



Desert-Adapt



Preparing desertification areas for increased climate change

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Desert-Adapt

Desert-Adapt LIFE project

Number: LIFE16 CCA/IT/000011

Location: Italy, Spain, Portugal

Budget: 4,075 M euro

% EC co-funding: 2,439 M euro

Duration: 01/09/2017 - 01/09/2023

Partners: 19 (9 technical, 10 landowners)

Coordinating beneficiary

Università degli studi della Campania Luigi Vanvitelli (IT)





- 9 Pilot areas
- 3 in SP (Extremadura)
- 3 in PT (Alentejo)
- 3 in IT (Sicily)

- **1016 ha implemented**
- *10,551 ha replicated*

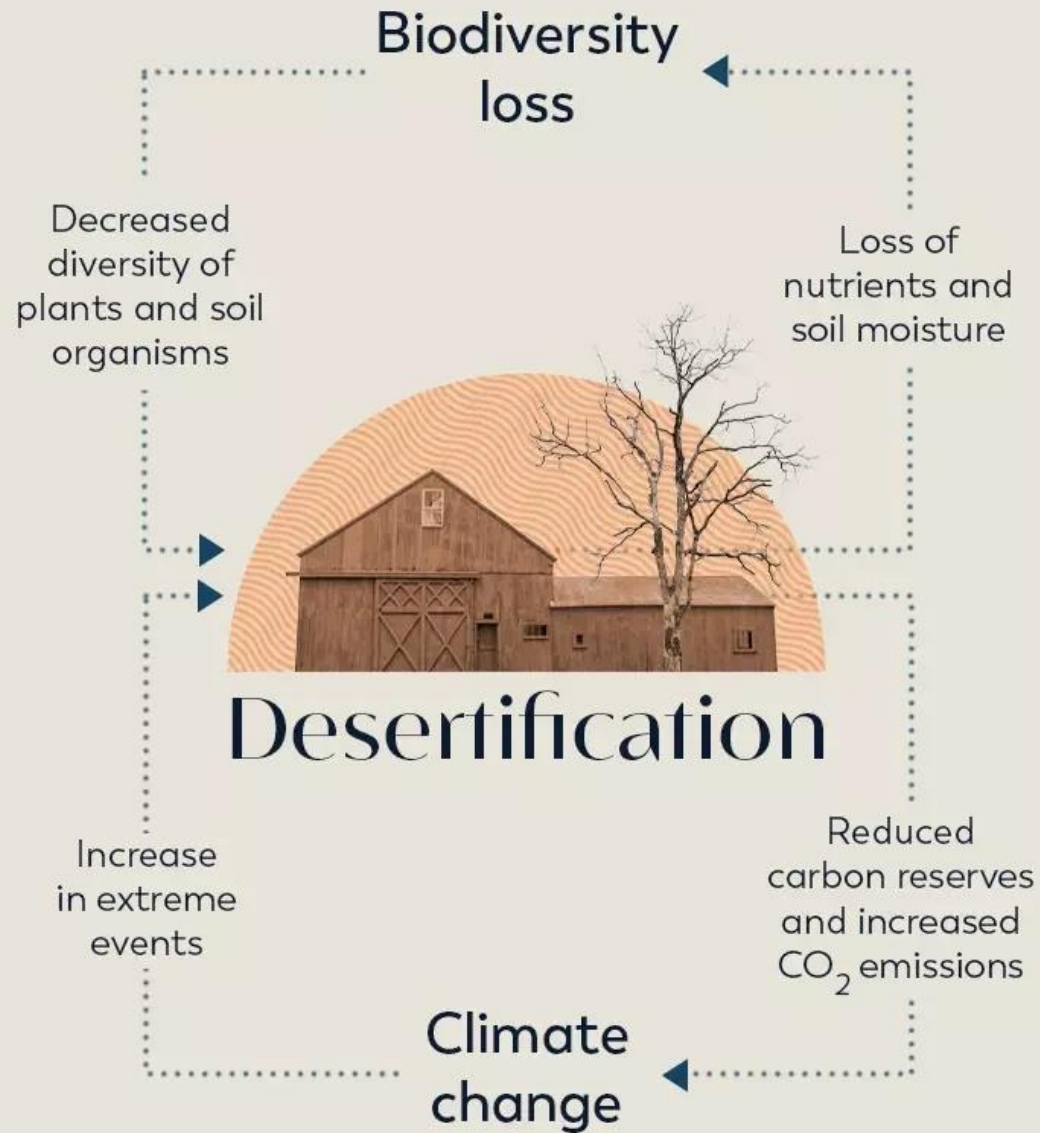


Desertification

risk “In EU 33% of soils are degraded and 90% might be by 2050 costing billions of euro per year”

- **Climate Change**
- **Land Management**



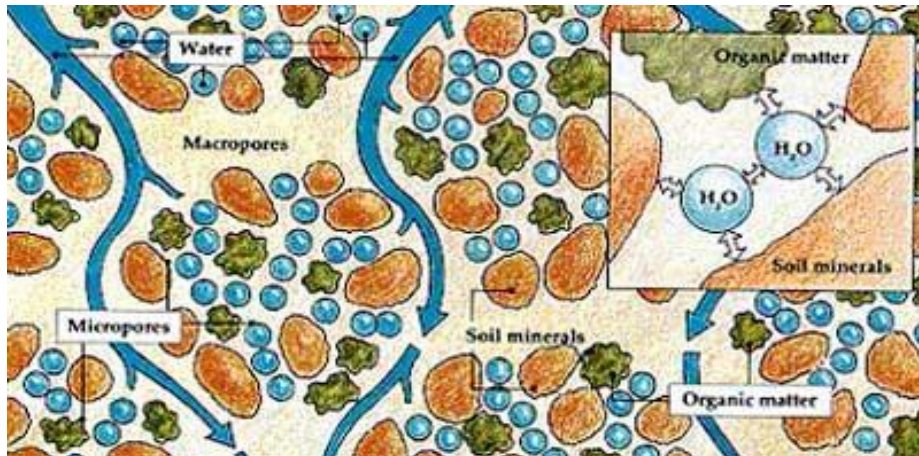


Soil quality loss is the most dramatic effect of desertification



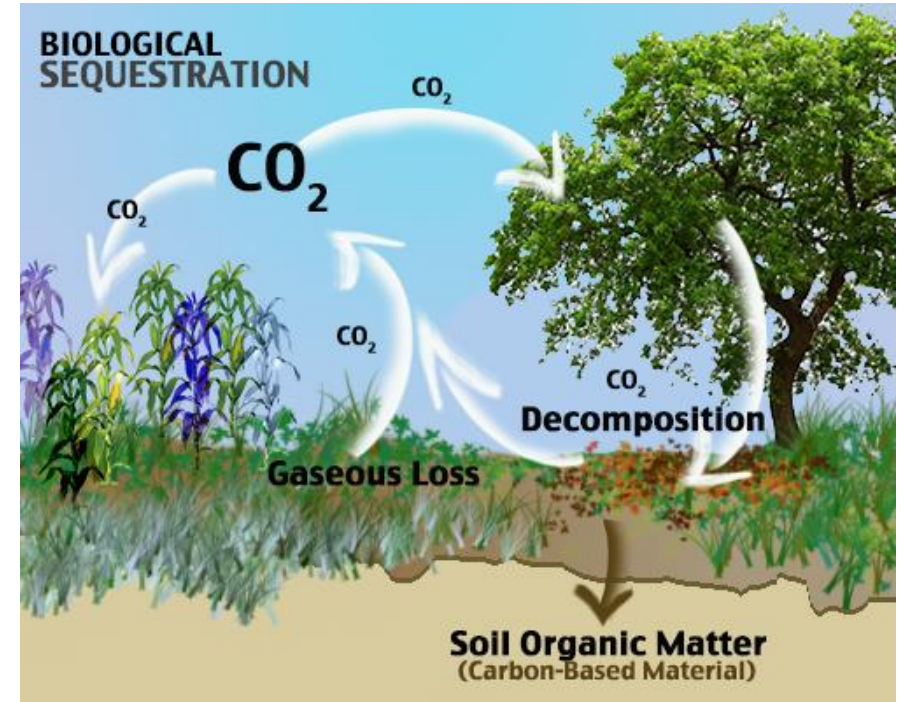
IMPORTANCE OF SOIL ORGANIC MATTER

- Gives tridimensionality to the soil
- Increases porosity
- Increases water retention
- Increases gas diffusion
- Increases cation retention (nutrients)
- Is a source of nutrients for plants
- Is a source of nutrients for microorganisms
- Is a niche for soil organisms
- Favor root growth
- Is a long term storage of atmospheric CO₂



Low INPUTS

Slow plant growth, low litter, residues



High OUTPUTS

Erosion, decomposition, harvest, grazing



DESERT ADAPT MANIFESTO



The environmental pillar: protect and enhance ecosystem quality and services

- **Protect and support plants and trees** in your land
- Increase **plant biomass and cover**
- Increase **soil organic matter**
- Reduce **soil erosion and loss**
- Stimulate **biodiversity** at all levels
- Reduce **fire risk**
- Protect quality and quantity of water bodies



The economic pillar: seek long-term self-sustainable economic investments

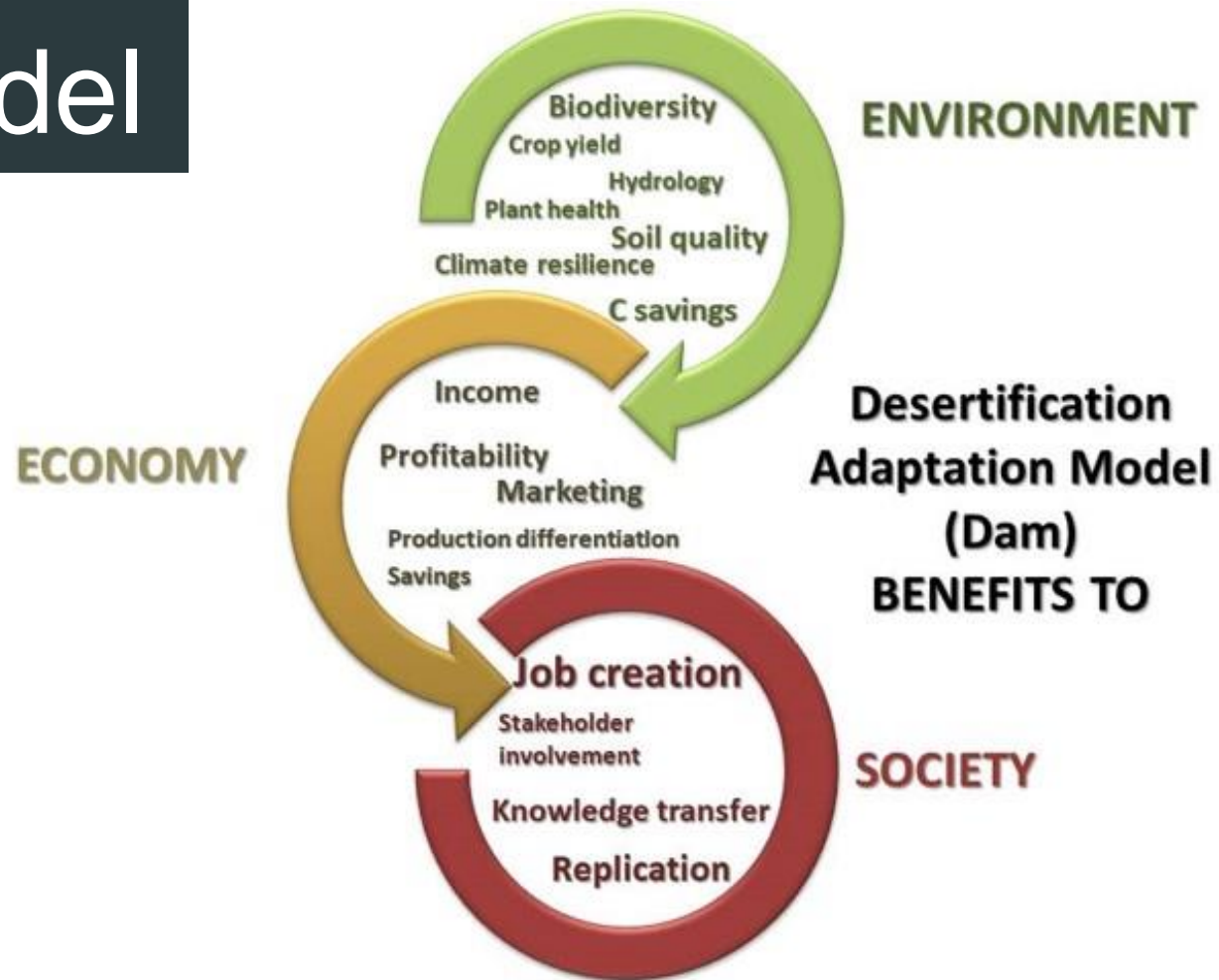
- **Differentiate income sources including bioproducts and ecoservices which valorise your local natural capital**
- Prefer local varieties and breeds which are adapted to local climatic conditions and soils
- Focalize the attention on management options that save money whilst increasing land quality
- **Avoid agronomic species that are not climate adapted**
- Focus on investments which have long term positive effect on your land



The social pillar: be inclusive for the local population

- Contribute to raise awareness and become a testimonial of sustainability with your personal experience
- Make your natural capital a shared good and responsibility

Desertification Adaptation Model





Adaptive multifunctional scapes

Land functions (51)

Economic (37)

Ecological (10)

Social (3)

Adaptation measures (53)

Soil management

Plant management

Landscape

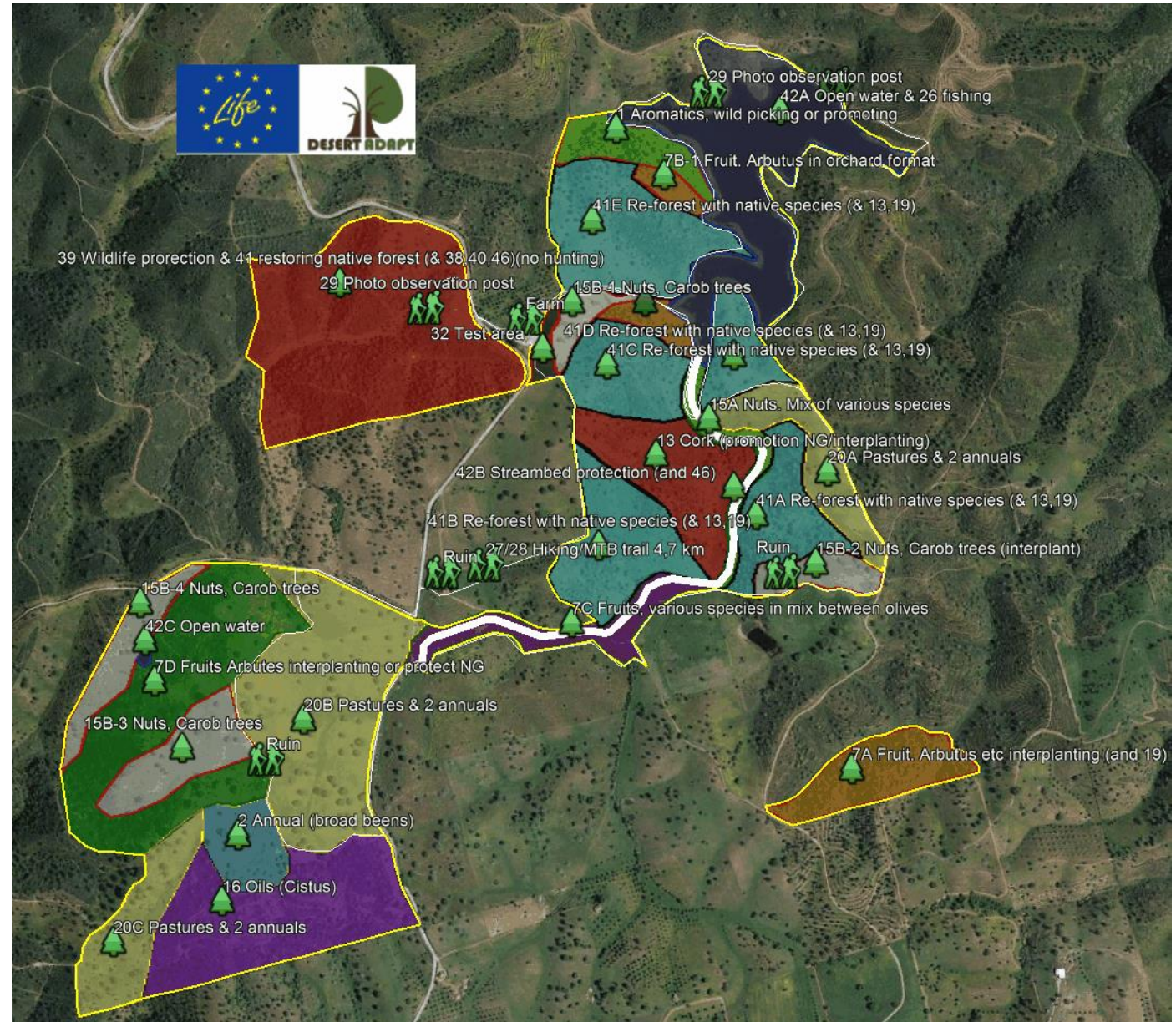
Hydrology

Livestock

C sequestration

NATURE-BASED SOLUTIONS

COST/BENEFIT BALANCE OF FUNCTIONS



9 DAMS - 4 municipalities and 5 private landowners

LIFE Desert-Adapt Replicator

Azula Bio

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👤 Peina Kaban
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Desert-Adapt
Restore Nature, Change to Adapt

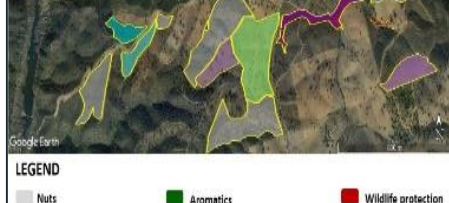
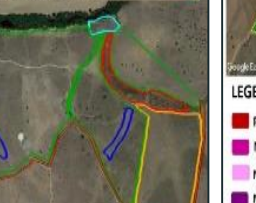
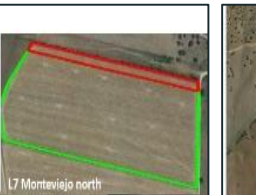
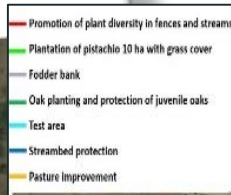
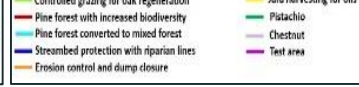
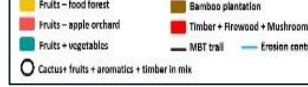
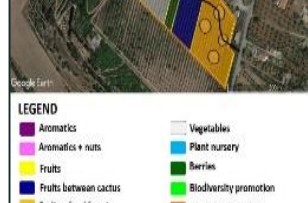


"Azula é um lugar, um projeto e a casa de uma família que possui a missão de criar os seus filhos num ambiente saudável e seguro, e de dar uma terra e a si próprios para destruir o medo da vida em plano. Localizada numa zona de risco de incêndio, a nossa missão é transformar esta terra, melhorando a produtividade e a biodiversidade, criando um espaço onde os filhos possam crescer e a própria natureza possa prosperar. Assim, este projeto tem a missão de transformar-nos a nós próprios, criando-nos de uma vida a transformar-nos a nós próprios, criando-nos de uma vida que estamos a fazer a coisa mais grande e bonita. Queremos fazer esta experiência com mais pessoas e fazer uma mudança real positiva no nosso mundo."

Desafios em relação às alterações climáticas:

Captação e acumulação de águas da chuva e neveiro para colmatar a escassez hídrica.

Modelo de Adaptação às Alterações Climáticas



- LEGEND**
- Nuts
 - Quercus & truffles
 - Animals and seeds
 - Erosion control + timber
 - Plant nursery
 - Aromatics
 - Biodiversity promotion
 - Olive island improvement
 - Lake protection
 - Test Area
 - Biomass + Timber production

- LEGEND**
- Aromatics
 - Aromatics + nuts
 - Fruits
 - Fruits between cactus
 - Fruits - food forest
 - Fruits - apple orchard
 - Fruits + vegetables
 - Cactuses + aromatics + timber in mix
 - Vegetables
 - Plant nursery
 - Berries
 - Biodiversity promotion
 - Bamboo plantation
 - Timber + Firewood + Mushrooms
 - MBT trail
 - Erosion control

- LEGEND**
- Chestnut for fruit and for timber
 - Chestnut for fruit
 - Pasture improvement
 - Sheep grazing under olive trees
 - Aromatics
 - Recover of burnt cork oak
 - Wildlife protection
 - Sheep grazing in chestnut area
 - Native arboretum
 - Hiking trails

- LEGEND**
- Dehesa wood pasture with increased tree diversity
 - Controlled grazing for oak regeneration
 - Pine forest with increased biodiversity
 - Pine forest converted to mixed forest
 - Streambed protection with riparian lines
 - Erosion control and dump closure
 - Aromatics
 - Jara harvesting for oils
 - Pistachio
 - Chestnut
 - Test area

- LEGEND**
- Promotion of plant diversity in fences and streams
 - Plantation of pistachio 10 ha with grass cover
 - Fodder bank
 - Oak planting and protection of juvenile oaks
 - Test area
 - Streambed protection
 - Pasture improvement
 - Places for wildlife feeding
 - Nuts replace eucalyptus
 - Nuts interplanting + fruits
 - Nuts new plantation + fruits
 - Erosion control
 - Aromatics
 - Food garden
 - Native forest (Tree clusters)
 - Native forest (interplanting)
 - Lake protection
 - Test Area
 - Timber, firewood and biomass
 - Caravans park

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- Places for wildlife feeding
 - Nuts replace eucalyptus
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 - Erosion control
 - Aromatics
 - Food garden
 - Native forest (Tree clusters)
 - Native forest (interplanting)
 - Lake protection
 - Test Area
 - Timber, firewood and biomass
 - Caravans park

- LEGEND**
- Aromatics
 - Fruits (Arbutus)
 - Fruits in mix between olives
 - Reforestation
 - Test Area
 - Lake protection
 - Cork
 - Streambed protection

- LEGEND**
- Nuts
 - Fruits (Arbutus)
 - Fruits in mix between olives
 - Reforestation
 - Aromatics
 - Cereals + pasture improvement
 - Wildlife protection
 - Test Area
 - Lake protection
 - Cork
 - Streambed protection



Ecology
Botany
Microbiology
Forestry
Agronomy
Zoology
Ornithology
Entomology

Business
Marketing
Social science

Land Owners
Producers

Soil science
Hydrology
Geography
Cartography
Climatology
Drones

- 24 key project indicators (KPI) for the environmental amelioration of ecosystem services and natural capital
- 7 KPI for economic performance and replicability

BASELINE CHARACTERIZATION CAMPAIGN IN 2018

CONTINUOUS MONITORING AND CAMPAIGNS IN 2022-23





Desert-Adapt
Restore Nature, Change to Adapt

Improved Environmental and Climate Performance (including resilience to climate change)	Reduction of greenhouse gas emissions (GHG)	CO2
	Reduction / substitution of dangerous substances	Chemicals substituted
	Water	water retention capacity
		Avoided soil run-off by improved land use water infiltration capacity
Desertification	Vulnerability to desertification	
Better use of natural resources	Water	Reduced plant mortality rates by use of growing aids in comparison with control plots (without growing aids).
Sustainable land use, agriculture and forestry	Agriculture	Areas of agricultural land under sustainable management and protected against further desertification
		Soil / Land, in average for all lands
	Soil Surface improved	
	Organic Matter	
	Bulk Density	
	Porosity	
	Aggregate stability	
	Improved Cation Exchange Capacity	
	Hot water extractable organic carbon	
	Particulate Organic Matter	
	Total Organic Carbon	
	Total Nitrogen	
	soil pH (H2O)	
	Increased plant root surface colonization by mycorrhizae	
Increased mycorrhizae spore density in the soil		
Improved Nature, Species and Biodiversity	General increase biodiversity	Presence of indicator species
		Soil functional biodiversity
		Presence of key plants for (threatened) bees, butterflies and other pollinizing species.
Economic Performance, Market Uptake, Replication	Employment	Jobs created
	Replication / Transfer	N . of replication / Transfer
	Market uptake	market size in number of customers
		Participation in 4 trade fairs
	Financials	Capital invested
IRR Savings/revenue expected		

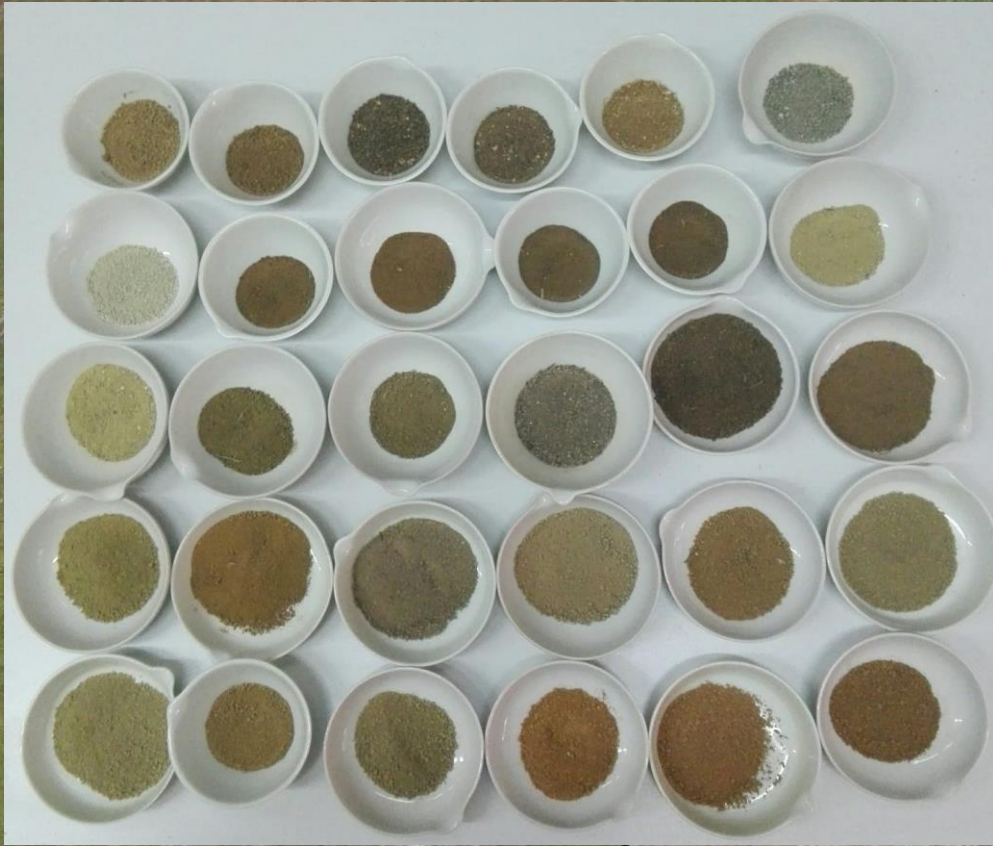
43 KPIs - PROJECT INDICATORS

24 for the environmental amelioration of ecosystem services and natural capital

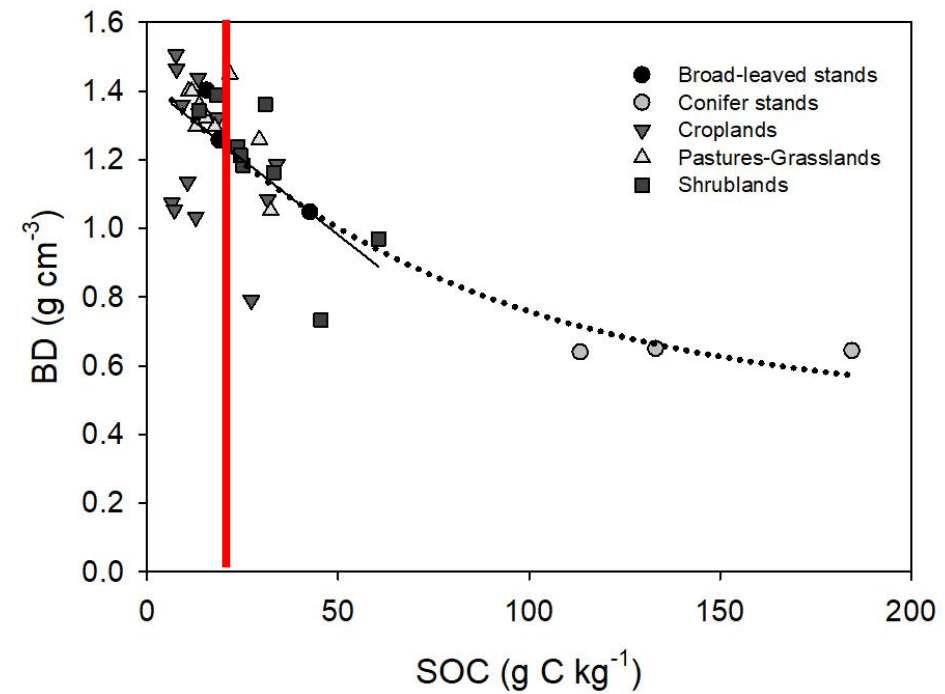
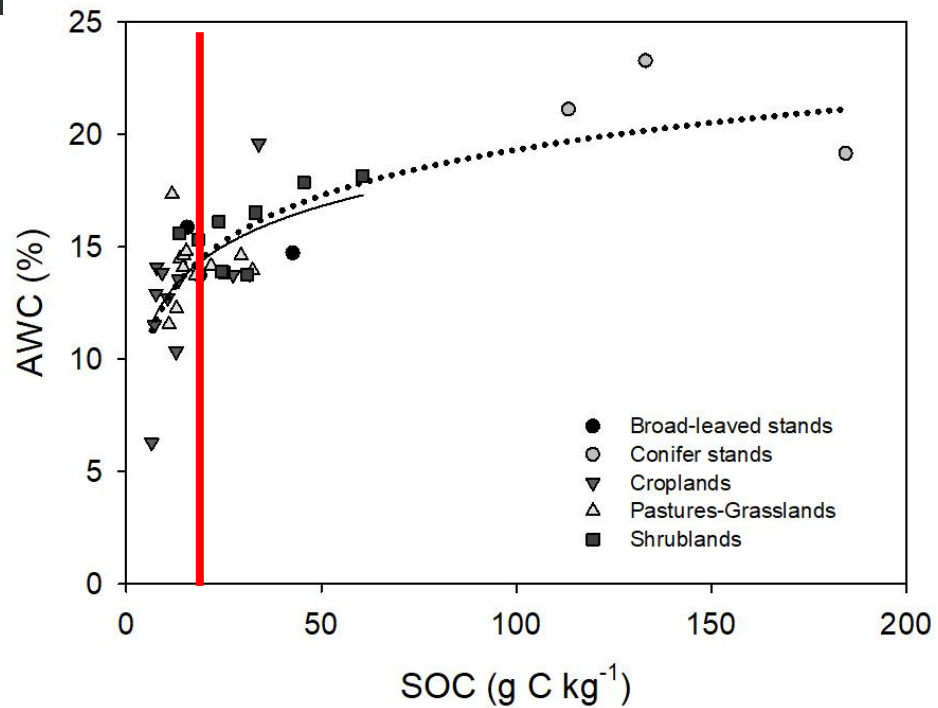
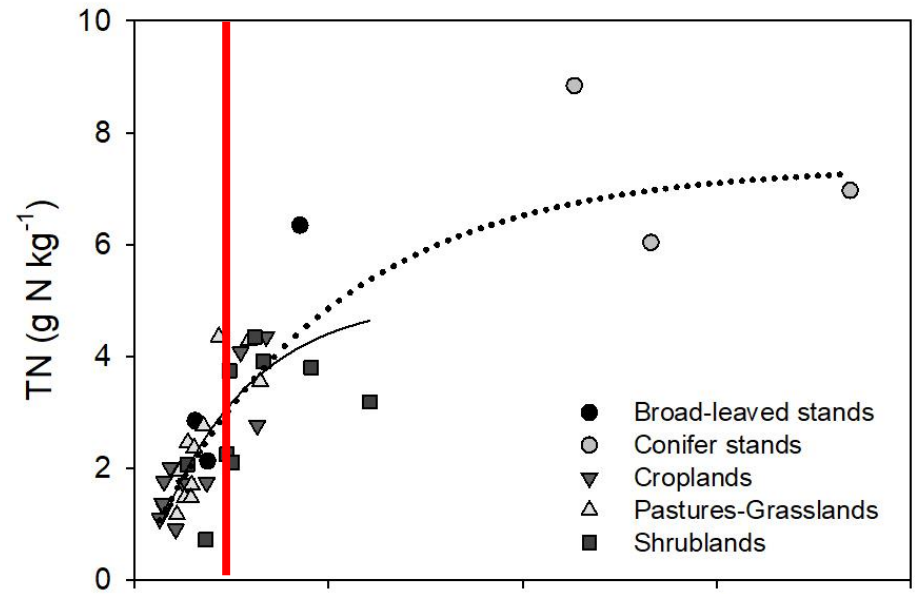
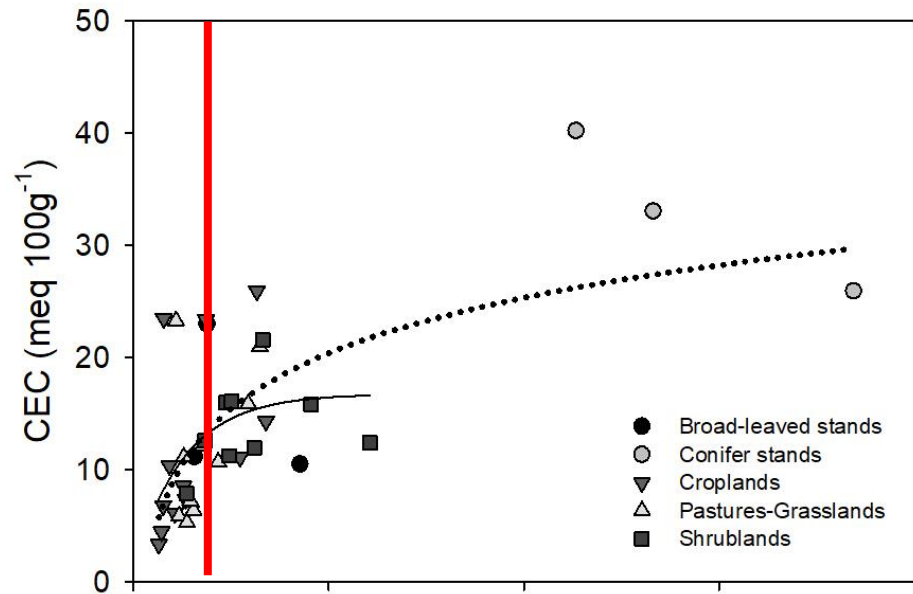
7 for economic performance and replicability

11 for social impact/dissemination

More than 50% of soils in the studied areas have less than **2% soil organic C** (20 g C kg⁻¹ dry soil)



20 g C kg⁻¹ dry soil (2%)



**FUNCTIONS AND MEASURES
BENEFICIAL TO SOIL
ORGANIC**





PRESENTATION TITLE



Desert-Adapt



VALORIZATION OF WILD AROMATIC SPECIES TO PRODUCE HIGH VALUE OILS (Desert-Adapt, Ajuntament Valverde del Fresno SP)



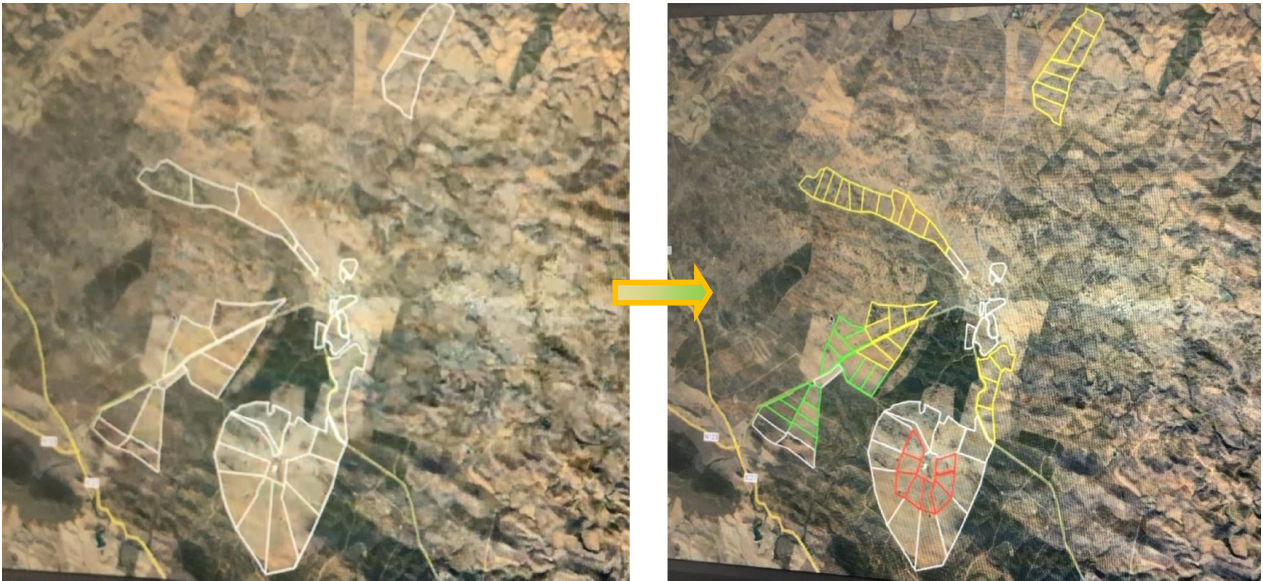
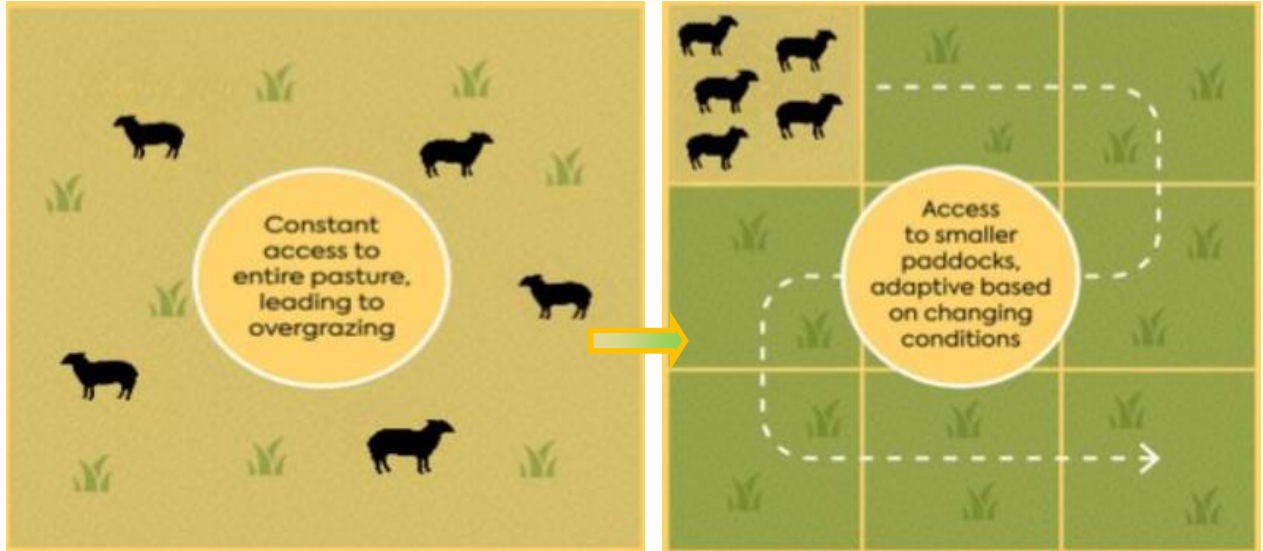
Adaptation

Adaptated species





Rotational grazing Nature based solution



L9 Site Portugal



Summer 2018



Pre-intervention



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Post-intervention

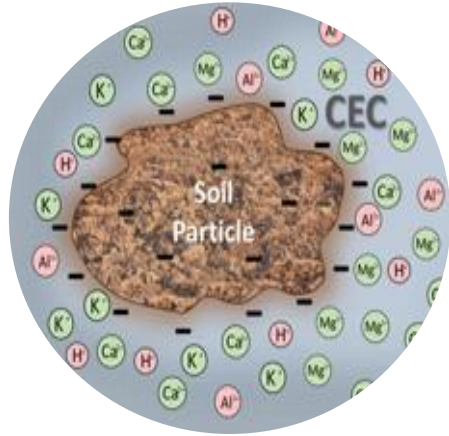


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L9 progress after 5 years



SOIL CARBON
+ 5 tons C/ha



CEC
+24-53%



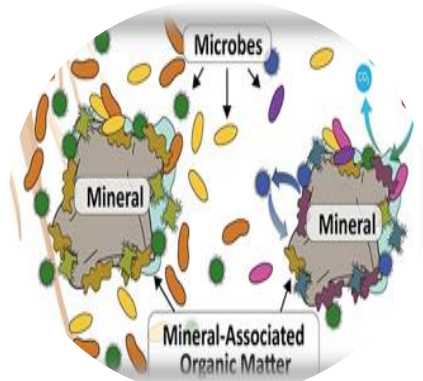
WATER RETENTION
+11-30% WHC



SOIL NITROGEN
+ 44 -120%



FUNGAL BIOMASS
+ 84%



STABLE SOIL C
+ 37-63% MAOM



GRASS PRODUCTIVITY
+3 months of forage



COST SAVING

Reduced external inputs

Advanced analysis for C sequestration estimate

$\delta^{13}\text{C}$ isotopic difference

$\delta^{13}\text{C}$ of the *Opuntia* cladodes (CAM)

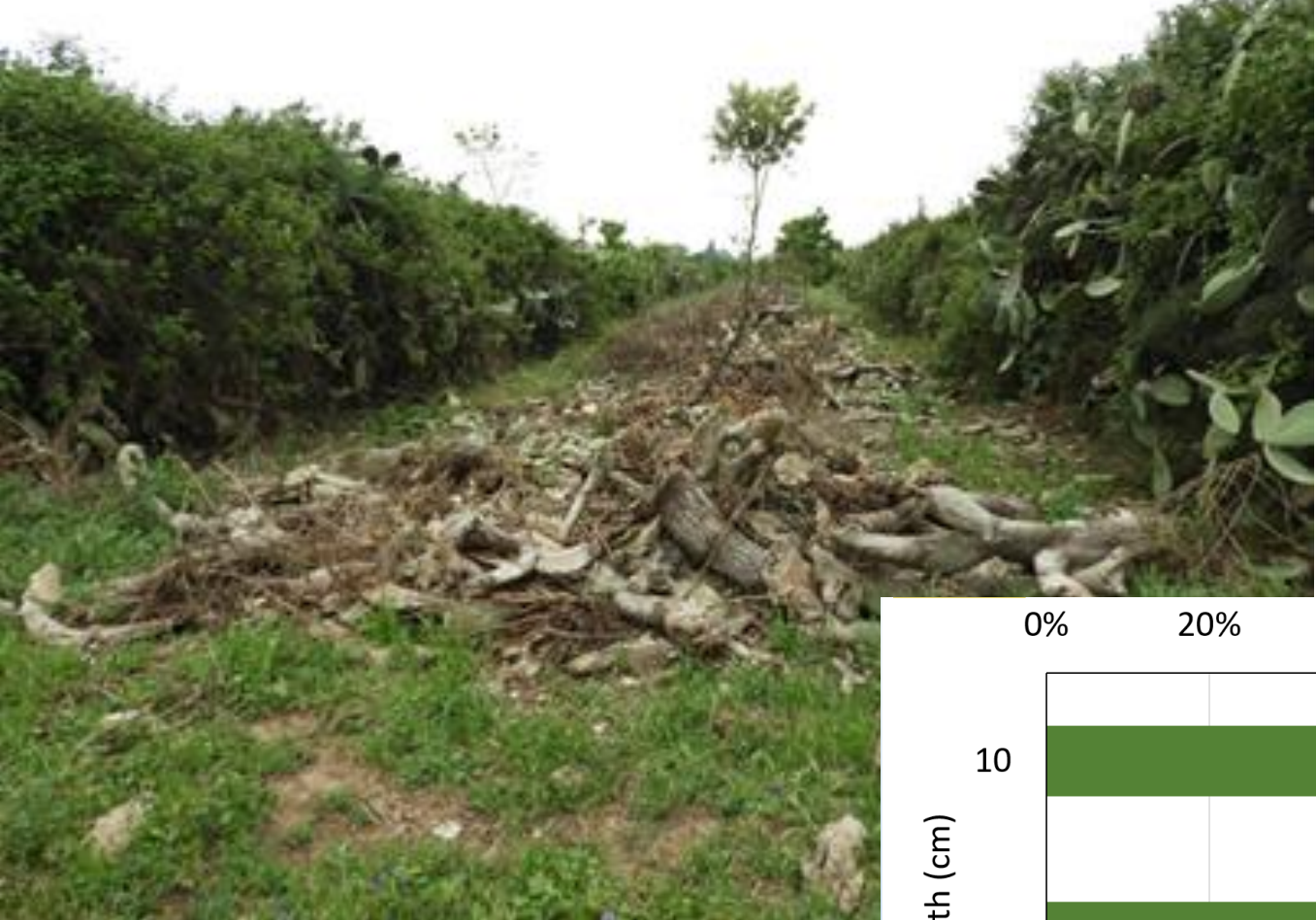
$\delta^{13}\text{C}$ of the reference soil (C3 inputs)
(NO cactus)

New C derived from the prickly pear mulching calculated using the mass balance equation (del Galdo *et al.* (2003):

$$f_{\text{new}} = (\delta\text{SOM} - \delta_{\text{ref}}) / (\delta_{\text{new}} - \delta_{\text{ref}})$$



10 YEARS OF MULCHING WITH CALDODE RESIDUES

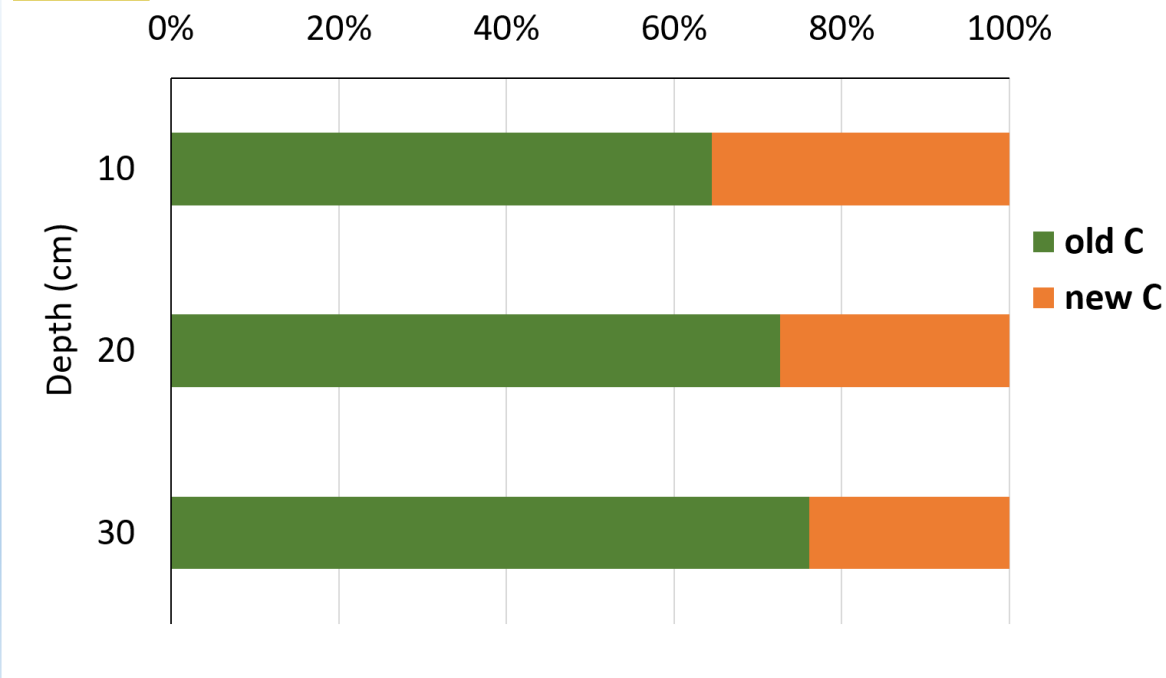


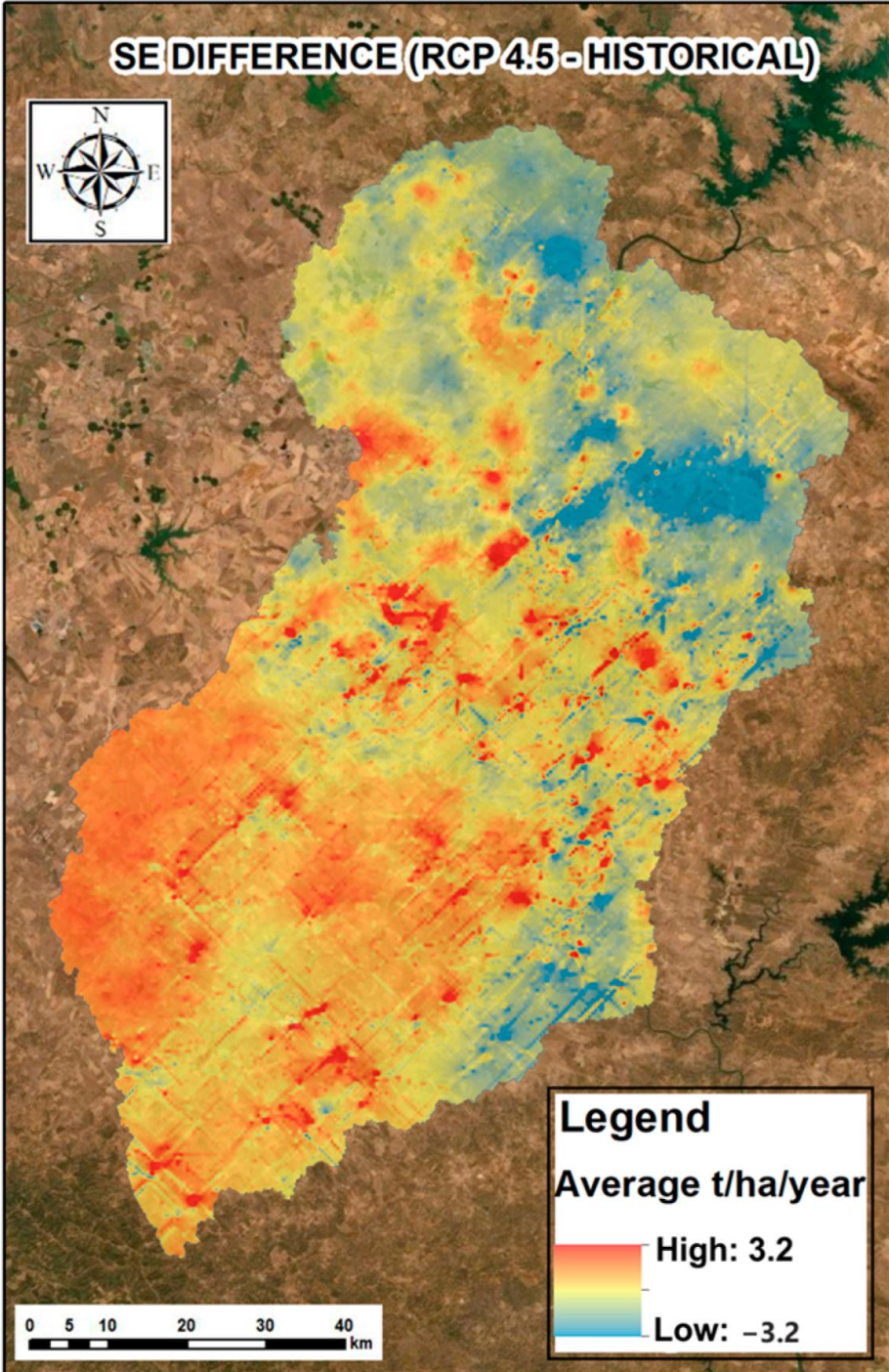
New C sequestration due to cladodes inputs

0-10 CM DEPTH 3.62 ± 0.92 tons of C·ha⁻¹

10-20 CM DEPTH 1.40 ± 0.29 tons of C·ha⁻¹

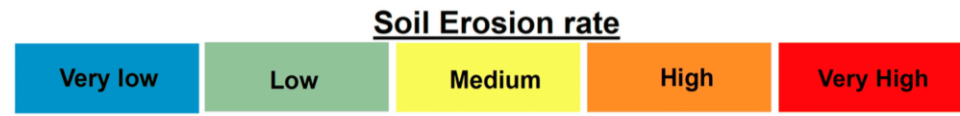
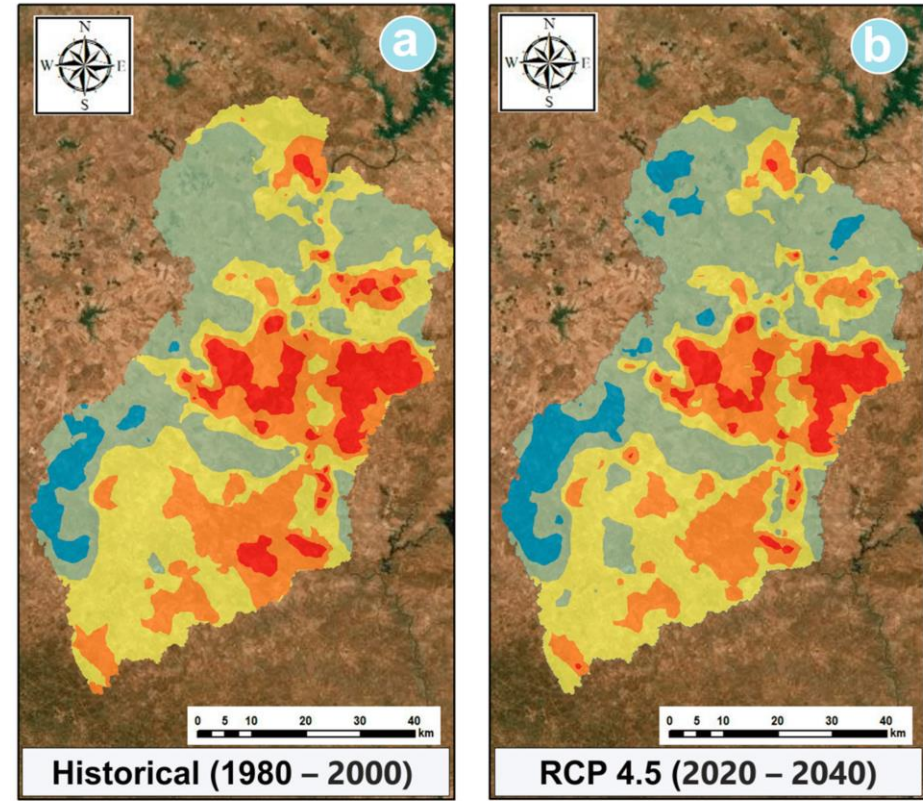
20-30 CM DEPTH 0.57 ± 0.18 tons of C·ha⁻¹





Soil erosion risk maps

susceptibility maps: net variation between future climate scenarios based on RCP 4.5 and historical scenario with a Business as Usual land management and cover



Busico et al. 2023. Assessing Soil Erosion Susceptibility for Past and Future Scenarios Semi-arid Mediterranean Agroecosystems. Sustainability 15, 12992.

DESERT ADAPT RESULTS



Improved
land

1016,18 ha covered by DAMs
Planted 93.391 trees, shrubs and plants in 132
species



C sink

C sequestered in the vegetation: 2,1 Tons CO₂/ha/yr



GHG
Reduction

180 Ton CO₂ sequestered in total on average per
year with newly planted trees

Desertification
risk



Reduction of 1 ESA class (Environmentally
Sensitive Area to desertification)



Soil water
resource

2-3% increase of soil water retention capacity
34-66% avoided soil run-off by improved land use
3 folds reduction of plant mortality rates by use of plant growing aids



Soil
quality

52-67% increase of soil C, 53-77% of soil N under adaptation measures
49-59 % increase of aggregate stability under adaptation measures
36-47% increase of nutrient retention (CEC) under adaptation measures



Biodiversity
Taxa
Species
Indicators
Functions

6-18 % increase (frequency -intensity) of mychorrizal root colonization
Indicator species: +30% more bird species; +29% soil fauna taxa; + 15% QBS, no variations of
butterfly Shannon index and 2% variation for Bees shannon index, while no increase in taxa.
>30% in soil microbial biodiversity, biomass and functionality



Capacity building issues requiring attention

ADAPTATION

- Climatic extremes beyond expectation
- Lack of awareness and knowledge
- Lack of technical dedicated staff for sustainable management planning

ECONOMIC FEASIBILITY

- Costs of measures not covered by subsidies
- Strong competition for manpower and water on smaller farmers from big agro-companies

POLICY

- Lack of a supporting sustainability network for farmers
- Complex bureaucracy for plans in public areas
- Conflicts with other EU frameworks (PAC, Natura 2000)

Thank you

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