Sustainable Pathways for Mediterranean Agro-Ecosystems: Insights from the REACT4MED Project

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Introduction

Land degradation and desertification represent escalating threats to Mediterranean agro-ecosystems, driven by unsustainable land and water management practices, population pressures, and climate change. The REACT4MED project addresses these challenges through dual direction approach (Figure 1) and a transnational partnership of scientists, practitioners, and policy actors across the Mediterranean. Its objective is to enhance sustainable land and water management to restore degraded lands, support agroecosystem productivity, and improve community livelihoods. Eight pilot areas across the Mediterranean region tested and upscaled proven solutions (Figure 2).

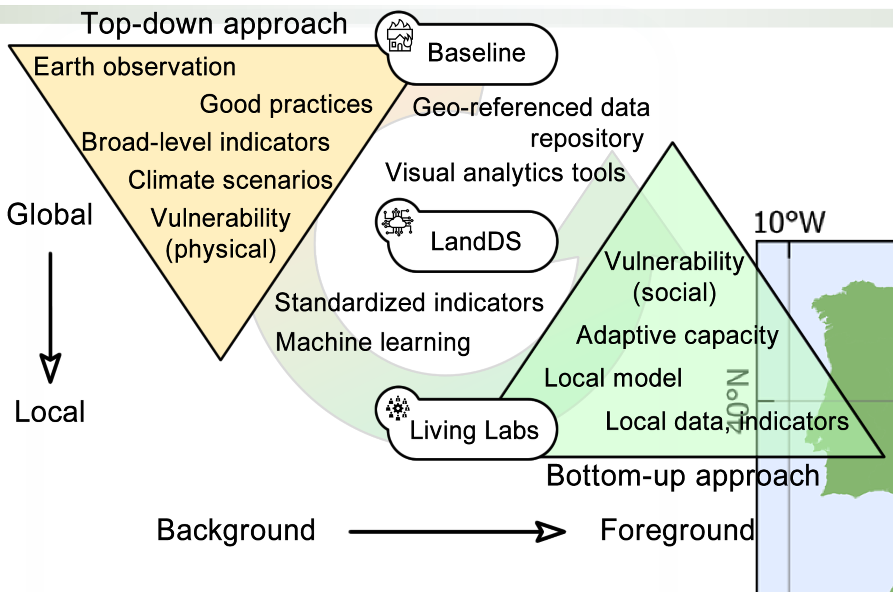

Figure 1. The REACT4MED concept.

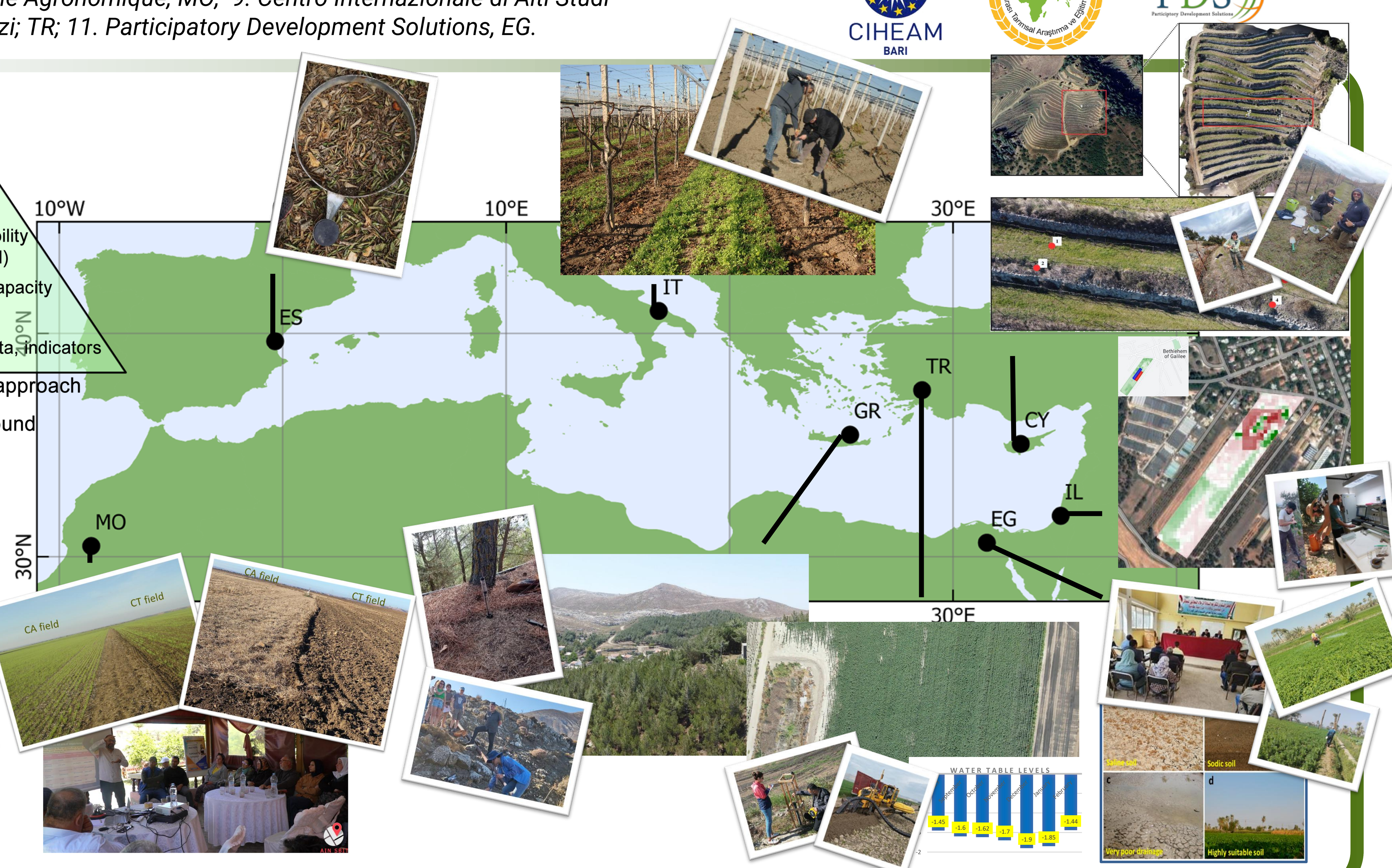

Figure 2. The REACT4MED Pilot Areas supporting traditional terrace restoration to combat soil erosion (CY), afforestation actions against soil erosion (GR), efficient water use management against salinity control and organic farming (IT), improved residue management using to combat soil erosion and biodiversity loss (ES), Supporting conservation agriculture to combat soil erosion and mitigate drought impact (MO), the establishment of food forests to boost biodiversity and alternative incomes (IL), and improved drainage measures to mitigate extreme soil salinity (TR).

Ecosystem Restoration Living Labs

At the core of REACT4MED are Ecosystem Restoration Living Labs (ERLLs), which engage local stakeholders in co-developing sustainability indicators, capacity-building initiatives, and decision-support frameworks. To achieve our objective, we performed over 30 workshops with over 800 unique participants of which over 30% women.

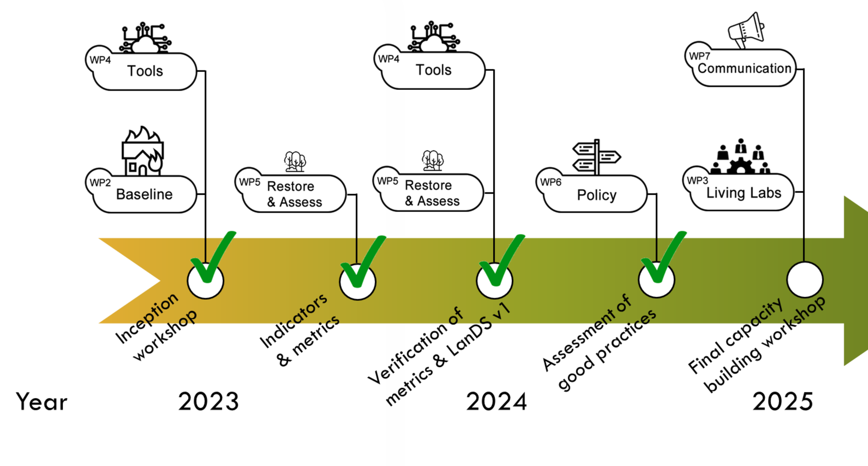

Figure 3. The REACT4MED workshop plan.

Figure 4. ERLL workshops at the eight Pilot Areas.

Historical and new scientific results and impact studies

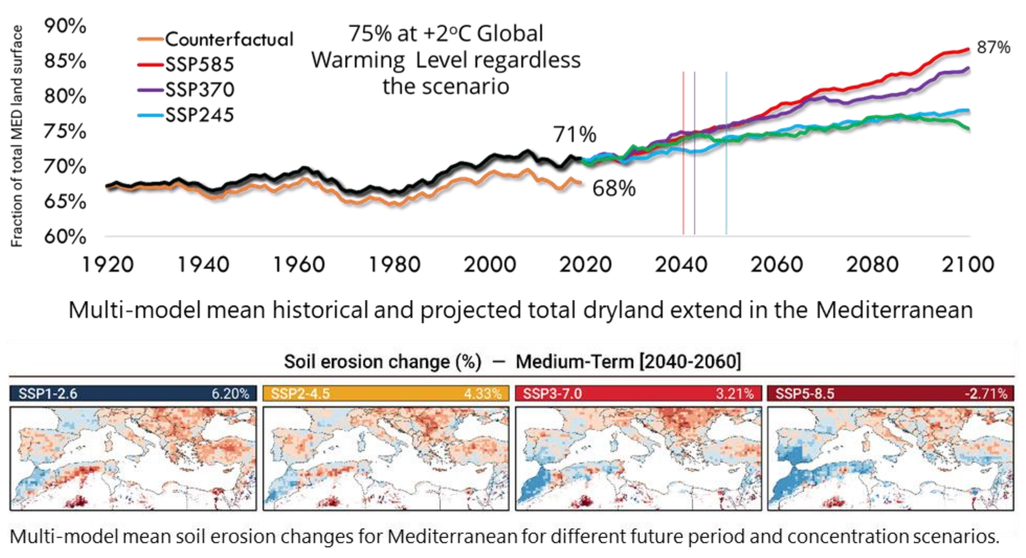

Figure 5. Historical and future climate for the Mediterranean drylands.

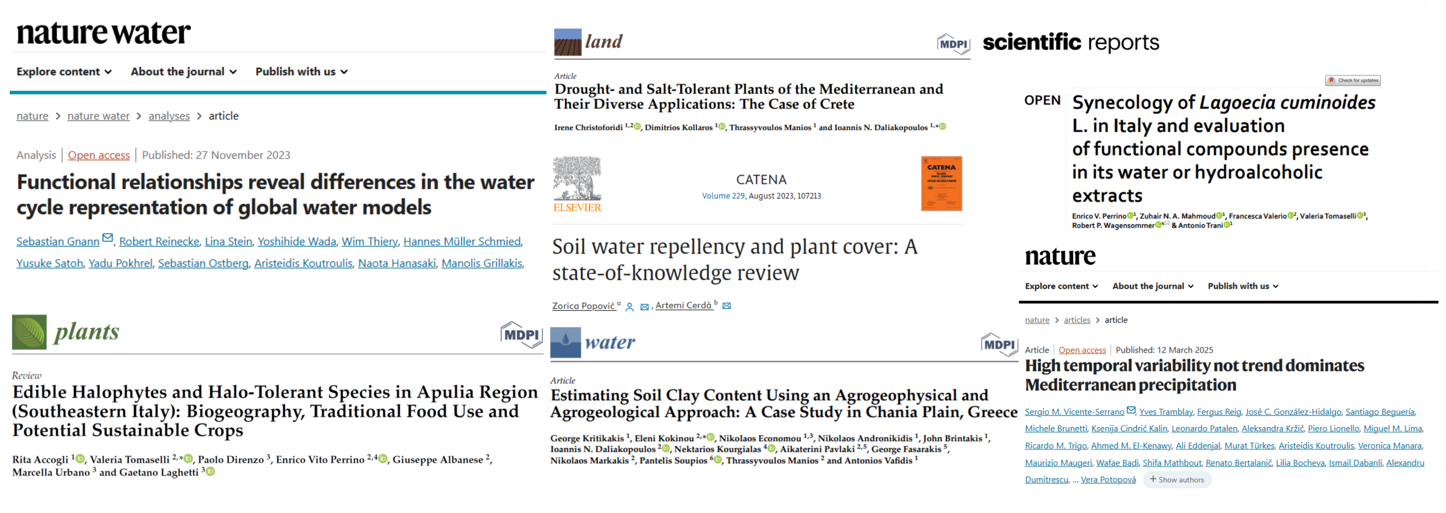

Figure 6. Some of the REACT4MED journal publications.

Background (Figure 5) and new REACT4MED Pilot Area studies (Figure 6) provided critical evidence on the effectiveness of agroecological practices across the Mediterranean. Meta-analyses and impact assessments helped identify the approaches the deliver tangible benefits for soil, water, and community resilience, forming the basis for the selection and out-scaling.

Land degradation Decision-Support Toolbox

Complementing this participatory work, and scaling on field observations and scientific results, REACT4MED employs advanced machine learning and remote sensing to generate suitability maps (Figure 4) that guide where these practices can be most successfully applied. This data-driven approach provides a spatial framework for decision-making, ensuring that interventions are adapted to local ecological conditions, and together with future climate information can deliver long-term impact.

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Figure 4.Suitability map for terraces based on the terraces studied at the Cyprus PA.

Policy recommendations

- EU policy framework on ecosystem restoration is coherent, even though the status of policy implementation differs from country to country, based on the institutional capacities they possess.
- Non-EU countries often lack the capacities and personnel to implement and follow policy implementation and have a deficit in policy coherence
- However, ongoing initiatives in the region are making headway to integrated and inclusive governance of water, food, energy and ecosystems
- Shared policy approach is a must for the stability and resilience of the region SDGs achievement, mainly related to ecosystem restoration, is challenging

Conclusions

What is at stake is nothing less than the stability and resilience of Mediterranean agro-ecosystems under a warming climate. Continued degradation risks undermining food production, accelerating migration, and eroding cultural landscapes. REACT4MED demonstrates that effective restoration requires both cutting-edge data science and deep local engagement, offering a clear pathway to scaling up restoration efforts, fostering investment in sustainable land management, and ensuring that Mediterranean societies can adapt and thrive in the face of global change.

Key messages

“ **Sustainability is real, restoration is urgent**

“ **People in the field understand the local problems better**

“ **Shared policy approach is a must for the stability and resilience of the region**

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PARTNERSHIP FOR RESEARCH AND INNOVATION IN THE MEDITERRANEAN AREA

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