

Why do research and innovation on adaptation of farming systems to Climate Change



The Mediterranean region is particularly vulnerable to the adverse impacts of climate change, including prolonged droughts, increased temperatures, and extreme events. These challenges threaten the stability of traditional farming practices, which have been integral to the region's culture and economy. Therefore, research and innovation are essential to develop and implement climate-resilient agricultural strategies, such as drought-resistant crop varieties, improved irrigation methods, agroecology practices and sustainable land management techniques. These innovations contribute to global food security while reducing the

environmental footprint of agriculture. In addition, they foster economic growth and adaptability, thus promoting the long-term sustainability of the Mediterranean region's agricultural sector in the face of an ever-changing climate.

PRIMA Funded Projects Adaptation

	Incremental adaptation	System Adaptation	Transformative adaptation
	34	45	11
	304	453	113
	36.13 M	66.46 M	25.98 M

Selection of a few projects logos





Potential Outcomes from Projects

1. Incremental adaptation to climate Change

Incremental adaptation of farming systems to climate change involves a gradual, ongoing process of making small, manageable adjustments in agricultural practices. This adaptation approach often includes measures such as **shifting planting dates**, selecting more **resilient crop varieties**, **adjusting irrigation and water management**, and **integrated pest management**

Crop Resistant Varieties

- IMPRESA project tested the resistant of 80 lines of **Durum wheat** heat, drought and salt stresses in Italy, Turkey and Algeria. The current results revealed that R69-9/R5 recombinant line has resulted highly heat and salt tolerant, both in tests under controlled conditions and in natural environments, including that of Biskra, one of the hottest regions in Algeria
- The project LEGUMED is valorizing neglected genotypes and wild crop relatives (**lentils and chickpeas**). 125 accessions of **lentil and chickpea** has been selected.
- CEREALMED identified new resistant and more adapted varieties of **durum wheat and legumes** with capacity of adaptation across different environments around the Mediterranean basin and suitable for conservation agriculture
- The project IMPRESA has identified new QTL for **strawberry** resistance to grey mold and powdery mildew diseases
- GENDIBAR is analyzing heat-tolerant of **barley landraces** in different mediterranean biotopes

Adjusting irrigation and water Management

11 funded projects (**Factsheet irrigation**) have developed frugal innovations such as sensors, data analytics, and automation, smart irrigation systems enable precise monitoring and control of water delivery to plants. This promotes water conservation by minimizing wastage and preventing overwatering, particularly in the Mediterranean region facing water stress or drought condition.

Integrated Pest Management Integrated Pest Management (IPM) considered as an incremental innovation in agriculture involves a step-by-step approach to pest control that seeks to reduce the reliance on chemical pesticides and instead emphasizes a combination of preventive measures, monitoring, and targeted interventions. This method represents incremental change because it builds on existing pest management practices by gradually introducing new techniques, such as biological controls, resistant crop varieties, and cultural practices.

- The project ZeroParasitic is studying the broomrape management for two important crops tomato and faba bean. In Spain, the project is investigating the effect of tomato rootstock to improve broomrape parasitism in greenhouses experiments. In Tunisia, Greenhouse and field experiments have been conducted to screen the faba germplasm for resistance to broomrapes. In Morocco, IAV Hassan II collected a set of germplasm basically contrasting, and conducted field trials to test the effect of shifted sowing dates of faba bean as an integrated pest management approach
- The project GeMed: This project is using IPM tools with essential oils, intercropping, mulches, and yellow traps. Trials with topical applications of dsRNA or siRNA on plants will provide results on the efficiency and feasibility of this technique to control geminiviruses. The project is also screening the accessions belonging to the Cucurbita genus for the resistance to germiniviruses (ToLCNDV).

2. System adaptation to climate Change

System adaptation of farming systems to climate change represents **the second, more comprehensive step** in addressing the impacts of a changing climate. Unlike incremental adaptation, which involves gradual adjustments, system adaptation entails a fundamental rethinking and restructuring of **the entire agricultural framework**. This approach may involve transitioning to **more diversified farming systems**, implementing **agroecological practices**, and **redesigning land use and water management strategies to enhance overall resilience and sustainability**. System adaptation seeks to create a more holistic and resilient agricultural system capable of withstanding the long-term challenges posed by climate change, rather than making small-scale adjustments.

Soil Management projects

28 projects dealing with soil management (Factsheet soil) since they involve comprehensive and transformative changes to the way soil is managed within the larger farming system.

Agro-ecology practices: Agro-ecology practices involve diversifying crops, integrating livestock, reducing chemical inputs, and fostering synergies between ecological and agricultural components. Below some examples:

- The project 4CEMED is adopting camelina as a **cash cover crop**, assuring short term economic profit to Mediterranean farmers. The emerging oilseed crop Camelina is introduced as a cash- cover crop to increase farmers' revenue, while enhancing soil and water conservation.
- The project HALOFARMS is **combining halophytes and crop species** in salt affected soils
- PLANTB is adopting a **mixed framing** systems Citrus/Medical plants/honeybees
- CHANGE-UP project is adopting the **rotation cereals/Legumes**
- UTOPIQ project is introducing a **new variety of tomato** able to thrive in **intercropping**
- SUSTAINOLIVE project is improving the sustainability of the olive oil sector, through the implementation and promotion of a set of innovative sustainable management solutions, based on **agroecological concepts**
- CAMA and ConSeveTerra projects are working on the conservation agriculture approach in the Mediterranean particularly how to overcome the barriers of the adoption

Agropastoral projects: Projects focused on enhancing agropastoralism within existing frameworks, improving traditional practices in the Mediterranean region

- PAS-AGRO-PAS project aims to increase productivity, adaptiveness, sustainability and profitability of agropastoral systems in 8 Mediterranean countries, through a systemic approach leveraged on the multifunctionality of resilient agro-pastoralism
- SUREPASTOR aims to improve the socioeconomic status of agro-pastoralism farmers in marginal areas and make it appealing, suitable and rentable for women and younger generation

3. Transformative adaptation to climate Change

Transformation adaptation of farming systems, as the **third and most profound level of adaptation**, goes beyond incremental and systemic changes. It involves a radical shift in the fundamental structure, objectives, and paradigms of agriculture. Transformation adaptation reimagines farming in response to the most severe and persistent climate change impacts, such as **shifting to entirely new crop varieties** or **alternative farming methods**. Transformation adaptation represents a paradigm shift that is necessary for addressing **the most extreme climate challenges** and achieving long-term food security.

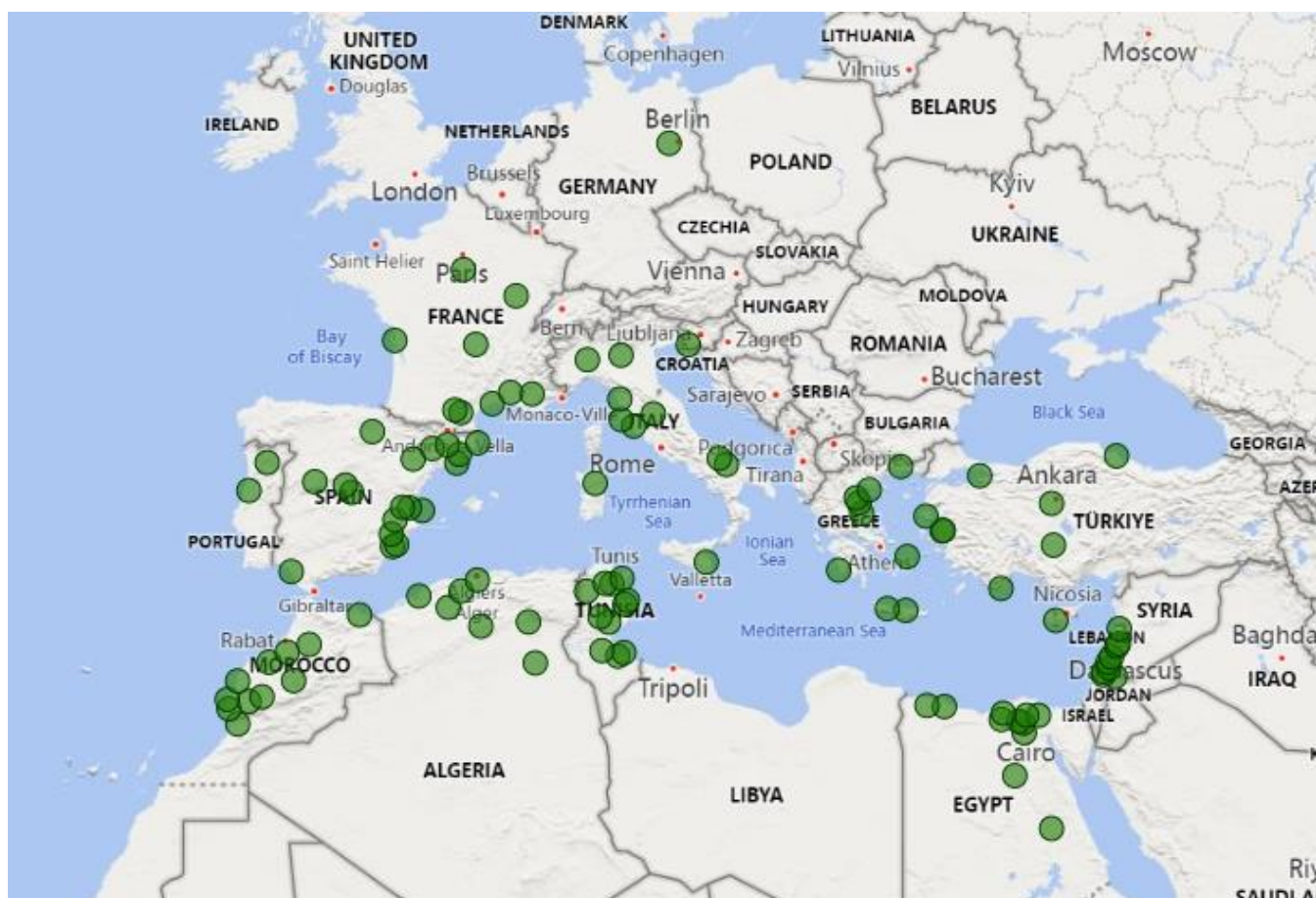
- **WEFE Nexus projects:** Projects that focus on the Water-Energy-Food-Ecosystems (WEFE) Nexus are typically considered a form of transformative adaptation. These projects aim to address the complex interconnections and trade-offs between water, energy, food, and ecosystems, and they often involve substantial changes to existing systems, policies, and practices to enhance sustainability and resilience
 - AWESOME and SIMTAP projects implemented aquaponics and hydroponics in several Mediterranean

countries

- WaterMed and SureNexus implemented transformative adaptation through Agrophotovoltaic systems designed to combine solar energy production with agricultural activities.
- **Agroforestry:** It strengthens the farming system's ability to withstand extreme weather events, such as droughts and floods. It provides alternative income sources through the sale of tree products, reinforcing economic resilience.
 - The project MA4SURE is implementing an integration of agroforestry and mixed farming system. Based on this integrative approach, the project will deliver results and recommendations to guide farmers, institutions, and policymakers towards strengthening their capacity to formulate long-term strategies for restoring and improving Mediterranean agroecosystems under climate change.

Demonstration sites

Demonstration sites serve as practical, real-world showcases of innovative solutions and practices designed to enhance adaptation of farming systems to climate change. They offer a platform for farmers, researchers, and the broader community to see the effectiveness of these innovations firsthand, facilitating knowledge transfer and promoting their adoption. They allow also researchers to gather data, monitor results, and fine-tune their approaches based on on-site experiences, fostering continuous improvement. Additionally, they can serve as hubs for collaboration, enabling stakeholders to exchange ideas and collectively develop and refine climate-smart farming solutions.



109 Demonstration sites

PRIMA Projects on Adaptation and Mitigation

Incremental Adaptation –Crop varieties and breeds

Project	Title
IMPRESA	IMProving RESilience to Abiotic stresses in durum wheat: enhancing knowledge by genetic, physiological and “omics” approaches and increasing Mediterranean germplasm biodiversity by crop wild relatives-based introgressomics
DIVICIA	Use and management of Vicia species for sustainability and resilience in biodiversity based farming systems
CEREAMED	Enhancing diversity in Mediterranean cereal farming systems
GENDIBAR	Utilization of local genetic diversity for studying barley adaptation to harsh environments and for pre-breeding
EXPLOWHEAT	Exploring durum wheat genotypes to minimize drought stress impact on grain yield and nutritional quality
BRASEXPLOR	Wide exploration of genetic diversity in Brassica species for sustainable crop production
FIGGEN	Valorising the diversity of the fig tree, an ancient fruit crop for sustainable Mediterranean agriculture
FREECLIM	FRUIT CROPS RESILIENCE TO CLIMATE CHANGE IN THE MEDITERRANEAN BASIN
MEDBERRY	Developing new strategies to protect strawberry crop in the Mediterranean countries
PULPING	Development of Pumpkin Pulp Formulation using a Sustainable Integrated Strategy
SCALAMEDI	Improving sustainability and quality of Sheep and Chicken production by leveraging the Adaptation potential of Local breeds in the MEDITerranean area.
VEG-ADAPT	ADAPTING MEDITERRANEAN VEGETABLE CROPS TO CLIMATE CHANGE-INDUCED MULTIPLE STRESS
MEDPOMESTONE	Valorizing some pome and stone fruit germplasm variability to ensure resilience to climate change in the Mediterranean area
LEGUMED	Legumes in biodiversity-based farming systems in Mediterranean basin

Incremental Adaptation -Water saving

Project	Title
PRECIMED	Precision Irrigation Management to Improve Water and Nutrient Use Efficiency in the Mediterranean Region
MEDWATERICE	Towards a sustainable water use in Mediterranean rice-based agro-ecosystems
DATI	Digital Agriculture Technologies for Irrigation efficiency
HANDYWATER	Handy tools for sustainable irrigation management in Mediterranean crops
INTEL-IRRIS	Intelligent Irrigation System for Low-cost Autonomous Water Control in Small-scale Agriculture
IRRIWELL	A novel plant-based approach to estimate irrigation water needs of orchards for an optimal water management
HUBIS	Open innovation Hub for Irrigation Systems in Mediterranean agriculture
IDEWA	Irrigation and Drainage monitoring by remote sensing for Ecosystems and Water resources management
SMARTIES	Real time smart irrigation management at multiple stakeholders’ levels
MED-WET	Improving MEDITerranean irrigation and Water supply for smallholder farmers by providing Efficient, low-cost and nature-based Technologies and practices
SMACUMED	Smart irrigation cube for sustainable agriculture in the Mediterranean region

Incremental Adaptation - Integrated Pest Management

Project	Title
INTOMED	Innovative tools to combat crop pests in the Mediterranean
GEMED	Prevention and control of new and invasive geminiviruses infecting vegetables in the Mediterranean
LAGMED	Improvement of preventive Actions to Emerging Lagoviruses in the MEDiterranean basin: development and optimisation of methodologies for pathogen detection and control
BLEU-MED	A novel integrated and sustainable approach to monitor and control Bluetongue spread in the Mediterranean Basin
ZEROPARASITIC	Innovative sustainable solutions for broomrapes: prevention and integrated pest management approaches to overcome parasitism in Mediterranean cropping systems
ECHINO-SAFEMED	New sustainable tools and innovative actions to control cystic ECHINOcoccosis insheep farms in the MEDiterranean area: improvement of diagnosis and SAFETy in response to climaticchanges
BIOPESTICIDES	Development of Bio-Pesticides and -Herbicides for Sustainable Agricultural Crop Production
MED4PEST	MEDiterranean alliance for ecological PEST management
VINEPROTECT	Ecological survey for biological management and protection of Mediterranean vineyards facing climate changes
SAFWA	ALTERNATIVE BIOPESTICIDES FOR SAFE INTEGRATED PEST AND WATER MANAGEMENT AROUND MEDITERRANEAN

System Adaptation

Project	Title	
SUSTAINOLIVE	Novel approaches to promote the SUSTAInability of OLIVE cultivation in the Mediterranean	
Revine	Regenerative agricultural approaches to improve ecosystem services in Mediterranean vineyards	
ISFERLADA	Improving Soil FERTility in Arid and semi-arid regions using Local DATE palm residues	
REACT4Med	Inclusive Outscaling of Agro-ecosystem REStoration ACTions for the MEDiterranean	
4CE-MED	CAMELINA: A CASH COVER CROP ENHANCING WATER ANDSOIL CONSERVATION IN MEDITERRANEAN DRY-FARMING SYSTEMS	
ADVAGROMED	ADVanced AGROecological approaches based on the integration of insect farming with local field practices in MEDiterranean countries	
ProSmallAgriMed	Promoting soil fertility, yield and income in smallholder agriculture of semiarid and arid Mediterranean regions by management of beneficial soil microbiota, conservation agriculture and intercropping.	
Optimus Prime	OPTIMal USage of natural product and biological PRIMing agents to improve rEsilience of agrosystems to climate change	
SUSFORAGE	Sown forage mixtures for sustainable agroecosystems in the Mediterranean area	
RESCHEDULE	RESilient to Climate CHange Extremes MeDiterranean AgricUltural Systems: LEveraging the Power of Soil Health and Associated Microbiota	
CAMA	Research-based participatory approaches for adopting Conservation Agriculture in the Mediterranean Area	
CONSEVATERRA	Overcoming the physical and mental barriers for upscaling Conservation Agriculture in the Mediterranean	
FARMS4CLIMATE	Smart governance and operational models for agroecological carbon farming	N
TRANSITION	InnovaTive Resilient fArmiNg Systems in MediTerranean envlRnments	
SHARIng-MeD	Soil Health and Agriculture Resilience through an Integrated Geographical information systems of Mediterranean Drylands	
SOIL4MED	Soil health monitoring and information systems for sustainable soil management in the Mediterranean region	
RECROP	Bioinocula and CROPPing systems: an integrated biotechnological approach for improving crop yield, biodiversity and RESilience of Mediterranean agro-ecosystems	
RESIDUE	Risk reduction of chemical residues in soils and crops – impact due to wastewater used for irrigation	
HALOFARMS	Development and Optimization of Halophyte-based Farming systems in salt-affected Mediterranean Soils	
PlantB	A sustainable mixed cropping-beekeeping system in the Mediterranean basin	

Biodiversity	Boost ecosystem services through highly Biodiversity-based Mediterranean Farming sYstems
ValueFarm	ALorization of Mediterranean small-scale FARMS by cropping wild UnExploited species
Greenplam	Development of sustainable date palm-based agro systems by preserving their biodiversity.
UTOPIQ	Use of Tomato lines tolerant to Proximity shade to Increase yield and Quality in intercropping agrosystems
MEDGOAT	Goat farming systems characterization and novel strategies to sustain production in the changing climate scenario in the Mediterranean regions
PAS-AGRO-PAS	The Making of Fragile Agro-ecosystems Productive, Adaptive and Sustainable: Multifunctional Agro-pastoralism
SUREPASTOR	Management Strategies to Enable SUsustainable REsilient AgroPASTORalism
Pastinnova	Innovative models for sustainable future of Mediterranean pastoral systems
AGRECOMED	NEW AGROECOLOGICAL APPROACH FOR SOIL FERTILITY AND BIODIVERSITY RESTORATION TO IMPROVE ECONOMIC AND SOCIAL RESILIENCE OF MEDITERRANEAN FARMING SYSTEMS
AGRI-FISH	Circular economy application: from the field to the net. Sustainable and innovative feeds from agricultural wastes for a resilient and high-quality aquaculture.
ASTER	Agroecology-inspired Strategies and Tools to Enhance Resilience and ecosystem services in tomato crop
BENEFIT-MED	Boosting technologies of orphan legumes towards resilient farming systems in the Greater Mediterranean Region: from bench to open field
BioMEnext	Modelling integrated biodiversity-based next generation Mediterranean farming systems
DREAM	Diversified orchards for REsilient and sustAinable Mediterranean farming systems
Mara-Mediterra	Safeguarding the livelihood of rural communities and the environment in the Mediterranean through Nature-based Solutions
SALAM-MED	Sustainable Approaches to LAnd and water Management in MEditerranean Drylands
ECOBOOST	Boosting functional biodiversity to maximize ecosystem services for Mediterranean crop production
HALOSHEEP	Agroecological sheep/goat production system based on the valorisation of halophytes of saline areas in the Mediterranean basin
Quinoa4Med	Quinoa as a climate-smart crop diversification option for higher income generation from marginal lands in the Mediterranean
ReMe-diation	Resilient Mediterranean with a holistic approach to sustainable agriculture: Addressing challenges of water, soil, energy and biodiversity
SUSTEMIOCROP	Development of eco-sustainable systemic technologies and strategies in key Mediterranean crops systems, contributing to small farming socio-economic resilience.
VALMEDALM	VALorization of MEDiterranean ALMond orchards through the use of intercropping integrated strategies
SEAFUNNEL	Innovative sustainable organic sea fennel (<i>Crithmum maritimum</i> L.) - based cropping systems to boost agrobiodiversity, profitability, circularity, and resilience to climate changes in Mediterranean small farms
CAMEL-SHIELD	Camel breeding systems: actors in the sustainable economic development of the northern Sahara territories through innovative strategies for natural resource management and marketing
Supertout	Improving sustainability and performance of aquaculture farming system: breeding for lactococcus resistance in rainbow trout

Transformative Adaptation

Project	Title
MA4Sure	Mediterranean Agroecosystems for Sustainability and Resilience under Climate Change
SIMTAP	SELF-SUFFICIENT INTEGRATED MULTI-TROPHIC AQUAPONIC SYSTEMS FOR IMPROVING FOOD PRODUCTION SUSTAINABILITY AND BRACKISH WATER USE AND RECYCLING
ADVAGROMED	ADVanced AGROecological approaches based on the integration of insect farming with local field practices in MEDiterranean countries
AWESOME	mAnaging Water, Ecosystems and food across sectors and Scales in the sOuth MEDiterranean
SIGMANEXUS	Sustainable Innovation and Governance in the Mediterranean Area for the WEF Nexus
LENSES	Learning and action alliances for Nexus environments in an uncertain future
NEXUS-NESS	Sustainable Innovation and Governance in the Mediterranean Area for the WEF Nexus
BONEX	Boosting Nexus Framework Implementation in the Mediterranean
SURENEXUS	Ensure fair NEXUS transition for climate change adaptation and sustainable development implementation based on coupled nature-based systems and bioeconomy.
FRONTAG_NEXUS	Impact of Climate-Smart and Water-Saving Frontier Agriculture on the WEF Nexus in Arid Mediterranean Regions
ECIFUTURE	A socio-ecological approach to combat desertification for a sustainable future

Relevant sources of information supporting Adaptation of farming to climate change

Initiatives such as EIP-AGRI, Partnerships (focused on accelerating the transition to sustainable farming systems through agroecology living labs and research infrastructures), and EU missions, especially the Missions "A Soil Deal for Europe" and "Mission Adaptation to Climate Change," offer valuable support to projects funded by PRIMA

EIP-AGRI activities

- Circular Horticulture
- Nature-Based Solutions for water management under climate change
- Protecting agricultural soils from contamination
- Soil salinisation
- Water & agriculture: adaptive strategies at farm level
- New irrigation systems from oval pipes with low flow emitters for better management and use of water
- Resilient and sustainable use of resources towards efficient water and land management
- Surface irrigation optimization in traditional crops of stable meadows and rice for groundwater protection
- Precision agriculture for processing vegetables to improve the management of water, fertilizer and pesticide

EU Mission Adaptation to Climate

EU Mission Soil

Partnership Accelerating farming systems transition: agroecology living labs and research infrastructures

Other interesting Funded projects in the Mediterranean region



- **CARDIMED** CARDIMED: Climate adaptation and resilience demonstrated in the Mediterranean region, €19.3 Million
- **SASi-SPI**: Sustainable Agri-Food Systems Intelligence – Science-Policy Interface (SASi-SPI) is a 5-year € 11.5 Million