Climate Change Adaptation in Agriculture and Forestry in the Mediterranean Region

Summaries on participating LIFE projects

LIFE project financed in 2008

AdaptFor

Adaptation of forest management to climate change in Greece (LIFE08 ENV/GR/c)

This project aims to demonstrate that forest management can be adapted to climate change, while enhancing the capacity of forest services. The project will also inform all stakeholders why it is necessary to adapt forest management to climate change.

LIFE projects financed in 2010

Crops for better soil

Profitable organic farming techniques based on traditional crops: contrasting soil degradation in the Mediterranean (LIFE10 ENV/ES/000471**)**

The Crops for better soil project aimed to show that the application of organic farming techniques can make cultivation of semi-arid land economically viable, by demonstrating an alternative to current erosive farming practices and land abandonment in areas with vulnerable dry soil types. The project examined optimal combinations of methodologies (crop rotation; fertilisation with compost; and re-introduction of traditional crops) to achieve the best soil and crop quality results for specific soil and climate conditions.

LIFE projects financed in 2011

AgroStrat

Sustainable strategies for the improvement of seriously degraded agricultural areas: The example of Pistachia vera L. (LIFE11 ENV/GR/000951)

This project will develop and demonstrate an integrated approach for the sustainable management of intensively cultivated areas in the Mediterranean, such as the pistachio producing areas on the island of Aegina. It will identify and characterise practices that contribute to soil degradation; define soil quality indicators; and develop a software tool so that farmers and farmers' networks can monitor soil quality.

RESILFORMED

Resilience to Climate change in Mediterranean forests (LIFE11 ENV/IT/000215)

The project's broad aim is to preserve forest ecosystems in the face of the risks related to climate changes, by promoting naturalisation processes and biodiversity increase, and by improving the resilience of ecosystems to environmental stress. The specific objective of the project is to implement a regional forest policy that will increase the resilience of Sicilian forests and favour biodiversity conservation.

OPERATION CO2

Integrated agroforestry practices and nature conservation against climate change (LIFE11 ENV/ES/000535)

The overall objective of this project is to demonstrate the economic viability and environmental validity of agroforestry carbon sequestering projects in Europe. The

first pillar of this project will promote active nature conservation and carbon management in natural forests over an area of 4 500 ha. Through implementing a series of targeted forest and carbon actions, the goal is to achieve the long-term improvement of carbon sequestering in natural forests. The project thus hopes to deliver the certification of carbon credits for the forest area that will subsequently be released on the Voluntary Carbon Offsets Market. The second pillar of the project will involve the transformation of two naturally degraded areas – each covering 25 ha - into integral agroforest ecosystems.

LIFE projects financed in 2012

CarbOnFarm **Technologies to stabilize soil organic carbon and farm productivity, promote waste value and climate change mitigation** (LIFE12 ENV/IT/000719)

The project intends to address the basic requirements concerning the sustainable use of agricultural soils through the restoration and preservation of soil properties; valorisation of the economic and environmental role of soil as a resource in agro ecosystems; and improved agricultural biomass recycling. The main objective is to monitor and improve the quantity and quality of soil organic matter (SOM) in agricultural soils. This will be achieved by applying environmentally-sustainable SOM management methods. The project will also adopt "on-farm" composting facilities for valorising residual biomass from local farming activities.

SOLMACC **Strategies for Organic- and Low-input-farming to Mitigate and Adapt to Climate Change** (LIFE12 ENV/SE/000800)

This project aims to promote the wider adoption of sustainable agriculture practices that contribute both to a reduction in greenhouse gas emissions and the mitigation of other environmental issues caused by agriculture, such as soil erosion, biodiversity conservation and sustainable management of natural resources. The project will implement and demonstrate four climate-friendly farm practices (optimised on-farm nutrient recycling, optimised crop rotation with legume-grass leys, optimised tillage system and agroforestry) in 12 organic farms in Sweden. These practices are expected to reduce greenhouse gas emissions by 15 % as well as increasing the resilience of the agricultural sector to climate change.

MEDACC **Demonstration and validation of innovative methodology for regional climate change adaptation in the Mediterranean area** (LIFE12 ENV/ES/000536)

The LIFE MEDACC project will trial some of the measures proposed in Catalonia's Strategy for Climate Change Adaptation. Demonstration activities will take place in three selected watersheds where adaptation measures in water use, agriculture and forest management will be tested.

Zaragoza Natural **Development and management of Green Infrastructure in Zaragoza** (LIFE 12 ENV/ES/000567)

The aim of this project is to protect, improve, give value to and raise awareness of the existing biodiversity in Zaragoza, including Natura 2000 network sites and other areas of natural interest within the city's boundaries. This will be done by defining and improving the ecological status, connectivity and coherence of green infrastructure in

Zaragoza. The project is structured around a 'blue matrix' - rivers, riversides and wetlands - and a 'green matrix' - forest and steppe areas - and their inter-connectivity.

LIFE projects financed in 2013

ENERBIOSCRUB **Sustainable management of shrubs formations for energy purposes** (LIFE13 ENVES/000660)

This project aims to obtain sustainable solid biofuels from biomass from shrublands under high risk of forest fires using innovative methods of forest management and harvesting. Apart from reducing the forest fire risk in these areas, the project also expects to cut CO2 emissions with the newly-developed biofuels

LIFEGENMON **LIFE for EUROPEAN FOREST GENETIC MONITORING SYSTEM (**LIFE13 ENV/SI/000148)

The main project objective is to develop a genetic monitoring system for forests that will serve as an early warning system aiding the assessment of a species response to environmental change at a long-term temporal scale

MONTSERRAT **Integrated silvopastoral management plan: An innovative tool to preserve biodiversity and prevent wildfires** (LIFE13 BIO/ES/000094)

This project aims to develop ecosystem-based measures to increase the resilience and stability of forests against fires in order to improve the prevention of wildfires on Montserrat mountain (Catalonia). It will also contribute to the conservation and improvement of biodiversity in the Montserrat area.

Pinassa **Sustainable management for conservation Black pine (Pinus nigra subsp. salzmannii var pyrenaica) forests in Catalonia** (LIFE13 NAT/ES/000724)

The main goal of LIFE+ Pinassa is to contribute to the conservation of black pine (Pinus nigra) forest habitats in Catalonia, listed in Annex I of the Habitats Directive as a priority for conservation

ADVICLIM **Adapatation of VIticulture to Climate change : High resolution observations of adaptation scenarii for viticulture** (LIFE13 ENV/FR/001512)

LIFE ADVICLIM aims to improve local management of vineyards in the face of climate change. It will develop tools to measure and model both contributions to climate change and the impact of climate change. It will build on these to help identify the best responses to mitigate and adapt to the impact of climate change in vineyards.

SUBER **Integrative management for an improved adaptation of cork oak forests to climate change** (LIFE13 ENV/ES/000255)

Life+ SUBER aims to implement, demonstrate and effectively transfer new forest management techniques applicable to European cork oak (Quercus suber) forests (subericulture). These actions are designed to improve the forests' adaptation and resilience to climate change and, subsequently, foster their conservation and the maintenance of the whole value chain associated with their management and valorisation.

EBRO-ADMICLIM **Adaptation and mitigation measures to climate change in the Ebro Delta** (LIFE13 ENV/ES/001182)

The project will implement a pilot integrated approach for climate change adaptation and mitigation in the Ebro Delta. This innovative approach will manage water,

sediment and habitats (rice fields and wetlands) with the goals of optimising ground elevation, reducing coastal erosion, increasing carbon sequestration in the soil, reducing greenhouse gas emissions and improving water quality.

ClimAgri **Best agricultural practices for Climate Change: Integrating strategies for mitigation and adaptation** (LIFE13 ENV/ES/000541)

The aim of Life+ ClimAgri is to develop a model for integrating climate mitigation and adaptation techniques in the management of irrigation agriculture in the Mediterranean Basin. Amongst other results, the model under development should reduce energy consumption by 20%, cut N2O emissions by 35%, and reduce CO2 emissions from energy use by 20% and from soil management by 40%.

VINEYARDS4HEAT **Vineyards for carbon footprint reduction: a sustainable strategy to use biomass for heat & cold in wineries** (LIFE13 ENV/ES/000776)

This project aims to demonstrate the feasibility of an integrated municipal climate change mitigation strategy based on a series of actions involving all local stakeholders. Project actions will include the establishment of a Biomass Value Chain for generating green energy from vineyard-pruning biomass waste. The project expects to cut Vilafranca´s CO2 emissions by some 3 000 tonnes/year and produce 10 500 MWh per year of renewable energy.

LIFE projects financed in 2014

ADAPTAMED **Protection of key ecosystem services by adaptive management of Climate Change endangered Mediterranean socio-ecosystems** (LIFE14 CCA/ES/000612)

The project aims to mitigate the negative effects of climate change on key ecosystem services in three representative Mediterranean national protected areas of socio-economic importance: the Doñana wetlands, the high mountain range of Sierra Nevada and the sub-desert coastal area, Cabo de Gata. The strategic ecosystems targeted are mountain Mediterranean shrubs, pine woods, pre-desert scrubland, coastal dune woods and Quercus woods. The project will use an ecosystem approach to develop, implement, monitor, evaluate and disseminate adaptive management measures focusing on soil retention, pollination, pastures, temperature regulation, water provision, forest fire prevention and desertification. As a result of this, the project expects to increase the resilience of the three socio-ecosystems concerned and protect their key ecosystem services from climate change.

LUGO + BIODINÁMICO **Planning for a multi-ecological neighbourhood as a model of urban resilience** (LIFE14 CCA/ES/000489)

The project's objective is to implement an innovative urban planning strategy by applying a set of actions in the city of Lugo, which is based on the promotion of the local timber industry and the sustainable management of forests, the identification and valorisation of the Linear River Park, formed by the Miño, Rato and Fervedoira basins, as a Green Climatic Protection infrastructure and the improvement of the environmental connectivity of the action plan area by implementing a multifunctional open-air space system. The project will showcase an integrated design and planning of resilient bioclimatic neighbourhoods that consume practically no energy and are largely planned with local wood systems along with a resilient urban landscape

prepared to face and to minimise the effects of climate change.

AgroClimaWater **Promoting water efficiency and supporting the shift towards a climate resilient agriculture in Mediterranean countries (LIFE14 CCA/GR/000389)**

The project aims to prepare the agricultural sector to adapt to climate change. It will do this by developing an agricultural climate change adaptation strategy and introduce water management adaptation strategies to selected farmers' organisations. It will focus on olive, citrus and peach orchards in two areas in Crete (Greece) and one area in Basilicata (Italy). Farmers will be provided with a methodology to adapt cultivation practices in order to achieve the highest possible yields despite low or erratic water availability.

FOREST CO2 **Assessment of forest-carbon sinks and promotion of compensation systems as tools for climate change mitigation (LIFE14 CCM/ES/001271)**

The project aims to promote forest systems and sustainable forest management as a tool for climate change mitigation through the application of the European legislation related to the accounting of emissions and removals in the land-use sector, changes in land use and forestry (LULUCF), improving knowledge base. One of the main actions will be to model and synthesize the accounting of sequestration and CO2 emissions as a result of sustainable forest management actions (pruning, thinning, etc.) in Pinus halepensis and Pinus pinaster forests in their various deposits: biomass (air and roots) through LIDAR, organic carbon of soils and dead organic matter. Methods of calculation will be the international standardized methods (IPCC, EU accounting regulations).

ADAPT2CLIMA **Adaptation to Climate change Impacts on the Mediterranean islands' Agriculture** (LIFE14 CCA/GR/000928)

The project aims to build a solid knowledge base on climate change and its impacts on the agricultural sector in three Mediterranean islands as well reducing vulnerability and increasing resilience to climate change risks. It will facilitate the development of adaptation strategies for Mediterranean island agriculture by demonstrating an innovative decision-support tool in Crete, Sicily and Cyprus. The tool simulates the impacts of climate change on crop production and the effectiveness of selected adaptation options. Using the tool, the project will develop water management adaptation strategies in partnership with farmers' organisations. Their implementation is expected to cut water consumption by at least 30% per participating farm.

CLIMATREE **A novel approach for accounting & monitoring carbon sequestration of tree crops and their potential as carbon sink areas** (LIFE14 CCM/GR/000635)

The project aims to contribute to the development of a novel methodology and provide policymakers with an innovative tool for the quantification of carbon storage in permanent tree-crops in the Mediterranean region. The project intends to improve and update the estimated carbon sink accounting in the EU by including the calculated tree-crop capacity, estimate the socioeconomic benefit of tree crops for carbon storage and provide guidelines to tree crop farmers.

LIFE projects financed in 2015

FORECCAsT — **Forest: Climate Change Adaptation** (LIFE15 CCA/FR/000021)

This project aims to provide owners and managers of forests in the Parc Naturel Régional du Haut Languedoc with the means to build a management strategy that takes climate change scenarios into consideration. The goal is to protect the forest ecosystems whilst ensuring that the dynamic forestry sector can meet current environmental, economic and social challenges. The project will create a digital application (the FORECCAsT tool) to help with decision-making, and distribute an action plan for crisis management, in order to better anticipate the risks identified in different climate change scenarios.

KEDROS — **Integrated conservation management of priority habitat type 9590* in the Natura 2000 site Koilada Kedron-Kampos** (LIFE15 NAT/CY/000850)

The project's main objective is to maintain the very rare, priority habitat type, Cyprus cedar (Cedrus brevifolia) in good conservation status in the long-term in the Koilada Kedron-Kampos Natura 2000 site. Actions will focus on reducing the risk of habitat loss through forest fire and enhancing the habitat's resilience and capacity to adapt to climate change. A number of forest management measures will be implemented for the first time in Cyprus. These include controlled grazing to reduce fire risk, silvicultural treatments in cedar stands, and the management of fauna to protect the young cedar trees.

AMMONIA TRAPPING — **Development of membrane devices to reduce ammonia emissions generated by manure in poultry and pig farms** (LIFE15 ENV/ES/000284)

The project will develop an innovative and sustainable solution to reduce ammonia emissions from animal husbandry excretions. In particular, it will test an anaerobic digestion and composting process, using devices that capture ammonia, to produce nitrogen fertiliser and decrease the energy necessary to ventilate the installations. The technology, which has a high replicability potential, will be demonstrated on farms in Spain by treating pig slurry (raw and digestate) and hens excretions.

SARMIENTO — **Demonstration of an innovative solution to reduce GHG emissions in vineyards while improves the soil in arid areas** (LIFE15 CCM/ES/000032)

The project will apply a circular economy principle to vineyard pruning waste, converting it into a substrate that can be applied as enriched compost in vineyards, seedbeds and urban allotments, as opposed to burning it. This process will be developed and tested on 750 ha of vineyards in Murcia. The project expects to reduce CO2 emissions by 85% in comparison with current management practices, as well as helping to avoid soil degradation and having a positive impact on biodiversity. The project will also develop tools, training modules and guidelines to effectively transfer this solution to other wine production areas in Europe.

ViVaCCAdapt — **Adapting to the impacts of Climate Change in the Vipava Valley** (LIFE15 CCA/SI/000070)

The project will focus on adapting agriculture in the fertile upper Vipava valley in Slovenia to the effects of climate change. As part of a holistic strategy for adapting to climate change it will create a pilot decision-support system (DSS) for irrigation and a

demonstration centre to plant green wind breaks, in order to show the importance of creating wind protection zones in areas with strong winds.

The Green Link **Restore desertified areas with an innovative tree growing method across the Mediterranean border to increase resilience** (LIFE15 CCA/ES/000125)

Through six trials in three countries, the project aims to demonstrate an innovative growing method that uses 'water buckets' made from recycled carton to plant trees in desertified areas without irrigation. The project will design specific interventions to respond to the demands of climate change adaptation, such as the promotion of indigenous and resilient species able to cope with expected bio-climates in the coming decades.

CLINOMICS **Fostering resilience. Opportunities and challenges of the local economy and society to adapt to climate change (**LIFE 15 CCA/ES/000102)

The project's objective is to encourage the province of Barcelona to implement climate change adaptation measures, by presenting them as an opportunity to update the local economy, improve competitiveness and create employment. It will involve local administrations and the agriculture, silviculture, fishery and/or tourism sectors in the counties of Montseny, Alt Penedès and Terres del Ebro. Key objectives include drafting action plans and strategies for climate change adaptation, and providing local authorities with the tools to affordably launch adaptation processes.

Agri Adapt **Sustainable adaptation of typical EU farming systems to climate change** (LIFE15 CCA/DE/000072)

The project will work in four rural pilot areas particularly at risk from climate change, in order to develop a knowledge base for the assessment and monitoring of climate change vulnerability at farm level. It will aim to promote sustainable adaptation measures amongst farmers and future farmers by raising awareness and disseminating training packages. Know-how and best practice will be also transferred to political, agricultural and food business stakeholders.

AFORCLIMATE **Adaptation of FORest management to CLIMATE variability: an ecological approach** (LIFE 15 CCA/IT/000089)

The project's goal is to maintain and improve the efficiency of the beech forest ecosystem in the Apennine mountains through effective forest management which takes climatic factors into account. It aims to create a detailed forecast model and develop a monitoring scheme that will assess the impact of climatic factors, in order to better promote forest regeneration and resilience, as well as seed production.

SHARA **Sharing awareness and governance of adaptation to climate change in Spain** (LIFE15 GIC/ES/000033)

The objective of the project is to improve the governance of adaptation to climate change and to increase climate resilience in Spain and Portugal. The project will strengthen the technical capacities of the government in dealing with adaptation to climate change. It will also improve cooperation among stakeholders in Portugal and Spain, including by exchange of information on shared vulnerabilities, and will raise awareness of the issue throughout society.

MixForChange **Innovative management strategies for climate change adaptation of mixed subhumid Mediterranean forests** (LIFE15 CCA/ES/000060)

The aim of this project is to safeguard Europe's sub-humid Mediterranean forests by increasing their resilience to climate change, promoting their conservation and enhancing their productive, environmental and social roles. It will test silvicultural techniques on a pilot area, and then transfer the developed tools to regional and European stakeholders, raising public awareness and improving long-term forest management.

VINECOS **Optimizing Ecosystem Services in Viniculture facing Climate Change** (LIFE15 CCA/DE/000103)

The main objective of the LIFE VinEcoS project is to optimise ecosystem services in vineyards by testing climate-adapted methods in viniculture. In the first part of the project, relevant methods will be implemented on demonstration vineyards. During the second half of the project these methods will be tested in other commercial and demonstration vineyards in the region. These trials will allow the project to evaluate the climate change adaptation measures in relation to the added value of the ecosystem services provided by the vineyards. Ecosystem-based approaches, focusing on synergies between nature protection, climate protection and climate adaptation are more cost-efficient than technical solutions.

MOTTLES **MOnitoring ozone injury for seTTing new critical LEvelS** (LIFE15 ENV/IT/000183)

The aim of the project is to define scientifically-based thresholds and critical levels for the protection of forests from ozone (O3) pollution injury in a changing climate scenario. To achieve this, the project is developing an integrated monitoring system for the continuous measurement of parameters affecting European forest ecosystem sustainability. This will be demonstrated in three European countries. The project will help in the development of adaptive management strategies for sustainable forest management and stimulate the development of legislative standards for protecting forests against ozone.

LIFE projects financed in 2016

PASTORALP **Sustainably managing alpine pastureland** (LIFE16 CCA/IT/000060)

Better understanding the carbon sequestration potential of pastureland in the Alps, and devising more sustainable ways to manage it, could change the current ad hoc approach to pastureland preservation. LIFE PASTORALP will work with graziers to develop and test adaptation measures, build capacity and improve management strategies for climate change adaptation in two national parks (one in Italy, one in France). Defining environmental and socio-economic indicators for the status of pastureland and consolidating results into guidelines will enable other alpine regions to benefit from lessons learned.

DESERT-ADAPT **Adapting to desertification is an opportunity for farmers** (LIFE16 CCA/IT/000011)

Climate change adaptation is not only a huge challenge, it is also an opportunity to open up new income sources for farmers. Desertification Adaptation Models tested by this project in vulnerable parts of Italy, Spain and Portugal will combine methods such as inter-planting, reforestation, water-saving technologies and soil protection to

increase resilience. As well as improved biodiversity, there will be a net carbon removal of one tonne of carbon dioxide per hectare using the new models. Another expected outcome is eight viable new sources of income (organic products and ecosystem services) generating an extra 100 euros per hectare.

AGROGESTOR **Collective management of crops at the service of environmental programs related to the use and quality of water** (LIFE16 ENV/ES/000287)

The core goal of the AGROgestor project is to reduce the environmental impact of the irrigation farming by means of the use and demonstration of a decision-making supporting tool (DST Platform), easing the efficient and sustainable COLLECTIVE PLANNING (phase 1) AND COLLECTIVE ACTUAL MANAGEMENT OF CROPS (phase 2) focused on 2 specific environmental purposes: the irrigation water efficiency of use and the quality of water masses. Main results of the LIFE AGROgestor project will be a DST Platform for Collective Managers validated in 3 environmental scenarios and replicate at national and international scales.

AMDRYC4 **Encouraging farmers to adapt in Mediterranean dry farming areas** (LIFE16CCA/ES/000123)

Mediterranean dry farming areas are especially vulnerable to climate change impacts. To build resilience, this LIFE project will implement adaptation measures and promote them through a land stewardship entity and voluntary agreements with farmers. It will also distribute guidelines for applying accounting methodologies for organic carbon and ecosystem services. Sustainable, smart and integrated management is expected to lead to an increase in carbon sequestration activity and biodiversity and a reduction in soil loss.

Other projects

MEDSCOPE **Financed by the European Research Area for Climate Services (ERA4CS)**

The overall objective of the MEDSCOPE project is to enhance the exploitation of climate predictions from seasonal to decadal timescales, maximising the potential of their application in different economic sectors, public and private, of relevance for the Mediterranean region (Mediterranean basin and surrounding areas).