

Co-developed indicators and metrics

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PRIMA
PARTNERSHIP FOR RESEARCH AND INNOVATION
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**REACT
4MED**





Inclusive Outscaling of Agro-ecosystem
REstoration ACTions for the MEDiterranean

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1 Introduction

One of the main priorities of REACT4MED is to develop a set of bio-physical and socio-economic indicators to check and validate the restoration actions that are implemented in the pilot areas. This is done in a participatory approach in close consultation with local stakeholders. The main scope is to enhance the management of natural resources, and the adoption of all practices and technologies towards achieving sustainable soil management, water use efficiency, and ecosystem recovery, especially in those areas that are degraded by human mismanagement or the impact of climate change.

1.1 Co-development of local scale indicators and metrics

The bulk of the work is based on a background document for the selected pilot areas that was completed during the project preparation phase (see **Annex I – Pilot Areas**) as well as on the outcomes of Tasks 2.1 and 2.3 where a list of newly developed soil, water and vegetation-related indicators was developed to assess the performance of the innovative technologies and restoration actions. Indicators include soil organic carbon stocks, water use efficiency, NDVI trends, etc. The list includes both biophysical and socio-economic indicators that are needed also for an economic assessment of the restoration actions. The biophysical and socio-economic indicators and metrics collected in Task 2.1 were reviewed and enhanced based on the experience and knowledge of local stakeholders that were thoroughly engaged and consulted during the workshops and subsequently through online verification. Much of the work reported in this deliverable is useful and will be used to assess the biophysical (Task 5.3) and socio-economic (Task 5.4) effectiveness and impacts of proposed restoration measures implemented in the Pilot Areas in the context of WP5. Furthermore, the work provides insights into the cost-benefit analysis and other positive effects of these actions in comparison with present conditions.

1.2 Scope

In the context of the analysis of biophysical and socio-economic indicators relevant for all the pilot areas of the project, this deliverable briefly presents the methodology of data collection and builds on the results as they are described and required by the project.

2 Methodology

2.1 Ecosystem restoration in the ERLs

WP3 uses a multi-actor approach that ensures the involvement of key stakeholders, including practitioners (farmers, extension officers and others) and decision-makers at different levels. The main goal is to use the Ecosystem Restoration Living Labs (ERLLs) as a platform for interaction of stakeholders with project partners for the purpose of communication, learning, demonstration and implementation of cost-effective good practices and approaches for land, water, and agro-ecosystem restoration and for eventual upscaling and outscaling. The ERLs for each of the Pilot Areas and the involved stakeholders act as incubators for testing the effectiveness and eventual transferability of good practices to other areas with similar biophysical and socio-economic conditions. WP3 develops and apply a participatory approach that involves all stakeholders from the start, to enhance the relevance of the knowledge in the project based on local conditions, and to feed what is gathered and assessed in the Pilot Areas into WPs 4, 5, and 6. Special attention was given to ensuring diversity in stakeholder engagement, in particular encouraging participation by

women and the next generation of practitioners such as the youth involved in agricultural, pastoral and ecosystem restoration actions.

2.2 Selection of indicators relevant for each pilot area

A thorough investigation was performed for each pilot area by the focus people in charge in close consultation with the local stakeholders.

The consultation process was carried out in 2 steps, with the aim of i) identifying problems and possible solutions; ii) describe a future vision of the agricultural system in 2043 (working on what are the needs of the agricultural system and the main differences compared to the current situation in the pilot area).

In each pilot area, the narratives of the visions were coded to identify the relevant indicators, that represent specific properties of a certain criterion in a quantitative or qualitative variable manner. The identified indicators were meant to monitor implementation of good practices in the pilot areas.

At a later stage, all identified indicators will be validated through a final consultation of stakeholders in the pilot areas.

It is evident that there are indicators that are relevant to all the pilot areas as well as those that are peculiar to each of them. Furthermore, each indicator was evaluated in detail based on data availability and on its impact on ecosystem recovery or resource base management, with major focus on land and water management.

The following is a table that provides a summary of selected indicators for each pilot area.

Pilot area	Criteria for selection	Bio-physical indicators	Socio-economic indicators	Data availability	Performance of the indicators	
Troodos Mountain (Cyprus)	Coordination and cooperation/ Community empowerment		Number of active farmer organizations/unions	Not at high spatial resolution	Depends on quality, spatial, and temporal resolution of data	
	Environmental sustainability/ Healthy ecosystems	Average LAI in Jun, Aug, Oct, Dec (10 m)		Copernicus		
	Environmental sustainability/ Nature conservation	Number of forest trees (#/km ²)		Copernicus		
	Environmental sustainability/ Nature conservation	Number of forest trees with Diameter at Breast Height > 30 cm (#/km ²)		Copernicus (f(canopy area))		
	Environmental sustainability/ Integration of land uses	% agricultural land/km ² (or /10 km ²)		Corine		
	Environmental sustainability/ Integration of land uses	% forest/km ² (or /10 km ²)		Corine		
	Environmental sustainability/ Integration of land uses	% transitional forest and shrub /km ² (or /10 km ²)		Corine		
	Environmental sustainability/ Integration of land uses	% sparsely vegetated, bare rock and burnt area /km ² (or /10 km ²)		Corine		
	Environmental sustainability/ Integration of land uses	% built up area /km ² (or /10 km ²)		Corine		
	Healthy soils	Soil organic carbon (%) (/km ²)		Geochemical atlas of Cyprus (not open source), EUSO (EU Soil Observatory, JRC), GEMAS (https://gemas.eurogeosurveys.org/)		
	Healthy soils	Soil pH (/km ²)		Geochemical atlas of Cyprus (not open source), EUSO, GEMAS		
	Healthy soils	Bulk density (g/cm ³) (/km ²)		EU Soil Observatory (EUSO), GEMAS		
	Healthy soils	Soil texture (/km ²)		EU Soil Observatory (EUSO), Camera et al (2017)		
	Healthy soils	Soil depth (cm) (/km ²)		EU Soil Observatory (EUSO), Camera et al (2017)		
	Healthy soils	Erosion (ton/ha) (/30m)		EU Soil Observatory (EUSO)		
	Rural revitalization/regional identity			Nr EU support measures for cultural heritage/tourism initiatives	RDP support measures?	
	Rural revitalization/economics			GDP euro/yr (/ km ²)	Wang et al	
	Rural revitalization/ Attractiveness of farming			Nr of young farmers (per community)	Agriculture Census?	
	Social sustainability/population			Population density (/km ²)	Wang et al	
	Social sustainability/population			Population change (/km ²)	Wang et al	
Sustainable use of Resources/circular economy	Green manuring, compost (plots /km ²)			RDP support measures?		
Sustainable use of Resources/circular economy	Distance to green point (recycling) (km)			Green points		

	Sustainable use of Resources/water resources	Long-term changes in groundwater levels (m)		Some		
Heraklion (Greece)	Under the category "Community", stakeholders stated that in the future they would like to see: (a) more young entrepreneurs, (b) more young people handling agricultural machinery (c) more producers groups / agricultural cooperatives, (d) more trade organizations, economy development		Number or percent young entrepreneurs			
			Percentage/number of young people formally trained on agricultural skills			
			Number of agricultural groups and cooperatives			
			GPD per capita			
	Under the category "Economy", stakeholders stated that in the future they would like to see: (a) reduction of meat consumption, (b) local markets and exports of local goods, (c) Local production and consumption of goods and (d) community grocery stores		Meat consumption (kg/person/month)			
			Exports (in euros)			
			Percentage of 0 mileage goods			
			Number of community grocery stores per inhabitant			
	Under the "Science/ education" category, stakeholders stated that in the future they would like to see these: (a) Technological literacy and adoption, (b) Fields under scientific monitoring, (c) Lighthouse and educational farms (living labs)		Number of farmers applying for technology subsidies			
			Number of Pilot areas			
			Number of living labs			
	Under the category "Ecosystem", Stakeholders stated that in the future they would like to see these: (a) more rotations in cultivations and intercropping, (b) reuse of agricultural waste, (c) increase of organic matter in soils, mulching (d) rich biodiversity / balanced ecosystem		Species diversity in agriculture.			
			Tons of organic waste towards valorisation.			
			Soil Organic Matter			
			Species richness			
	Under the "Technology" category, stakeholders stated that in the future they would like to see these: (a) Decentralization of production (b) more decentralized water reservoirs, (c) advanced agricultural infrastructure (d) AI implementation (e) Robots in agriculture (f) PVs, wind energy, internet (g) Mechanization			Number of SMEs in rural areas		
			Number of water reservoirs			
				Length of irrigation network		
				Reach of high-speed internet		
				Length of agricultural roads		
			Number of farmers applying for technology subsidies			
			Number of farmers applying for technology subsidies			
		Number/area of agrivoltaics and renewables				
		Number of farmers applying for technology subsidies				

Stornara and Tara (Italy)	Coordination and cooperation		Community managed assets	Partial data on infrastructures and/or technologies such as irrigation water provision	High
			Network density of social relations	Platforms for farmers associations and water managers	Medium
			Knowledge sharing and cooperation among farmers	Partnerships and cooperation	Medium
		Flood risk management		Flooding (frequency <5 yrs, >5yrs)	>5yrs
		Integration of land uses		Agritourism	High density
		Integration of land uses		Land abandonment	Low
		Integration of land uses		Multifunctionality of agricultural land	
			Science for practice	Appropriate irrigation strategies present	High
			Scientific knowledge accessible	Science-practice exchange and consultation	Medium
			Technical knowledge present	Consultation services present	Medium
		Resource efficiency enhanced through technology	Smart farming; Automation; AI; Digitalisation; Data monitoring;	High	
	Biodiversity in nature	Structural diversity		Physical arrangement of biotic components within ecosystems	Low
	Climate change adaptation and mitigation	Carbon sequestration carbon sinks		Potential for carbon sequestration	Medium
	Connection between people and planet		Environmental awareness of society	People are aware of water, soil, and environment	Medium
			Presence of NGOs	Availability of NGOs creating environmental awareness	Low
		Stewardship of land & environment		Farmers are supported to be stewards of the land; benefits from maintaining the landscape and ecosystem services;	High
	Ecosystem services	Decomposition of SOM in soil		SOM mineralization	High
		Provision of ecosystem services		Services provided	High
		Water storage in soil		Water storage capacity; soil water retention	High
	Education for sustainable development		Recognition of value of farming	Public dissemination of agriculture benefits	High
	Nature conservation		Landscape conservation	Integrity of traditional landscapes; cultivation of traditional crops,	High
	Policy instruments		Support to innovative/ sustainable farming	Institutional (regulatory) and economics barriers or support to innovation farming techniques and change	Medium
			Polluter pays principle implemented		Low
		Support for smallholders	Adaption of market demands for smallholders	High	
Supportive institutional framework		Regulated trade	Reduce reliance on imported food products; stimulate regional trade	High	
	Microbial carbon availability		Needs measurements	High	

Stornara and Tara (Italy)	Biological properties	Microbial Nitrogen availability		Needs measurements	High
		Organic matter decay		Needs measurements	High
		Organic matter turnover		Needs measurements	High
		Root density		Needs measurements	High
		Soil biodiversity		Needs measurements	High
		Soil microbial diversity		Needs measurements	High
	Chemical properties	Cation exchange capacity		Needs measurements	High
		Crop yields and available soil P contents in agricultural soils		Needs measurements	High
		pH, EC, NO3 and metal concentration		Chemical elements related to fertilisation stress and soil pollution	High
		Soil organic matter (SOM)		Soil erosion and degradation index	High
		Soil organic carbon (SOC)		Soil erosion and degradation index	High
		Soil salinity (<4dS/m, > 4dS/m)		Measure of minerals and salts that can be dissolved in water (often > 4dS/m)	High
		Soil sodicity		Needs measurements	High
	Physical properties	Field capacity, wilting point		Needs measurements	High
		Infiltration rate		Needs measurements	High
		Soil bulk density		Needs measurements	High
		Soil texture		Needs measurements	High
		Stone content		Needs measurements	High
		Water storage capacity		Needs measurements	High
	Land degradation	Land degradation status		Overall assessment of the Degradation status in the pilot area (L, M, H).	Medium
		C/N ratio		Soil erosion and degradation index representing the ratio of the mass of carbon to the mass of nitrogen in organic residues	Medium
		Soil erosion intensity (L, M, H)			Low
		Trend of % soil sealed			Low
	Attractiveness of farming		No. of youth and women engaged in farming (% of workforce)	Level of engagement of young people and women in farming	Low
			Sufficient labour present		Low
			Income diversification	Diverse forms of income; combination e. g. with agritourism;	Medium
			Ownership of agricultural land	Land tenure; access rights to agricultural lands	High
		Acceptability of restoration practice		High	
		Accessibility of technologies	Affordable and accessible; accessible to smallholders and local farmers	Medium	
		Affordability of restoration practice	Applying best practice is financially profitable	Medium	
		Feasibility of restoration practice		Medium	
		Farming as main occupation	Reliance on income (single source)	High	

Stornara and Tara (Italy)	Economics		Income level (EUR/day)		High	
			Marketability / competitive advantage	Emergence of new markets; added-value production;	Low	
			Technical readiness of restoration practice		Medium	
	Sustainable use of water resources	Amount/share of water reused			Needs measurements	High
		Area of drip irrigation			More than 50 ha	High
		Performance of drainage system				Medium
		Environmental (water) flows				High
		Groundwater contamination risk (L, M, H)				Medium
		Groundwater quantity				Low
		Groundwater recharge				Low
		Rainfall intensity				High
		Use of alternative water sources			Water stored in reservoirs; water harvesting	High
		Water availability				High
		Water quality				High
		Performance of water supply system				High
		Irrigation water supply costs			Annual cost of water supply per cultivated area	High
Water irrigation/ management efficiency			Rate of irrigation water use efficiency for the different implemented irrigation systems	High		
Water supply / demand ratio of irrigation			Water supply exceeds water demand (No it is the opposite)	High		
Water use efficiency				High		
Canyoles (Spain)	Coordination and cooperation	Community empowerment	No. of agricultural cooperative model/networks	Presence of cooperatives and unions	High	
	Coordination and cooperation	Community empowerment	Knowledge sharing and cooperation among farmers	partnerships and cooperatives; pooling of machines and other resources	High	
	Coordination and cooperation	Integration of land uses	Land abandonment	the impact of land abandonment, Measurement of cultivated land asset per year (against loss of agricultural area)	High	
	Coordination and cooperation	Integration of land uses	multifunctionality of agricultural land	Integrated silvopastoral systems; agritourism; recreation; wildlife observation; renewable energy production; food production; provision of ecosystem services; integration of nature protection and agriculture	High	
	Coordination and cooperation	Science for practice			High	
	Coordination and cooperation	science for practice	Scientific knowledge accessible	connectivity of academia and practice; Science-practice exchange and consultation; State-of-the-art knowledge application; Presence of	High	

Canyoles (Spain)				learning centres and experimentation sites; proximity of academic and agricultural facilities	
	Coordination and cooperation	Technological modernization / innovation	technology to replace unskilled labour		High
	Environmental sustainability	Climate change adaptation and mitigation	Adapted species and breeds used	availability of adapted species and cultivars	High
	Environmental sustainability	Connection between people and planet	Environmental awareness of society	people are aware of water, soil and environment; education and information strategies tackle knowledge-behavior-gap	High
	Environmental sustainability	Connection between people and planet	Stewardship of land & environment	farmers are supported to be stewards of the land; benefits from maintaining the landscape and ecosystem services;	High
	Environmental sustainability	Education for sustainable development	Recognition of value of farming	public dissemination of benefits of agriculture	High
	Good Governance	participatory governance	Bottom-up/participatory decision-making for political goals and rules	Autonomy and local decision-making power	High
	Good Governance	participatory governance	Representation of peoples' visions in political rules and goals	Incorporation of people based long-term vision in political processes	High
	Good Governance	policy instruments	decrease bureaucracy		High
	Good Governance	policy instruments	Support for smallholders	land access; adaption of market demands for smallholders;	High
	Healthy soils	chemical properties	Soil organic matter (SOM)	Soil erosion and degradation index indicating the fraction of the soil that consists of plant or animal tissue in various stages of decomposition	High
	Healthy soils	physical properties	infiltration rate		High
	Rural revitalisation	Attractiveness of farming	No. of youth and women engaged in farming (% of workforce)	Level of engagement of young people and women in farming: trends and opportunities, Participation of young people in agriculture; average age of farming population	High
	Rural revitalisation	Attractiveness of farming	Ownership of agricultural land	land tenure; access rights to agricultural lands	High
	Rural revitalisation	Economics	income level (EUR/day)		High
	Rural revitalisation	regional identity	preserve cultural heritage	traditional landscapes; unique regional identity; traditional practices	High
	Social sustainability	Equity	Gender equality		High
	Sustainable agriculture	Diets	Healthy diets	willingness to pay for healthy food; trend in demand for healthy food products; information on healthy diets is available	High
Sustainable agriculture	Economics	land productivity (t/ha)	utilisation of abandoned land; increase in efficiency; trend in crop yield	High	
Sustainable agriculture	Education	knowledge of good practices	stimulate learning and capacity building; presence of training	High	

				facilities; presence of demonstration sites and hands-on training	
	Sustainable agriculture	Farming Inputs	Share of biological fertilisers and pesticides	trend in organic fertilizers, pesticides and pheromones; composting; green manure; mulching; availability of nature-based solutions	High
	Sustainable agriculture	Soil restoration	Soil cover (bare, covered)	vegetation cover; permanent soil cover	High
	Sustainable use of Resources	Circular economy	Composting of organic wastes	composting, green manure, mulching	High
	Sustainable use of Resources	Sustainable use of water resources	sediment yield		High
Merchouch (Morocco)	Coordination and cooperation	Community empowerment	Community managed assets	Partial data on infrastructures and/or technologies	High
		Community empowerment	Network density of social relations	Platforms for farmers associations and water managers	Medium
		Community empowerment	Knowledge sharing and cooperation among farmers	Partnerships and cooperation	Medium
		Community empowerment	No. of agricultural cooperative model/networks	Survey data	High
		Community empowerment	Consensus decisions	Survey data	High
		Technological modernization / innovation	Resource efficiency enhanced through technology	Survey data	High
		Integration of land uses		Land abandonment	
		Integration of land uses		Multifunctionality of agricultural land	
			Scientific knowledge accessible	Science-practice exchange and consultation	Medium
			Technical knowledge present	Consultation services present	Medium
		Resource efficiency enhanced through technology	Smart farming; Automation; AI; Digitalisation; Data monitoring;	High	
	Biodiversity in nature	Structural diversity		Physical arrangement of biotic components within ecosystems	Low
	Environmental sustainability	Climate change adaptation and mitigation	Carbon sequestration carbon sinks	Potential for carbon sequestration	Medium
		Climate change adaptation and mitigation	Dependence on fossil fuels	Reduced use of fossil fuels with CA	High
		Climate change adaptation and mitigation	GHG emissions	Field measurement	Medium
	Connection between people and planet		Environmental awareness of society	People are aware of water, soil, and environment	Medium
			Presence of NGOs	Availability of NGOs creating environmental awareness	Low
Stewardship of land & environment			Farmers are supported to be stewards of the land; benefits from maintaining the landscape and ecosystem services;	High	
	Decomposition of SOM in soil		SOM mineralization	High	
	Provision of ecosystem services		Services provided	High	

Merchouch (Morocco)	Ecosystem services	Water storage in soil		Water storage capacity; soil water retention	High
	Education for sustainable development		Recognition of value of CA farming	Public dissemination of conservation agriculture benefits	High
	Policy instruments	CA Road Map	Support to innovative/ sustainable farming	Institutional (regulatory) and economics barriers or support to innovation farming techniques and change	Medium
			Financial support	Subsidies	High
			Support for smallholders	Adaption of market demands for smallholders	High
	Supportive institutional framework		Support for smallholders	Provision of seeds, fertilizers and drills	High
	Healthy soil	Biological properties	Microbial carbon availability	Field measurements	High
			Microbial Nitrogen availability	Field measurements	High
			Organic matter decay	Field measurements	High
			Organic matter turnover	Field measurements	High
			Root density	Field measurements	High
			Soil biodiversity	Field measurements	High
		Chemical properties	Soil microbial diversity	Field measurements	High
			Cation exchange capacity	Field measurements	High
			Crop yields and available soil P contents in	Field measurements	High
			pH, EC, and nutrient concentration in soils	Field measurements	High
			Soil organic matter (SOM)	Field measurements	High
			Soil Organic matter quality	Field measurements	High
		Physical properties	Field capacity, wilting point	Needs measurements	High
			Infiltration rate	Needs measurements	High
			Soil bulk density		
	Soil texture		Needs measurements	High	
	Soil compaction		Needs measurements	High	
	Water storage capacity		Needs measurements	High	
	Land degradation	Land degradation	Land degradation status	Overall assessment of the Degradation status in the pilot area (L, M, H).	Medium
			C/N ratio	Soil erosion and degradation index representing the ratio of the mass of carbon to the mass of nitrogen in organic residues	Medium
			Soil erosion intensity	Rainfall simulation	Low
			Trend of % soil sealed and runoff	Infiltration and rainfall simulation studies	Low
			Overgrazing	Survey data	High
			No. of youth and women engaged in Conservation agriculture farming (% of workforce)	Level of engagement of young people and women in CA farming	High

Merchouch (Morocco)	Rural revitalization	Attractiveness of farming	Sufficient labour present		High
			Income diversification	Diverse forms of income; combination e. g. with agritourism;	High
			Ownership of agricultural land	Land tenure; access rights to agricultural lands	High
		Rural-urban connectivity	Presence of urban farming and community gardening and agroecology	Survey data	Medium
		Economics	Accessibility of CA technologies	Affordable and accessible; accessible to smallholders and local farmers	High
			Affordability of CA technologies	Applying best practice is financially profitable	High
			Feasibility of CA practice	Adoption studies	High
			Farming as main occupation	Reliance on income (single source)	High
			Income level (EUR/day)	Survey	High
			Marketability / competitive advantage	Emergence of new markets; added-value production;	High
	Technical readiness of CA practice		Survey	High	
	Rural revitalisation				
	Social sustainability	Social inclusivity		Survey data	High
		Human health and wellbeing	health impacts from pesticides	Survey data	High
		Resource access	Resource distribution equality	Survey data	High
		Gender equity		Survey data	Medium
	Sustainable agriculture	Farming Inputs	Input uses including seeds and mechanization	Field and survey data	High
			Nitrogen and P fertilization	Field and survey data	High
			Weed and pest control	Field and survey data	High
		Economics	land productivity (t/ha)	Survey data	High
			Farm size and other features	Field and survey data	High
			No. of livestock and cattle units per year	Field and survey data	High
			No. of youth and women engaged in farming (% of workforce)	Survey data	High
			Farm income (per crop, per year, total)	Survey data	High
		Education	Knowledge intensive agriculture	Level of knowledge from surveys/ No. of skilled workers	High
			Training opportunities for young and female farmers and NGOs	Questionnaires and information from local authorities	High
			Extension service (efficiency and functionality)	Questionnaires and information from local authorities and farmers (ONGs)	High
		Trend of land consumption	Survey and information from local authorities	Medium	
		Land cover/ vegetation cover; permanent soil cover	Satellite data	Medium	

		Soil restoration	CA acreage	Survey data	High
			No. of CA and agroecological farms	Survey data	High
		Food Security	Pillars	Survey data and information from public administration	Medium
Bethlehem of Galile (Israel)	Financial		Cost/ quantity of herbicide and pesticide per kg of produced yield	central bureau of statistics	high
	Social		readiness of consumer's percentage of spending on agricultural produces	central bureau of statistics	medium
	Governance		governmental support for conservation management	ministry of environment	high
	Social		ratio between monoculture and conservation agriculture	soil atlas	medium
	Social		land use change (agriculture to other)	soil atlas	high
	Governance		investment in clean technologies	central bureau of statistics	medium
	Social		meat consumption per capita	central bureau of statistics	medium
	Social/ physical	change in agricultural produce per soil degradation percentage		-	high
	Remote sensing	percentage of degraded soils		sentinel 2 - google earth engine	high
	Remote sensing	soil coverage		sentinel 2 - google earth engine	medium
	Transboundary indicators	vulnerability to climate change (Agricultural Vulnerability Index (AVI))		FAO	high
	Soil resilience	Aggregate stability		Own samples	high
	Soil resilience	biodiversity index		Own samples	high
	Soil resilience	Soil structure		Own samples	high
	Soil resilience	Bulk density		Own samples	high
	Soil resilience	Buffering capacity		Own samples	high
	Soil resilience	organic matter in soils		Own samples	high
	Soil resilience	microbial biomass carbon (MBC)		Own samples	high
	Soil resilience	Presence of key microbial groups		Own samples	high
	Soil resilience	soil porosity		Own samples	high
Soil resilience	Soil respiration		Own samples	high	
Soil fertility	N		Own samples	high	
Soil fertility	P		Own samples	high	
Soil fertility	K		Own samples	high	
Lower Gediz (Turkey)	Community: a) Higher income b) Clean food c) Raised population in rural areas, villages, d) Younger population e) Education status	Community empowerment	Migration not from the village to the city but from the city to the village because life in the village has improved, the earnings cover the labor, so people are happy	Integrated systems, food production, provision ecosystems	High
		Community empowerment	Clean food communities can establish and by organizing continuous information meetings, clean production and therefore clean food is accessible to everyone	partnerships and cooperatives	High

Lower Gediz (Turkey)			The increase in the number of schools in rural areas in the near future, the widespread use of co-op farming, and the increase in migration from cities to villages were the common views of every participant in the group.		High
		Community empowerment	In the countryside, three generations live together. the second and third generations benefit from the experience and knowledge of the second generation and everyone is happy. in the cities there is a return to the countryside and the crowds in the cities are spread out in the countryside, leading to a longer and happier life.		High
		Science for practice	The age of the farmers is young and educated, the elderly rest at home because they have passed on their experiences to young farmers who have received academic education, and they rest peacefully and healthily in their homes. There are a lot of small family farms. They do not only produce for sale, they produce and grow enough to meet their own needs.		High
	Agriculture a) Large scale and integrated farms b) Biodiversity c) Nature-based solutions d) The basin-based production model e) water harvesting f) integrated systems planning	Soil OM, OC, Nitrogen, residue analyses	livestock, crop production, waste control, etc.		High
		Species richness, crop rotation	Different species and varieties are cultivated, not only for the richness of biodiversity, but also to reduce soil fatigue and have fertile soil.	Crop maps	High
		Number of water reservoir, number of water harvest plant	composting, green manuring, mulching Agriculture, in which pesticides and chemicals are used sparingly and which may pose problems for the environment and human health, has been abandoned	m ³ available water	High
		Soil alkalinity and salinity management, drainage management, water management	a separate production planning is made in accordance with the socio-economic situation, climate, water resources and soil fertility of each basin. Since the market is regulated under the same state policy, there is no loss of profit or unfair gain.	Water table levels map	High
		Water management	Consolidation and water harvesting practices that will reduce land losses	Water distribution maps	High

Lower Gediz (Turkey)			in agricultural production are increasing		
		Water quality and quantity management (irrigation water quality analyses) Soil physical analyses (FC, WP, bulk density) Infiltration rate Soil texture	integrated models emerge that will provide irrigation, fertilization, and revision of the system after production and harvest for the continuity of production. In this way, less water, fertilizer, pesticides and pollution occur.	Soil fertility maps	High
	Environment				
	a) Less chemical use	Water management	Water is distributed through closed canals. Wild irrigation is prohibited.	Scarcity of water, Annual cost of water supply per cultivated area	High
	b) Protected water resources (dam consolidation, modern/pressurized irrigation techniques, water harvesting, closed channels for distribution of irrigation water, clean potable and drinking water, new dams and irrigation ponds, proper functioning of drainage systems)	Water management	to save water, water harvesting is practiced in production areas and roof rain harvesting in buildings.	Scarcity of water	High
	c) Cycle	Marginal water management and quality analyses (EC, pH, NO ₃ , fecal coliform, Na etc.)	Treated wastewater and gray water are used as irrigation sources.	Scarcity of water, Rate of irrigation water use efficiency	High
	d) Climate change adaptation and mitigation	Sustainable agriculture and resource uses. SOM, Pesticides and harmful residue analyses. Water content in soil Ecosystem services	The waste from raw materials used in agriculture is converted into energy, that energy is used in production, and thanks to the proper functioning of production policies, the profit is satisfactory. The profit is reinvested, and raw materials are purchased for agricultural production.		High
Technology				Medium	
a) Automation and robots, AI, smart agriculture techniques and combination of drones and satellite images are being used for irrigation, fertilization and spraying.					
b) Fully automated cultivation and harvesting,					
c) Less fossil fuels, more solar and wind energy					
d) Electrical and driverless tractors and machinery, robotic systems					
Education					
a) Increase in the level of education, specialization in agriculture is increasing. On-site and applied agricultural education		farmers and agricultural engineers are highly qualified with hands-on training. The level of agricultural education of young producers and specialization in agriculture is increasing. On site and applied agricultural education is developing.		High	

Lower Gediz (Turkey)	<p>Management, Markets & Policy</p> <p>a) Management, Markets & Policy Farmers' organizations and cooperatives for better income and also low price for consumers, no intermediaries</p> <p>b) Regional and national policies for sustainable agricultural production (inputs such as water, energy and fertilizer used during production are supported by the state) are designed by the Ministry at least for a period of ten years.</p> <p>c) Well operated agricultural insurances</p>		Producers market fresh and fast products through a farm-to-table trade network. They have created their own markets. Producers earn good money for their labor in a clean environment.		High	
			market agricultural products collectively in farmer organizations they create rather than marketing them individually.		high	
Tamia (Egypt)	Sustainable agriculture, use of resources and supportive framework	Circular economy	Composting of organic wastes	composting, green manure, mulching	High	
		Farming Inputs	Share of biological and nitrogen and phosphorus fertilisers	trend in organic fertilizers, pesticides and pheromones; composting; green manure; mulching	High	
			Support for smallholders	seeds, fertilizers (N and P) and drills	High	
	Soil analysis	Biological properties		Support for smallholders	Weed and pest control	High
				Microbial carbon availability	Field measurements	High
				Microbial Nitrogen availability	Field measurements	High
				Organic matter	Field measurements	High
				Soil biodiversity	Field measurements	High
				Soil microbial diversity	Field measurements	High
		Chemical analysis		Cation exchange capacity in the soil	Field measurements	High
				Crop yields and available soil P contents in	Field measurements	High
				pH, EC, and nutrient concentration in soils	Field measurements	High
				Soil organic matter	Field measurements	High
				Field capacity, wilting point	Field measurements	High
				Soil texture	Field measurements	High
Physical analysis		Water holding capacity	Field measurements	High		

3 Results

Summary of the findings of this deliverable:

1. How relevant these indicators are for each pilot area?

Data collected showed that the long list of selected indicators points out the main drivers affecting the sustainability of natural resources use and management. During the collection process an effort was made to evaluate the performance of each indicator. It is very encouraging that most of the selected indicators have been marked as high by the local stakeholders. Such work will be essential for the outcomes of WP5 that will deep in socio-economic analysis of the impacts of restoration measures. In addition, a monitoring system will be established to check and monitor even after the lifetime of the project the effectiveness of the restoration measures based on the selected indicators and their performance.

2. Are all the data collected able to perform the restoration evaluation for each ERL?

There is strong belief that the wealth of data collected is adequate for ecosystem restoration assessment and for all the necessary analyses. Nevertheless, in the due course of the project and especially after the third workshop with stakeholders' other indicators may be included.

3. What is the opinion of local stakeholders on the selected list of indicators?

All the indicators were selected thoroughly consultation with local stakeholders who expressed their interest and opinions for each of them. It appears relevant that socio-economic ones take particular importance especially in terms of income level. However, also bio-physical indicators appear to have interest especially those related to soil health that directly affect crop yield and ecosystem recovery in degraded areas.

Summary of the results of this deliverable:

The results of this exercise will serve many purposes:

1. Monitoring the performance of selected indicators

The performance of each selected indicator will be based on data availability. The main purpose of this deliverable was to identify those most relevant for each pilot area.

2. Identification of gaps between indicators performance and real status on each pilot area

The performance of indicators was assessed as high, medium, and low. This was done on expert assessments, but based on a thorough evaluation of the local conditions and especially on the inputs that were collected during the stakeholder's workshops. The real conditions in each pilot area expose a great diversity between them, but at the same time allow to identify the main trends in each of them and could claim with confidence that each selected indicator is adequate for ecosystem recovery assessment.

3. Identifying barriers and opportunities for change in restoration actions

Changing ordinary management practices is not easy for farmers, herders and foresters who are used to their work styles. For instance, in the pilot area of Canyoles (Spain) only one farmer is

implementing chopping of branches coming out of grafting olive groves. Despite he's convinced that this practice improves soil health and increases soil moisture, other farmers are reluctant to implement it. The same in the Stornara and Tara pilot area in Italy. Only few farmers are willing to implement organic farming in their fields, while the rest remains confident that conventional agriculture based on excessive use of chemical inputs is the most profitable one. It appears difficult to establish an equilibrium between profit and environmental quality.

4. Developing the background aspects for policy-related outcomes

One of the major outcomes of this deliverable is the input towards establishing policy-related findings to promote ecosystem recovery. Yet there is a gap between research and policy implementation. This deliverable, in addition to offer a detailed list of indicators able to assess the status of natural resources, mostly land and water, also provides an overwhelming assembly of bio-physical and socio-economic indicators, that can be used as background of policies needed to change the status quo in degraded landscapes.

5. Disseminating the results in the REACT4MED through its website and other REACT4MED dissemination tools.

The results along with the list of indicators for each pilot area will be disseminated through the project's web site and the social media tools. However, the most important dissemination component will be the interaction with local stakeholders who will be informed about the results of the work done and will be consulted regarding the implementation and monitoring of each indicator.