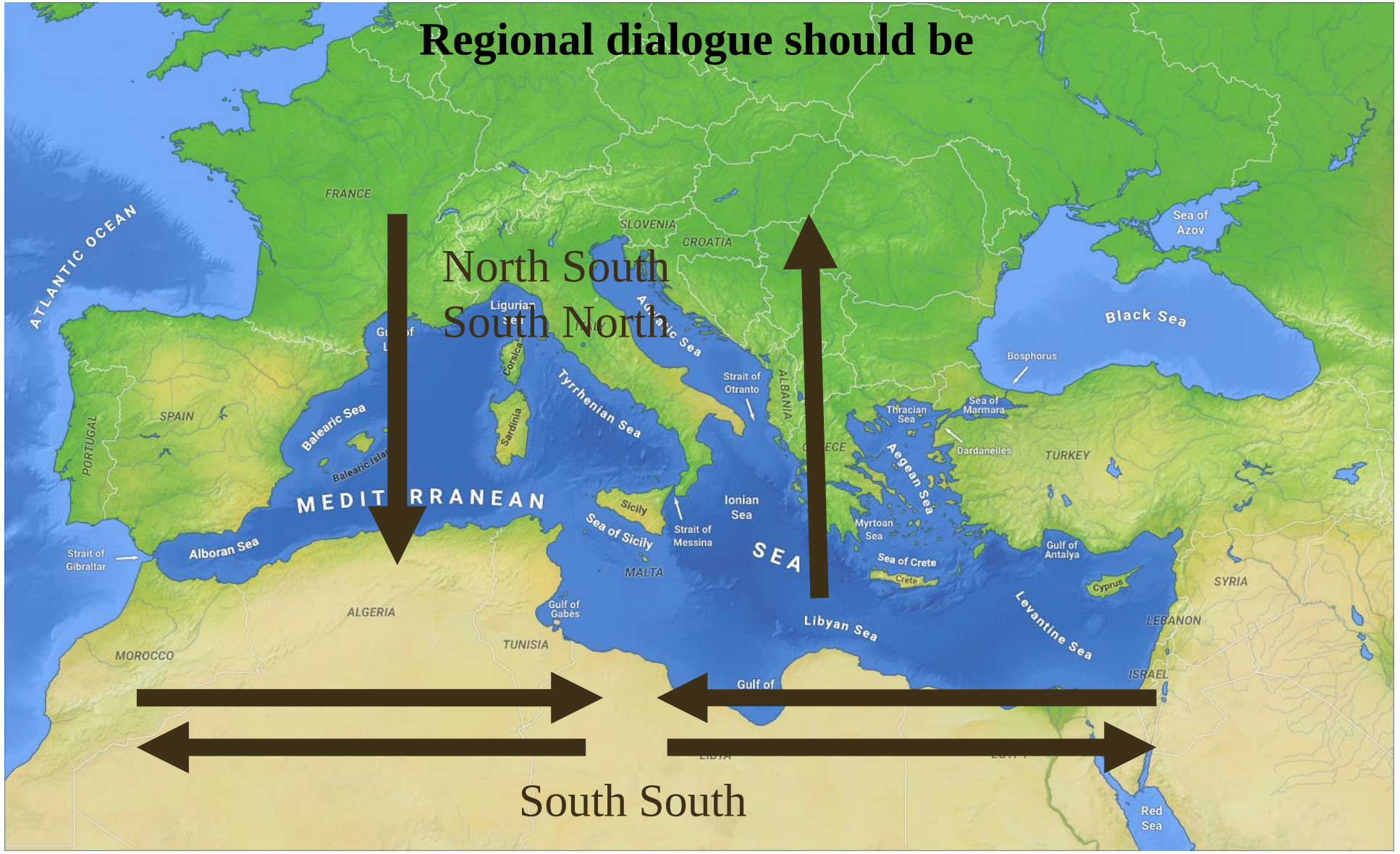
Land and soil are not the same. The EU Thematic Strategy for Soil Protection (European Commission, COM (2006) 231final) describe **soil** as "***the top layer of the Earth's crust, formed by mineral particles, organic matter, water, air and living organisms. It is the interface between Earth, air and water and hosts most of the biosphere***" .

Land is "the terrestrial bio-productive system that comprises **soil,** vegetation, other biota, and the ecological and hydrological processes that operate within the system" (UNCCD).



Many of them have been identified previously by the EU Soil Thematic Strategy (COM 2006) 232

Mediterranean dialogue

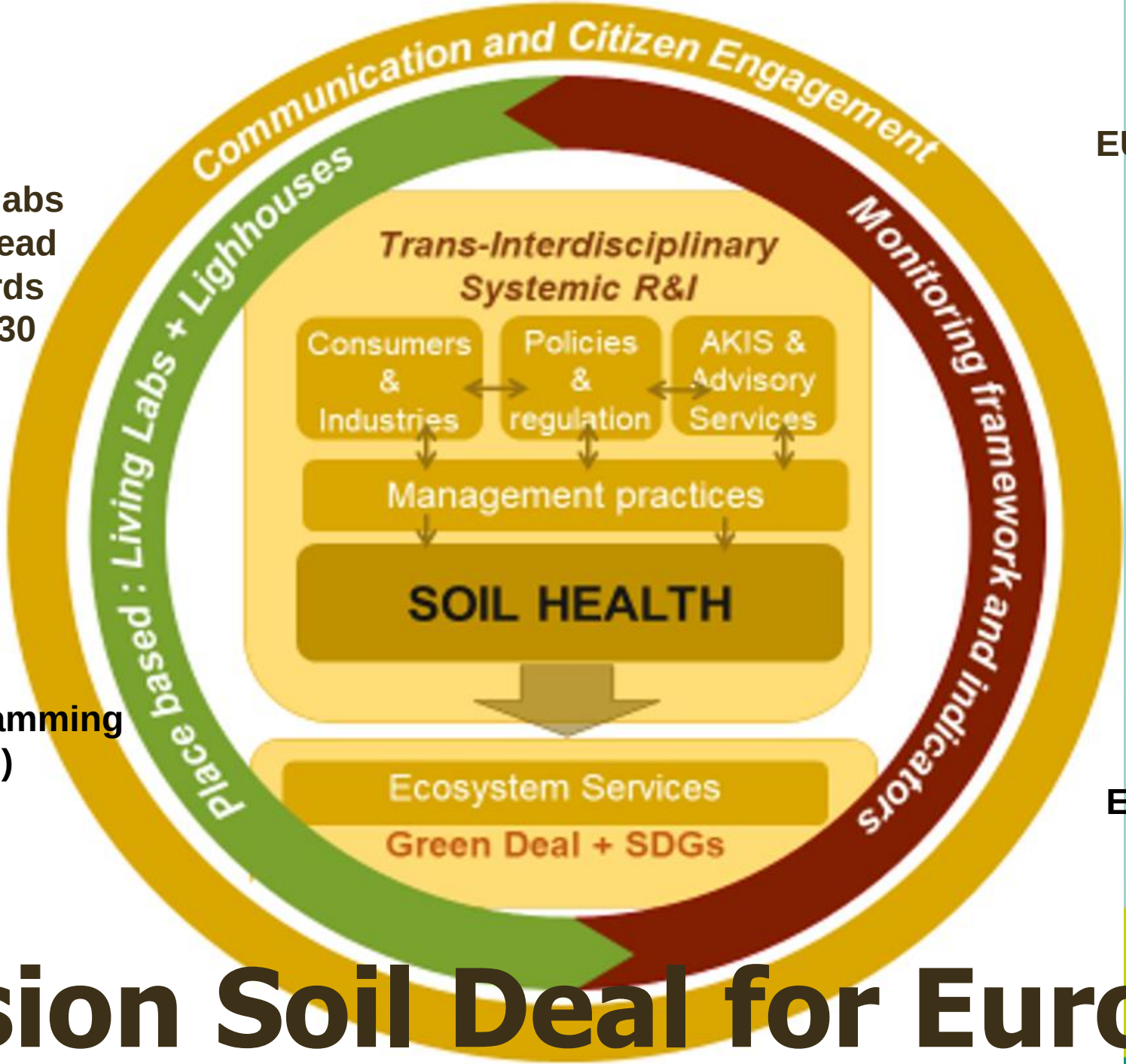


Soil agenda in the EU

Goal: make 75 % of EU Soils healthy by 2030!

Establish 100 living labs and lighthouses to lead the transition towards healthy soils by 2030

EU Soil Observatory and LUCAS monitoring system



EU Soil Thematic Strategy (revised)

European Joint Programming in Soil (EJP Soil)

European Soil Data Centre (ESDAC)

Mission Soil Deal for Europe

The urgency to act

Soils are threatened: **60-70% of all soils in Europe are unhealthy** due to current management practices;
Indirect effects of air pollution and climate change add to that pressure.

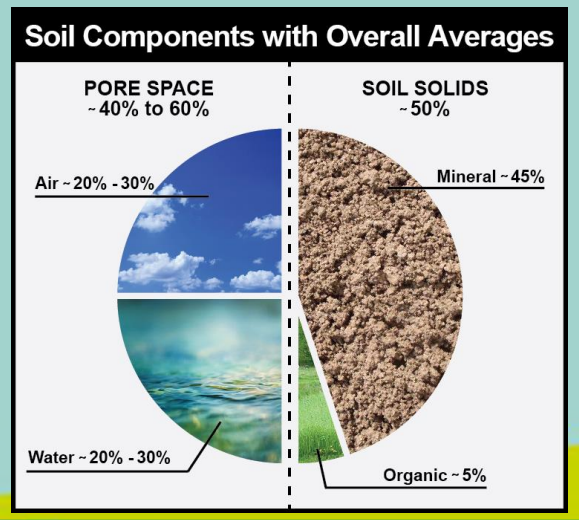
EU Examples:

- 2.8 million potential **contaminated sites**, but only 24% inventoried;
- 65-75% of agricultural soils with nutrient inputs at levels risking **eutrophication of soils and water** affecting biodiversity;
- Cropland soils **losing carbon** at a rate of 0.5% per year and 50% of peatlands drained and losing carbon
- 24% of land with **unsustainable water erosion rates**;
- 25% of land at High or Very High risk to **desertification** in Southern, Central and Eastern Europe in 2017
- The **costs associated with soil degradation in the EU exceed 50 billion € per year**.

Credit: “Caring for soil is caring for life” report

List of indicators to monitor soil quality

1. **Presence of soil pollutants, excess nutrients and salts.**
2. **Soil organic carbon.**
3. **Soil structure including bulk density and the absence of soil sealing and erosion.**
4. **Soil biodiversity.**
5. **Soil nutrients and pH.**
6. **Vegetation cover.**
7. **Landscape heterogeneity,**
8. **Area of forest and other wooded lands**



A North African example

MARSADEV Project

Matrouh Rural Sustainable Development Project

Implementing agencies:
Egypt: Ministry of Agriculture, Desert Research Center (DRC) of Marsa Matrouh – Egypt
Executing agency:
CIHEAM Mediterranean Agronomic Institute of Bari, Italy
Funding: Debt conversion
Beneficiaries: Local associations and communities of Marsa Matrouh area.
Duration: Feb. 2014-Feb. 2017

MARSADEV OBJECTIVES

Land and water management (wadi reclamation, water harvesting, Supplementary irrigation systems, building cisterns)

Improved agronomic aspects of olive, figs and horticultural crops (IPM, Organic farming, orchard management, composting)

Post harvest management (reduce waste, improve olive oil mill technology, modernize marketing)

Improve gender conditions

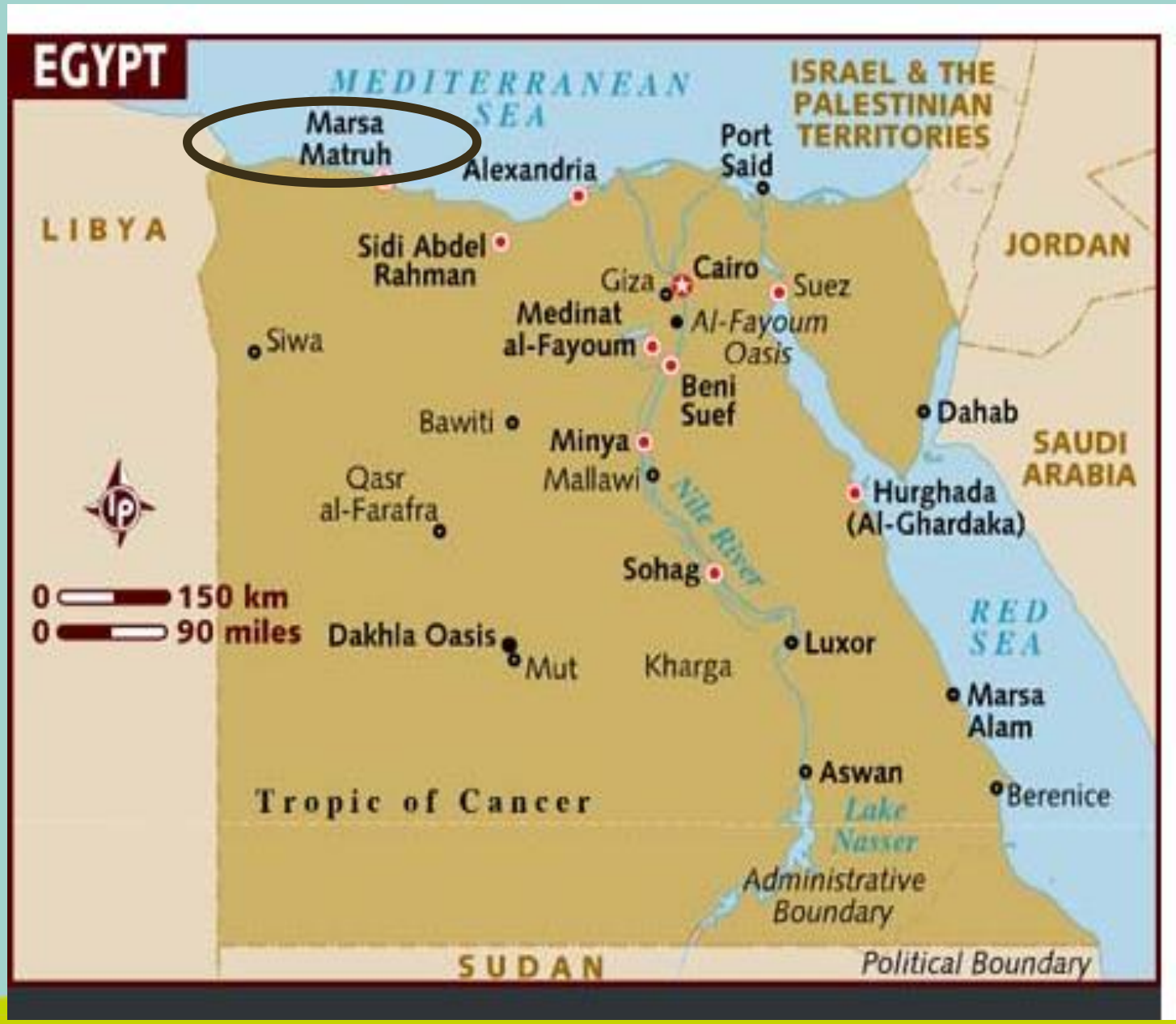
Research and knowledge transfer (i.e. introduction of Quinoa)

Promotion and dissemination

Egypt: land and water shortages and food security

- **Rainfed agriculture** in Egypt occupies about **1 – 2 percent** of the total agricultural area
- **Irrigated agriculture** occupy **98-99** percent of the agricultural area
- **Agricultural land** occupy less than **5 percent** of the territory
- Egypt relay heavily on the **Nile** for most of its water needs
- In 1960 Egypt had **60 million** people but in 2020 reached **100 million** and in 2050 could reach as high as **150 million**
- Egypt is the **largest cereal importer** in the world
- **Food security** is a crucial issue

- In 2013 local Bedouin communities were estimated by 22,000 households with population of 152,000.
- Hot summers and mild winters
- Mean annual temp. maximum 25 °C and mean annual minimum 15 °C
- The average annual rainfall varies from 102 to 140 mm/ year (over the last years the area of Wadi Kharouba has received on average only 50 mm of torrential rainfall

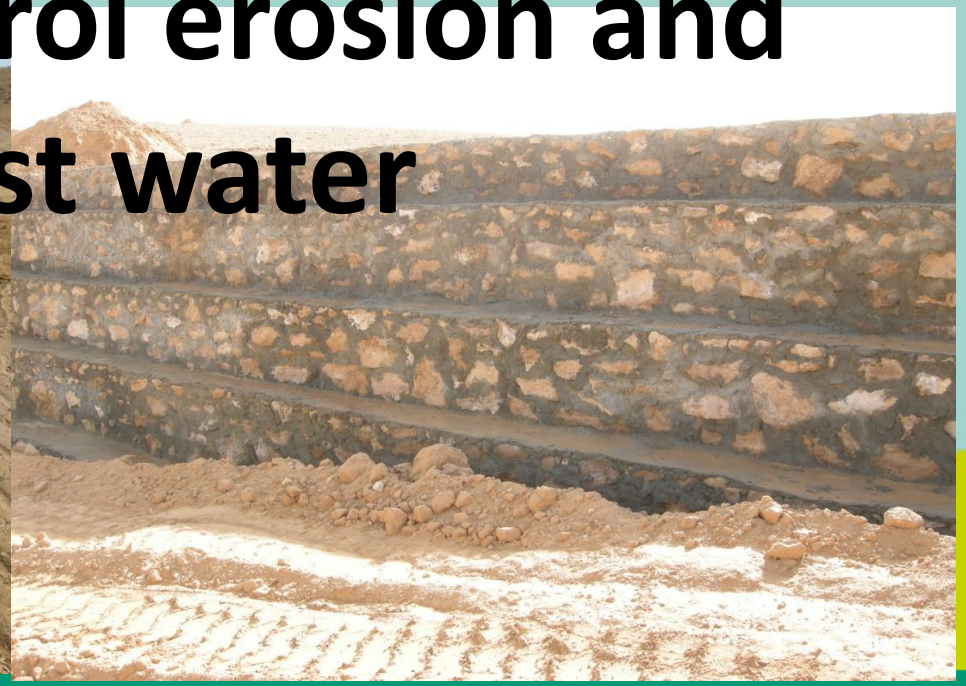


Wadi Khaorruba in 2013

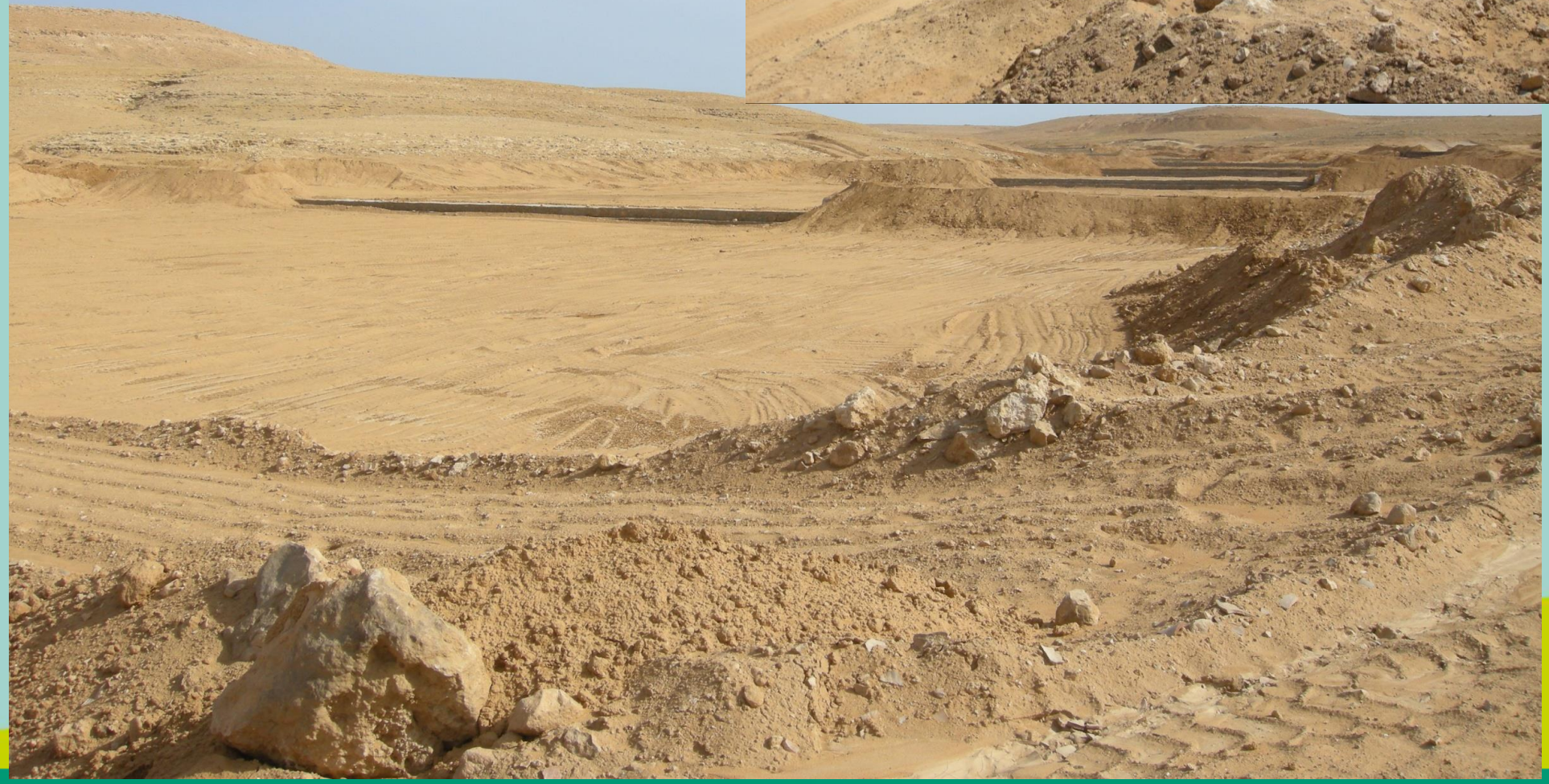
Gully erosion

In 2014 the work started

Leveling land and building dikes to control erosion and harvest water



December 2014: surface leveling completed in about 7 ha and dikes are completed.



The first results

January 2015: Harvesting water inside the wadi

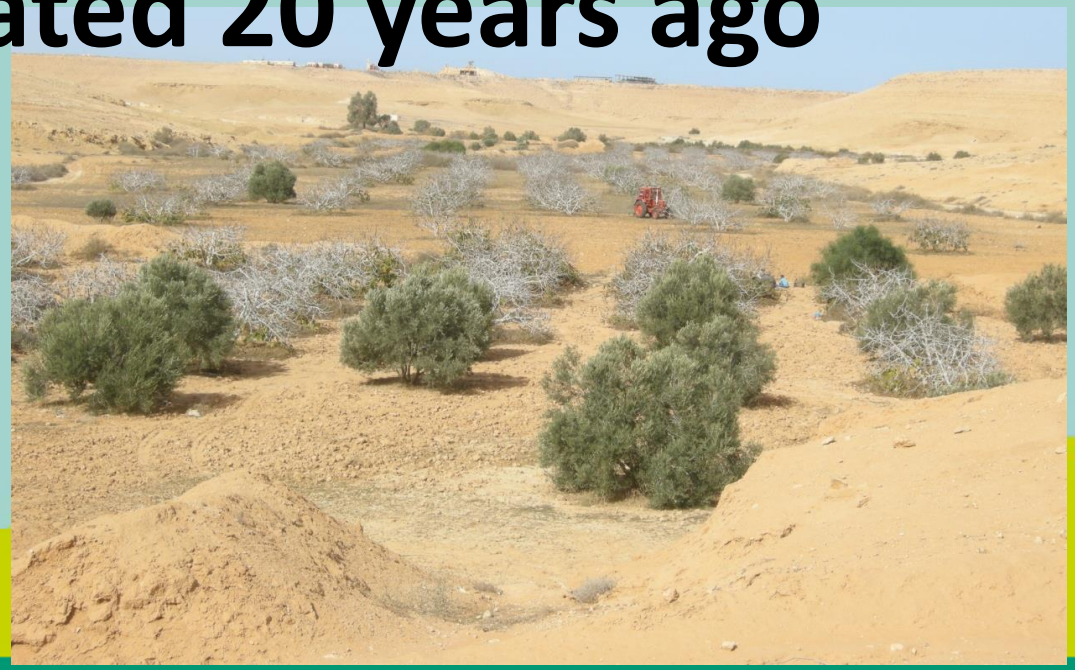
March 2015: 13 ha of reclaimed land were handed over to local community. Two ha already planted with olives, figs and vegetables

Next steps in soil management

- Plant N-fixing crops such as *Vicia Faba* inside the *wadi* and mix them with the soil
- Add 5 kg of organic manure and 0.5 kg of superphosphate at each pit before planting olives and figs.
- Plant cover intercrops between the olives and figs
- Implement minimum tillage or no-till
- Implement mulching

Existing best practices

Wadi rehabilitated 20 years ago



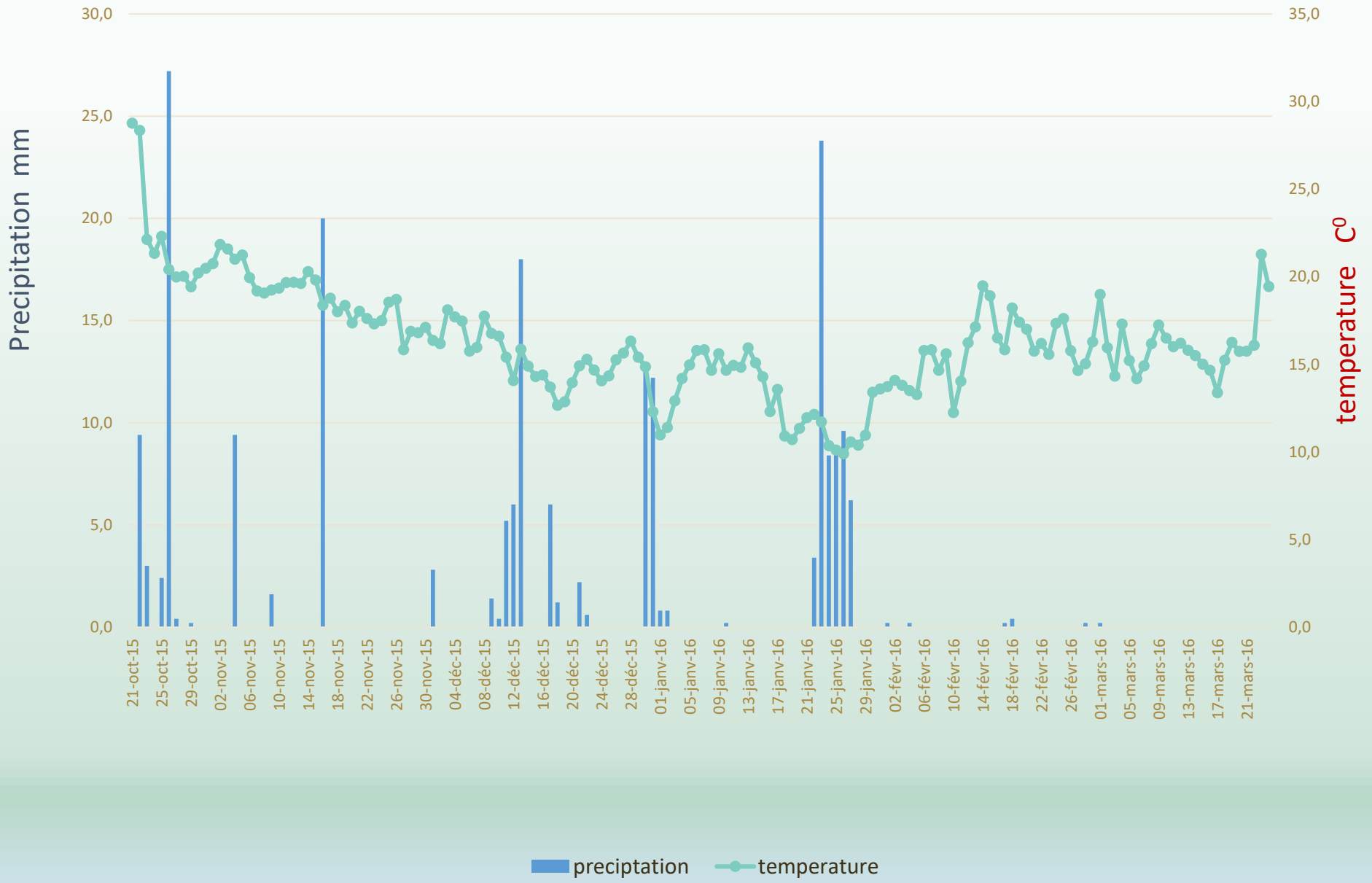
Two crucial issues:

1. Erosion control on the slopes
2. Harvest water inside the wadi and collect surplus water for supplementary irrigation

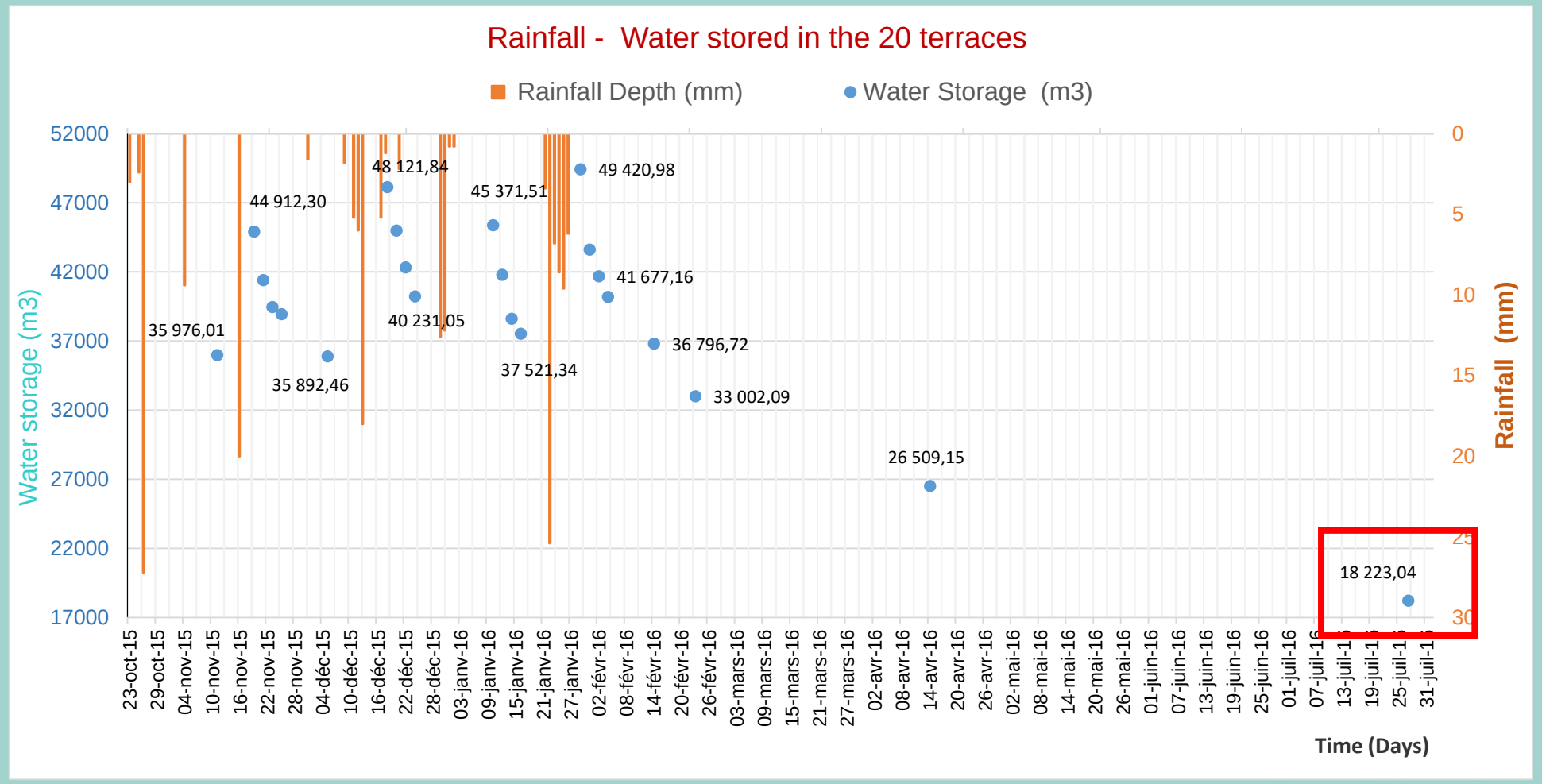
Tens of semicircles are built and planted with local native plants used for grazing and income generating

Opuntia ficus-indica, Medicago arborea, Atriplex spp, Moringa oleifera

Daily precipitation and average temperature of Wadi Kharrouba



In 2016 Wadi Kharrouba harvested almost 50,000 m3 of water of which about 18,000 m3 were still stored in the soil until the end of July

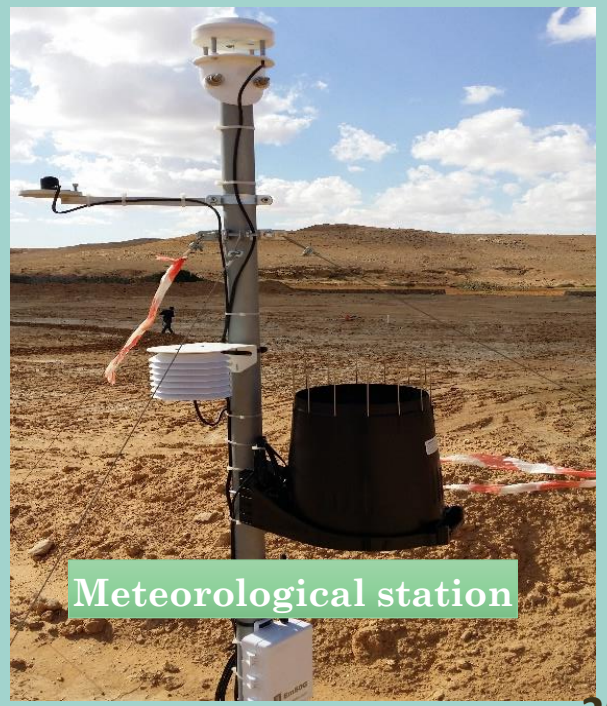


Coppola et al., 2018 *Ecohydrology*

If not for land reclamation this amount of water would have been lost!

Results

January 2016: water harvesting inside the wadi



Water content monitoring

20 access tubes installed in 20 terraces

Reaping off results:
Planting olives, figs, and *Vicia Faba* as intercrop


A new variety of *Vicia Faba* is being tested


Reinfed cereals in the desert


Planting olives


Integrated management of slopes and wadi area


Supplementary irrigation:
Installing drip irrigation system by gravity

Land and water management

Crop management

Agro-food value chain

Marketing of local products

Empowering women

Respect for local traditions

22 March 2016
Wadi Kharrouba is handed over to local Bedouin people

Thank you

pandi@iamb.it