Collaboration on glocal aspects:
Examples from the Mediterranean

"The Earth Talks"

GLOBAL FORUM ROME, Italy **5-9 MAY, 2025**

Community Event
EO for Land: The power of collaboration for country impact

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Medenine

Background

NewLife4Drylands LIFE20 PRE/IT/000007	Remote sensing-oriented nature-based solutions towards a new life for drylands [2021-2024]
MONALISA	MONitoring and Assessing prevention and restoration soLutIons to combat desertification [2024-2028]
LANDSHIFT	Community-Led Creation of Living Spaces in Shifting Landscapes for Climate-Resilient Land Use Management and Supporting the New European Bauhaus [2024-2027]

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The Challenge

Problem: To provide local decision-makers (e.g., Protected Area managers, National Park authorities, etc.) with evidence-based information for the design and assessment of Nature-Based Solutions to combat land degradation.

Proposed solution: evaluate and promote the use of remote-sensing EO

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Activity **FOCUS**

1

Highlight the role and importance of EO from **remote sensing** for NBS design and assessment

2

Focus on local aspects and their relationship to global aspects (**glocal**)

3

Adoption of EO for **decision-making** at local level (e.g., protected area managers, national park authorities)

4

Case studies and prototypes of services in the **Mediterranean region**

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Case studies

NewLife4Drylands

MONALISA

LandShift

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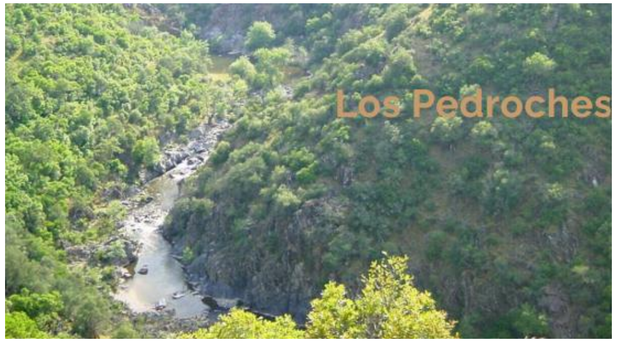
Case studies

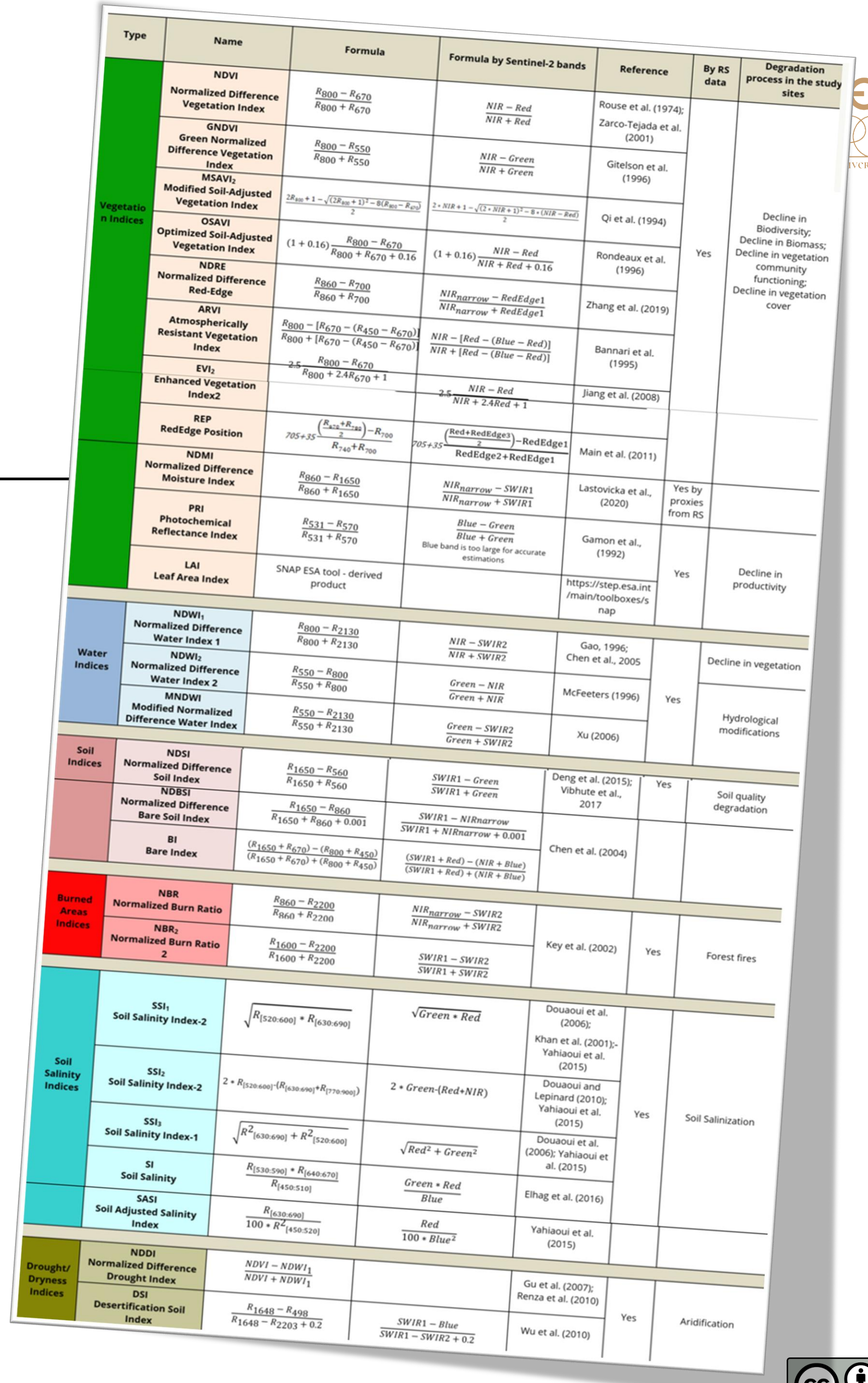


EO for local monitoring

Constraints

- use of **well-known remote sensing indicators and spectral indices** (E.g., for reliability in the estimation of land degradation, for inter-comparison)
  - Full set of **26 indicators of interest** from the scientific and technical literature

- Use of **free and open satellite data** as much as possible (E.g. for long time series requirements, cost-effectiveness, simple usage policy)
  - Long-term monitoring back before 2015 - **Landsat** data (30 m)
  - Medium/short-term monitoring after 2015 - **Sentinel-2** data (10-20 m);



Type	Name	Formula	Formula by Sentinel-2 bands	Reference	By RS data	Degradation process in the study sites
Vegetation Indices	NDVI Normalized Difference Vegetation Index	$\frac{R_{800}-R_{670}}{R_{800}+R_{670}}$	$\frac{NIR-Red}{NIR+Red}$	Rouse et al. (1974); Zarco-Tejada et al. (2001)	Yes	Decline in Biodiversity; Decline in Biomass; Decline in vegetation community functioning; Decline in vegetation cover
	GNDVI Green Normalized Difference Vegetation Index	$\frac{R_{800}-R_{550}}{R_{800}+R_{550}}$	$\frac{NIR-Green}{NIR+Green}$	Gitelson et al. (1996)		
	$MSAVI_2$ Modified Soil-Adjusted Vegetation Index	$\frac{2R_{800}+1-\sqrt{(2R_{800}+1)^2-8(R_{800}-R_{670})}}{2}$	$\frac{2*NIR+1-\sqrt{(2*NIR+1)^2-8*(NIR-Red)}}{2}$	Qi et al. (1994)		
	OSAVI Optimized Soil-Adjusted Vegetation Index	$(1+0.16)\frac{R_{800}-R_{670}}{R_{800}+R_{670}+0.16}$	$(1+0.16)\frac{NIR-Red}{NIR+Red+0.16}$	Rondeaux et al. (1996)		
	NDRE Normalized Difference Red-Edge	$\frac{R_{860}-R_{700}}{R_{860}+R_{700}}$	$\frac{NIR_{narrow}-RedEdge1}{NIR_{narrow}+RedEdge1}$	Zhang et al. (2019)		
	ARVI Atmospherically Resistant Vegetation Index	$\frac{R_{800}-[R_{670}-(R_{450}-R_{670})]}{R_{800}+[R_{670}-(R_{450}-R_{670})]}$	$\frac{NIR-[Red-(Blue-Red)]}{NIR+[Red-(Blue-Red)]}$	Bannari et al. (1995)		
	EVI_2 Enhanced Vegetation Index2	$2.5\frac{R_{800}-R_{670}}{R_{800}+2.4R_{670}+1}$	$2.5\frac{NIR-Red}{NIR+2.4Red+1}$	Jiang et al. (2008)		
	REP RedEdge Position	$705+35\frac{\left(\frac{R_{670}+R_{780}}{2}\right)-R_{700}}{R_{740}+R_{700}}$	$705+35\frac{\left(\frac{Red+RedEdge3}{2}\right)-RedEdge1}{RedEdge2+RedEdge1}$	Main et al. (2011)		
	NDMI Normalized Difference Moisture Index	$\frac{R_{860}-R_{1650}}{R_{860}+R_{1650}}$	$\frac{NIR_{narrow}-SWIR1}{NIR_{narrow}+SWIR1}$	Lastovicka et al., (2020)	Yes by proxies from RS	
	PRI Photochemical Reflectance Index	$\frac{R_{531}-R_{570}}{R_{531}+R_{570}}$	$\frac{Blue-Green}{Blue+Green}$ Blue band is too large for accurate estimations	Gamon et al., (1992)	Yes	Decline in productivity
	LAI Leaf Area Index	SNAP ESA tool - derived product		https://step.esa.int/main/toolboxes/snap		
Water Indices	$NDWI_1$ Normalized Difference Water Index 1	$\frac{R_{800}-R_{2130}}{R_{800}+R_{2130}}$	$\frac{NIR-SWIR2}{NIR+SWIR2}$	Gao, 1996; Chen et al., 2005	Yes	Decline in vegetation
	$NDWI_2$ Normalized Difference Water Index 2	$\frac{R_{550}-R_{800}}{R_{550}+R_{800}}$	$\frac{Green-NIR}{Green+NIR}$	McFeeters (1996)		Hydrological modifications
	MNDWI Modified Normalized Difference Water Index	$\frac{R_{550}-R_{2130}}{R_{550}+R_{2130}}$	$\frac{Green-SWIR2}{Green+SWIR2}$	Xu (2006)		
Soil Indices	NDSI Normalized Difference Soil Index	$\frac{R_{1650}-R_{560}}{R_{1650}+R_{560}}$	$\frac{SWIR1-Green}{SWIR1+Green}$	Deng et al. (2015); Vibhute et al., 2017	Yes	Soil quality degradation
	NDBSI Normalized Difference Bare Soil Index	$\frac{R_{1650}-R_{860}}{R_{1650}+R_{860}+0.001}$	$\frac{SWIR1-NIRnarrow}{SWIR1+NIRnarrow+0.001}$	Chen et al. (2004)		
	BI Bare Index	$\frac{(R_{1650}+R_{670})-(R_{800}+R_{450})}{(R_{1650}+R_{670})+(R_{800}+R_{450})}$	$\frac{(SWIR1+Red)-(NIR+Blue)}{(SWIR1+Red)+(NIR+Blue)}$			
Burned Areas Indices	NBR Normalized Burn Ratio	$\frac{R_{860}-R_{2200}}{R_{860}+R_{2200}}$	$\frac{NIR_{narrow}-SWIR2}{NIR_{narrow}+SWIR2}$	Key et al. (2002)	Yes	Forest fires
	NBR_2 Normalized Burn Ratio 2	$\frac{R_{1600}-R_{2200}}{R_{1600}+R_{2200}}$	$\frac{SWIR1-SWIR2}{SWIR1+SWIR2}$			
Soil Salinity Indices	SSI_1 Soil Salinity Index-2	$\sqrt{R_{[520:600]}*R_{[630:690]}}$	$\sqrt{Green*Red}$	Douaoui et al. (2006); Khan et al. (2001);- Yahiaoui et al. (2015)	Yes	Soil Salinization
	SSI_2 Soil Salinity Index-2	$2*R_{[520:600]}\cdot(R_{[630:690]}+R_{[770:900]})$	$2*Green\cdot(Red+NIR)$	Douaoui and Lepinard (2010); Yahiaoui et al. (2015)		
	SSI_3 Soil Salinity Index-1	$\sqrt{R^2_{[630:690]}+R^2_{[520:600]}}$	$\sqrt{Red^2+Green^2}$	Douaoui et al. (2006); Yahiaoui et al. (2015)		
	SI Soil Salinity	$\frac{R_{[530:590]}*R_{[640:670]}}{R_{[450:510]}}$	$\frac{Green*Red}{Blue}$	Elhag et al. (2016)		
	SASI Soil Adjusted Salinity Index	$\frac{R_{(630:690]}}{100*R^2_{[450:520]}}$	$\frac{Red}{100*Blue^2}$	Yahiaoui et al. (2015)		
Drought/ Dryness Indices	NDDI Normalized Difference Drought Index	$\frac{NDVI-NDWI_1}{NDVI+NDWI_1}$		Gu et al. (2007); Renza et al. (2010)	Yes	Aridification
	DSI Desertification Soil Index	$\frac{R_{1648}-R_{498}}{R_{1648}-R_{2203}+0.2}$	$\frac{SWIR1-Blue}{SWIR1-SWIR2+0.2}$	Wu et al. (2010)		

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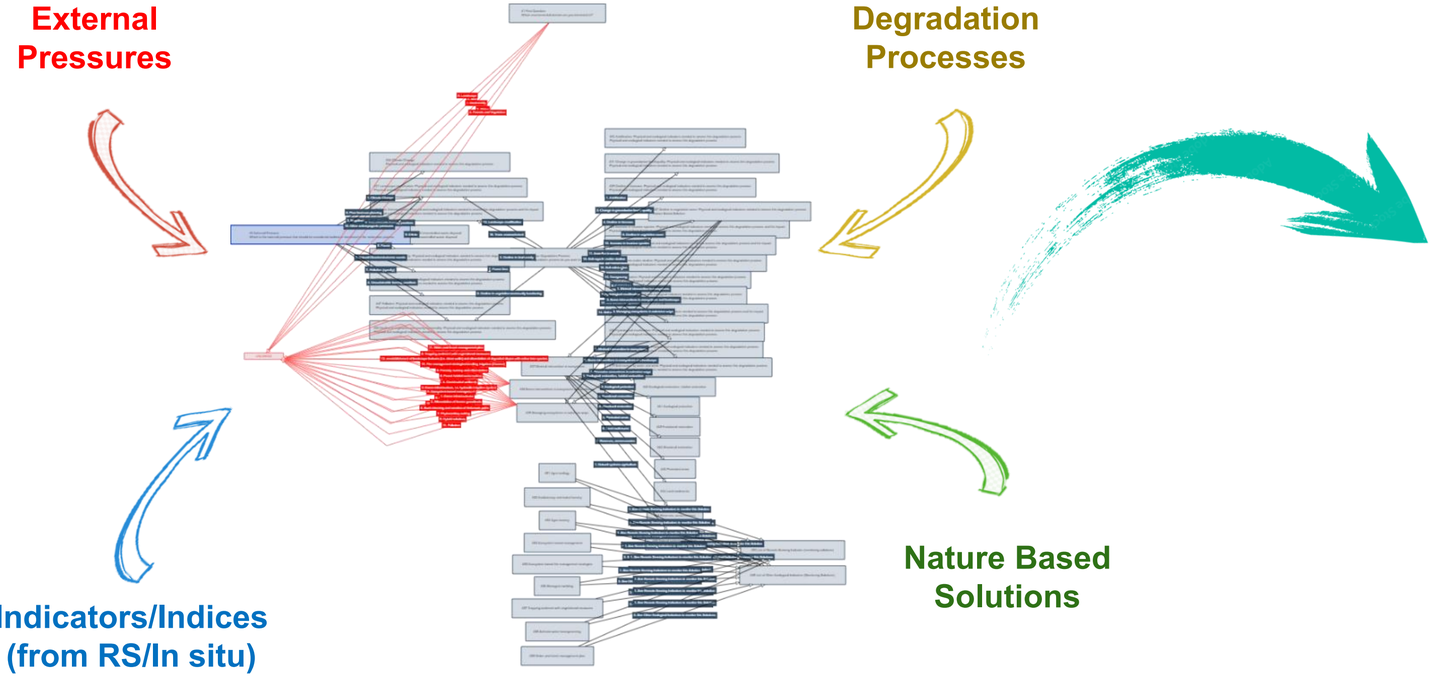
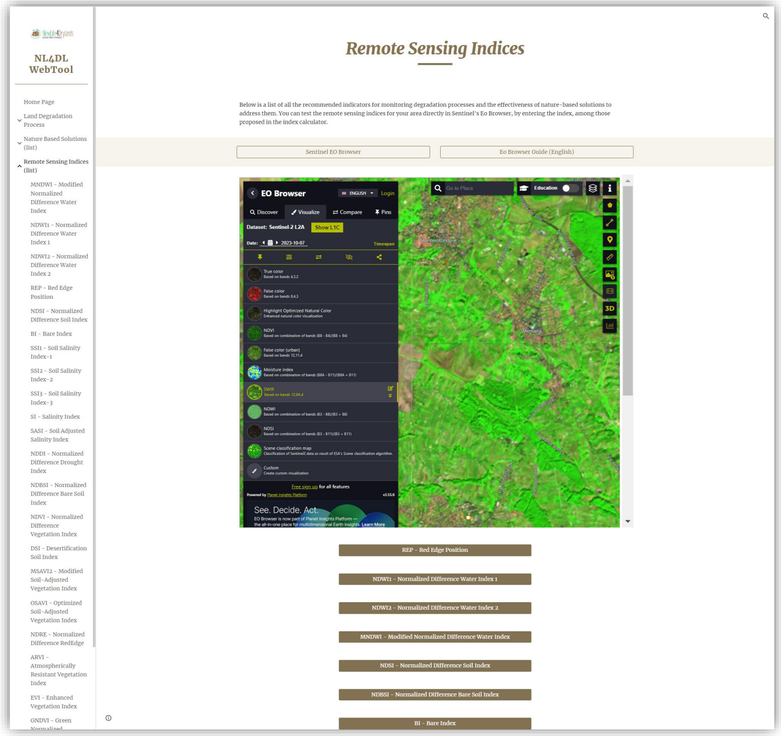
NewLife4Drylands Monitoring Model

DECISION SUPPORT MODEL





WEB TOOL

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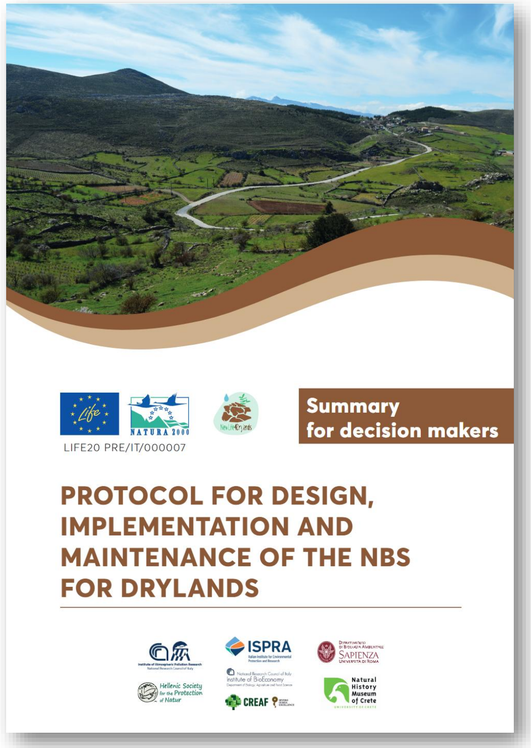
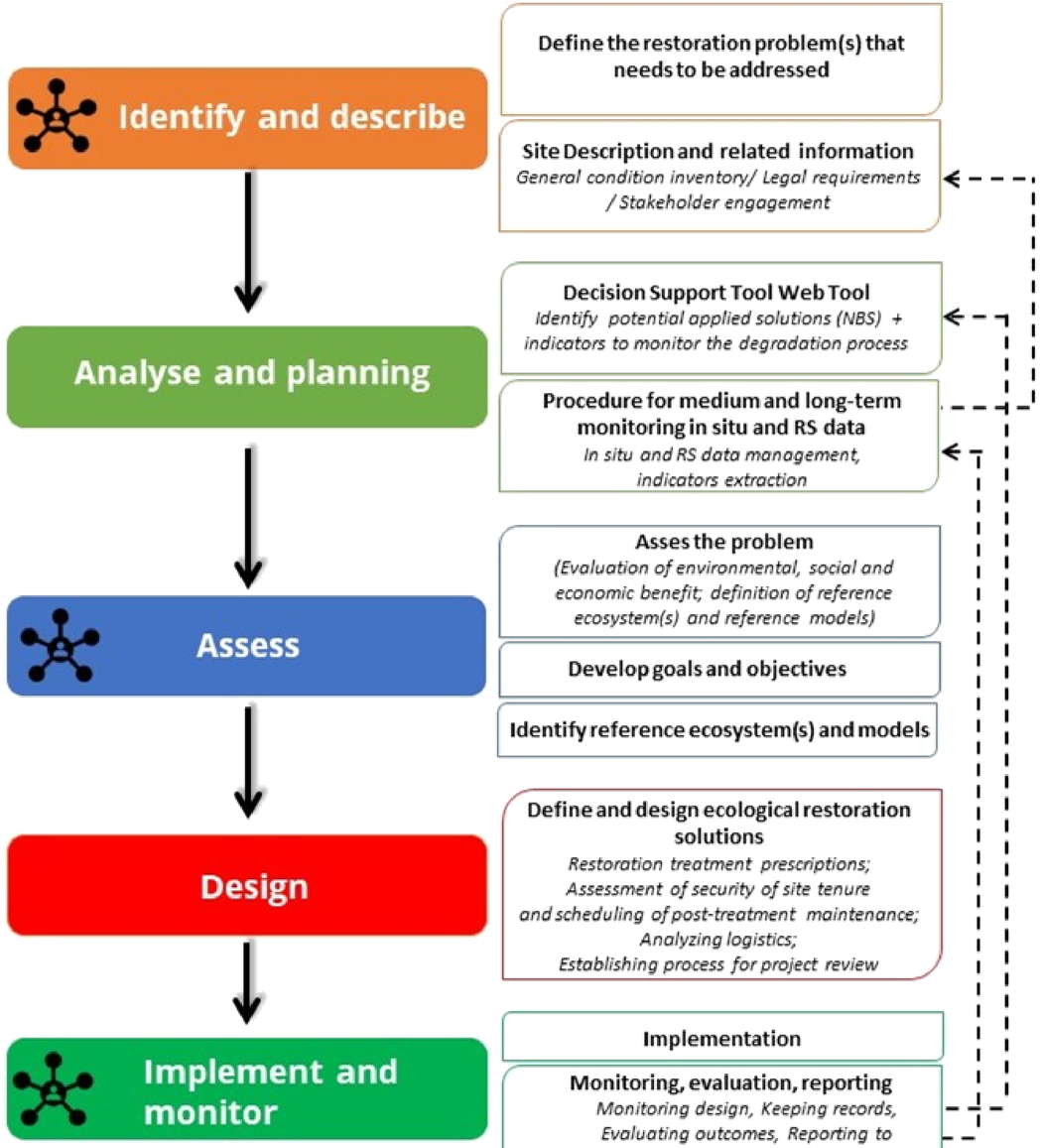
NewLife4Drylands Protocol

- Help decision makers and end users in the identification of the process for the restoration activities of degraded soils;
- Define the process that addresses both the process of restoring degraded soils and the medium and long-term monitoring of the effectiveness of proposed restoration solutions (NBS);
- Guide to the identification of specific/local solutions (NBS) for dryland restoration, starting with the identification of degradation processes (Catalogue of best practices/solutions (NBS) applied in the NL4DL project);
- Raise awareness of dryland NBS needs and opportunities.





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Networking and collaboration

GEOSS PLATFORM PLUS

Life Nieblas

LIFE DELTA

Life Terra

TECMINE
INNOVATIVE TECHNIQUES FOR MINE RESTORATION

LifePRIMED
LIFE17 NAT/GR/000511

life Guguy

NRD - Desertification Research Centre

LIFE ATIAS

soil4life
What is essential is invisible to the eye

ERA-PLANET

LAND SUPPORT

TERRASAFE
Cultivating resilience, restoring the earth.

TheGreenLink

DESERT ADAPT

ERA-PLANET
The European network for observing our changing planet

UNIVERSITY OF OXFORD

LAND DEGRADATION NEUTRALITY

LIFE STEMMA THOS

EJP SOIL
European Joint Programme

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Summary

- **Innovation**: effective use of EO for NBS design and assessment at local level; Monitoring Model and Protocol; sub-indicators for SDG 15.3.1 at local level
- **Collaboration**: Strong interaction with stakeholders (local administrations, academy, government, industry), networking with projects/initiatives, living labs approach
- **Country Impact**: Mediterranean region (Greece, Italy, Spain, *France*, *Tunisia*, *Palestine*), with involvement of local stakeholders and case studies
- **Role of GEO**: part of the original activity design; EuroGEO LU/LI Action Group (and Green Deal Data Spaces Action Group); GEO LDN; GEO Statement on Open Knowledge.

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https://www.newlife4drylands.eu/en/ [**NewLife4Drylands Web site**]

https://monalisa4land.eu/ [**MONALISA Web site**]

https://landshift.eu/ [**LandShift Web site** (under construction)]

https://sites.google.com/view/newlifefordrylands/home-page [**Monitoring Model / Web Tool**]

https://zenodo.org/records/11565224 [**Protocol**]

THANK YOU!

NewLife4Drylands
LIFE20 PRE/IT/000007

LANDSHIFT

MONALISA

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