

MED

Meeting' 23

3 - 4 July | UÉvora | Herdade da Mitra

Healthy SOILS
for **FOOD**
for **LIFE**
and for the **FUTURE**

Book of Abstracts



MED

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ENVIRONMENT AND DEVELOPMENT

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University of Évora

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under the theme

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July 3 - 4, 2023

Edited by:

Anabela Romano, MED – University of Algarve

Cláudia Vicente, MED – University of Évora

Elsa Lamy, MED – University of Évora

Fátima Baptista, MED – University of Évora

Fátima Duarte, MED – CEBAL

Luis Gomes, MED – University of Évora

Nuno Pedroso, MED – University of Évora

Rui Lourenço, MED – University of Évora

Sofia Eufrázio, MED – University of Évora

Teresa Pinto Correia, MED – University of Évora

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Preface

Healthy soils and sustainable land use are fundamental to achieve the Sustainable Development Goals and the Green Deal objectives, through the provisioning of several ecosystem services crucial to the planet and society. Food security and sustainable agriculture depend on soil health, preserved from physical damage or pollutants. Preventing soil/land degradation is key to halt biodiversity loss and protect the terrestrial ecosystems. In addition, soil plays an important role in reducing the impacts of climate change, namely by sequestering and storage CO₂ and by the infiltration and storage of water as a support of all ecosystem services. MED research deals with activities that are affected or affect soils and can contribute to a better future, in line with the Soil Health Mission of Horizon Europe.

The urgency of this theme motivated the focus of the 2nd MED Meeting, held in Évora between 3 and 4 July 2023, within the theme “Healthy soils, for food, for life and for the future”.

The 2nd MED Meeting not only served as a platform for the dissemination of knowledge but also fostered vibrant discussions, debates, and exhibitions, offering a holistic view of the groundbreaking work undertaken by the MED researchers.

In a world increasingly shaped by environmental challenges and where the health of our soils determines the health of our future, this compilation stands as a testament to the collective dedication of MED researchers striving to create a sustainable and resilient tomorrow.

The Organising Committee of the 2nd MED Meeting

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2nd MEETING MED

FULL PROGRAMME

Room	Time	
3 July (monday)		
Conference room (Ed. Regentes Agrícolas)	11:00 – 11:15	OPENING SESSION (Fátima Baptista, Augusto Peixe, Rui Salgado and Teresa Pinto Correia)
	11:15 – 12:30	SPECIAL SESSION “Healthy soils, for food, for life and for the future” Initial talk: Soil health is the future of Mediterranean farm, forestry and food systems: new agenda setting indispensable! Hubert Wiggering with participation of João Madeira, Lília Fidalgo, Sergio Prats, and Teresa Pinto-Correia
Ed.ÁRIO Lobo de Azevedo (Anel)	12:30 – 14:30	Lunch and visit to exhibitions (teams and labs from MED)
Conference room	14:30 – 15:45	Session 1 - Contribution of the thematic lines to soil research and conservation – Viticulture and Enology (Maria João Cabrita); Olive groves and Olive oil (António Dias); Horticulture (Mário Reis)
	15:45 – 16:15	<i>Coffee break</i>
	16:15 – 17:30	Session 2 - Contribution of the thematic lines to soil research and conservation – Animal Production and Health (Rui Charneca); Agro-silvo pastoral system (Nuno Guiomar); Biodiversity and Ecosystem functioning (Diogo Alagador)
	17:30 – 18:00	<i>Coffee break</i>
	18:00 – 19:30	DEBATE – Next evaluation: differentiation and societal impact of MED Bruno Medronho, Diogo Costa, Anabela Romano, Fátima Duarte, Fátima Baptista e Teresa Pinto-Correia Moderator: Nuno Pedroso

	19:30 – 20:30	Dinner
4 July (tuesday)		
Ed. Ário Lobo de Azevedo	9:30 – 10:30	Parallel sessions – oral presentations about research activities in MED (Full programme below)
	10:30 – 11:00	<i>Coffee break</i>
	11:00 – 12:00	Parallel sessions – oral presentations about research activities in MED (Full programme below)
Conference room	12:00 – 12:30	Award delivery “Concurso Horticultura como base de sustentabilidade ambiental, social e económica - Herdade do Azinhal” CLOSING SESSION

PARALLEL SESSIONS (4 JULY)

Room	Room 206 (Ed. Ário Lobo de Azevedo)	Room 202 (Ed. Ário Lobo de Azevedo)	Room 208 (Ed. Ário Lobo de Azevedo)
Time	SOIL REGENERATIVE PRACTICES <u>Moderator: Teresa Pinto-Correia</u>	LAND USE MANAGEMENT <u>Moderator: Rui Lourenço</u>	FOOD PRODUCTION <u>Moderator: Anabela Romano</u>
09:30	Biochar's potential for improving soil health Paulo Mira Mourão (MED-UÉvora)	Animal movement and ecological processes: from roads to disease transmission Sara Santos (MED-UÉvora)	Decoding chemical composition and food safety in grapes, wines and olive oil matrices Raquel Garcia/Maria João Cabrita (MED-UÉvora)
09:40	CynAgriMulch - A strategy for the development of biodegradable mulching films Fátima Duarte (MED-CEBAL)	Mating strategies of a threatened vole in Mediterranean agroecosystems: Investigating density-dependent variation using genetic non-invasive sampling Ricardo Pita (MED-UÉvora)	Mediterranean fermented foods: promoting innovation while preserving local diversity Marta Laranjo (MED-UÉvora)
09:50	Subcellular element redistribution in wheat under Mn toxicity is influenced by intact AMF extraradical mycelium Jorge Faria (MED-UÉvora)	From bare soil to self-sustainable ecosystems: 16 years restoring animal communities in degraded areas Pedro Salgueiro (MED-UÉvora)	Hedge training system for Portuguese olive varieties António Dias (MED-UÉvora)
10:00	VIMoS- An approach to develop Visual Indicators on Montados' Soil functions Óscar Pelayo (MED-UÉvora)	The role of land management practices on soil biodiversity in olive groves of Alentejo (Portugal) José Muñoz-Rokas (MED-UÉvora)	The assessment of quality as a contribution to a raspberry (<i>Rubus idaeus</i> L.) breeding program Ana Cristina Agulheiro Santos (MED-UÉvora)
10:10	Characterization and improvement of soil fertility in the Montado Alentejano: ECO-SPAA experimental field Luís Roma (MED-UÉvora)	BIOMONTADO – Montado ecosystem and vineyards Carla Pinto Cruz (MED-UÉvora)	Influence of a high transmittance film cover on the agronomic and microclimatic parameters of a greenhouse tomato crop Maria Moreno-Teruel (MED-UÉvora)
10:20	Round of questions (10 min)	The energy transition as an element that affects the use of agricultural soil and livestock land in Iberian Peninsula, and the agrivoltaics concept Miguel Muñoz Garcia (MED-UÉvora)	Round of questions (10 min)
10:30	Coffee break (Ed. Ário Lobo de Azevedo)		

	MICROBIOLOGY APPLICATIONS Moderator: Cláudia Vicente	PUBLIC POLICY APPLICATION Moderator: Nuno Guiomar	SUSTAINABILITY OF RESOURCES Moderator: Fátima Duarte
11:00	Antagonistic fungi in the fight against the pinewood nematode David Pires (MED-UÉvora)	Living Labs in agriculture and forestry: A systematic review of H2020 and Horizon Europe projects Maria Rivera (MED-UÉvora)	The role of land management practices on carbon balance in olive groves of Alentejo (Portugal). José Muñoz-Rojas (MED-UÉvora)
11:10	Aiding Cork oak: a soil-plant-microbe approach Celeste Santos Silva (MED-UÉvora)	From Research to Innovation in public policies: the pilot measure in PEPAC “Management of the Montado for results” Isabel Ferraz Oliveira (MED-UÉvora)	Carbon footprint in horticulture Maria João Caldinhas (MED-UÉvora)
11:20	Metabolome Analysis and Immunity of <i>Phlomis purpurea</i> against <i>Phytophthora cinnamomic</i> Alfredo Cravador (MED-UAlg)	Cows and the Montados: Friends or Foes? Managing grazing pressure for soil health Elvira Sales Baptista (MED-UÉvora)	Energy valorization of wastewater from the wine industry through bioelectrochemical remediation systems Conceição Fernandes (MED-UÉvora)
11:30	Monitoring soil microbial activity under different inter-row management practices: the importance of cover crops in the vineyard Vanessa Silva (MED-UÉvora)	How many trees to fall: how and where are we losing the Montado silvo-pastoral system? J. Tiago Marques (MED-UÉvora)	On the valorization of agroforestry residues into novel bio-based materials Bruno Medronho (MED-UAlg)
11:40	Effect of tree canopy and dolomitic limestone application on soil microbial activity, floristic diversity and quality of the pasture in the Montado ecosystem Daniel Bailote/Isabel Brito (MED-UÉvora)	Healthy collaboration for healthy soils – the case of the results-based model in the Montado Helena Guimarães (MED-UÉvora)	The cross between valuing fish and sustainability of resources Maria João Lança (MED-UÉvora)
11:50	Round of questions (10 min)	Round of questions (10 min)	Round of questions (10 min)

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Parallel Sessions



Soil Regenerative Practices

Biochar's potential for improving soil health

Paulo Mourão¹

¹MED - Mediterranean Institute for Agriculture, Environment and Development & CHANGE - Global Change and Sustainability Institute, Departamento de Química e Bioquímica, Escola de Ciências e Tecnologia, Universidade de Évora.

Corresponding author: pamm@uevora.pt

In this communication the potential for biochar, as a naturally derived material, to be used in a variety of areas with effective impacts on soil health will be reviewed. Aspects such as precursor materials, production techniques, its physical and chemical properties, namely its porous structure and chemical composition will be addressed. Particular attention will be given to the strategy of biochar doping as a way to enrich this material and the consequent valorisation of this biomaterial. Some examples of such doping already carried out will be presented. This approach, the conversion of bioproducts to biochar, is clearly part of a strategy to generate value, not only by contributing to the reduction or elimination of lignocellulosic waste, but also by converting this waste into a value-added material such as biochar.

Keywords: Biochar, Soil, Circularity, Valorization.

CynAgriMulch - A strategy for the development of biodegradable mulching films

Teresa Brás^{1,2 *}, Maria F. Duarte^{1,2}

^a Alentejo Biotechnology Center for Agriculture and Agro-food (CEBAL)/ Polytechnic Institute of Beja (IPBeja), 7801-908 Beja, Portugal

^b MED – Mediterranean Institute for Agriculture, Environment and Development & CHANGE – Global Change and Sustainability Institute, CEBAL, 7801-908, Beja, Portugal

Corresponding author: teresa.bras@cebal.pt

Plastic mulching has become a globally applied agricultural practice. Low-density polyethylene presents easy production and adequate mechanical properties. However, presents low biodegradability, removal costs and final disposal with most farmers letting them to accumulate in the field or to be abandoned along rivers or rural areas. Food and Agriculture Organization of the United Nations (2021) and Intergovernmental Technical Panel on Soils (2015) declared that soil is under pressure from multiple sources, including over-use and contamination. Influence of plastics to this burden is increasing evidence. According to UN Environment Programme (2019), maintaining healthy and productive soil is a critical aspect of food security. Biodegradable mulch films (BDM) derived from natural polysaccharides (NP), present biodegradability and biocompatibility. However, have low mechanical properties and high moisture affinity. CynAgriMulch aims the development of BDM films, using multiphase NP derived from agro-resources (*Cynara cardunculus*, *Cydonia oblonga* prunes, Quince fruits and Walnut green husk) by sustainable production methods. NP extraction and purification will consider non-conventional extraction methodologies and membrane separation processes. It is expected to integrate, for the first time, different NP constituents for the development of polymeric matrices like a tuning approach, adapting its mechanical, water barrier and degradation time to involved crop. It is expected that biodegradation products do not change soil properties. The knowledge derived from process development for BDM films adapted to different crops and derived from NP, together with biodegradation products effect on soil at short, medium and long time will pave the way for future innovative research related with industrial development.

Keywords: Biodegradable mulch film; Natural polysaccharides; sustainable production; biodegradation products

Subcellular element redistribution in wheat under Mn toxicity is influenced by intact AMF extraradical mycelium

Jorge M. S. Faria^{1,2}

¹INIAV, I.P., Nacional Institute for Agrarian and Veterinary Research, Quinta do Marquês, 2780-159 Oeiras, Portugal

²MED, Mediterranean Institute for Agriculture, Environment and Development & CHANGE—Global Change and Sustainability Institute, Institute for Advanced Studies and Research, Évora University, Pólo da Mitra, Ap. 94, 7006-554 Évora, Portugal

In the Alentejo region, most soils of the Montado system are acidic, which restricts agricultural production via nutrient deficiency and/or toxicity by metals such as manganese (Mn). Manganese toxicity reduces productivity inducing leaf chlorosis and stunted growth. The presence of an intact extraradical mycelium (ERM) of arbuscular mycorrhizal fungi (AMF), under Mn excess, protects crops against toxicity and stimulates growth. The biochemical mechanisms associated to this effect are unknown but appear to promote a subcellular redistribution of essential macro- and micronutrients. By resorting to Inductively Coupled Plasma Mass Spectrometry (ICP-MS), element uptake and distribution was followed in wheat grown in soil with excess Mn and in the presence of intact ERM of AMF associated to two distinct native pasture plants. In natural conditions, wheat accumulated toxic amounts of Mn in the vacuole, along with Mg and P [2]. However, in the presence of intact ERM Mn concentration was lowered in wheat shoots and this element was preferentially relocated to the shoot apoplast. Phosphorus amounts increased in the shoots and followed the tendency of Mn in accumulating in the cell wall. Nonetheless, element distribution in wheat shoots appears to be dependent on the diversity of the AMF consortium, i.e., the diversity of AMF species associated to the native pasture plant that preceded wheat [3]. This opens the way to a functional optimization in the combinations of ‘native plant - crop’ towards the improvement of crop growth under Mn toxicity in a sustainable farming framework.

Keywords: Compartmentalization, Inductively Coupled Plasma Mass Spectrometry (ICP-MS), Mn toxicity, Montado, Wheat

VIMoS- An approach to develop Visual Indicators on Montados' Soil functions

González-Pelayo, O.; Marques, J.T.; Ferraz-Oliveira, M.I.; Guimarães, M.H.; Pinto-Correia, T.

MED, Mediterranean Institute for Agriculture, Environment and Development & CHANGE—Global Change and Sustainability Institute, Institute for Advanced Studies and Research, Évora University, Pólo da Mitra, Ap. 94, 7006-554 Évora, Portugal

The Portuguese Montado is a culturally embedded agro-silvo-pastoril system that has survived for centuries. However, climate change and intensive land management are negatively impacting Montados, decreasing its size and health. The present proposal focuses in developing an integrated methodology to assess Montados' soil functions. We focus on soils because of its fundamental role in ecosystem processes and, consequently, its centrality for assuring the provisioning of ES. Thus, the methodology developed here seeks to serve to quantify the supporting and regulating ES provided by the Montado, so the method can be used by managers and practitioners on the field. The methodology will help them to understand better how management practices impacts soil ES. To develop the methodology, we concomitantly will apply field-lab soil measurements on selected soil quality indicators (SQI), and create a set of visual indexes of soil functionality in order to correlate them. The validation and correlation between SQI and visual indexes of soil functionality will be done in a set of treated (soil amendment)/control paired-plots using a chrono sequence approach at the three major soil types in the central Alentejo region. By doing so, we will test the suitability of literature selected SQI and visual indexes of soil functionality to assess the health of Montados. As indexes capture soil functionality, they are also indicators of soil functions such as water and soil conservation, carbon sequestration, nutrient cycling and biodiversity.

Characterization and improvement of soil fertility in the Montado

Alentejano: ECO-SPAA experimental field

Emanuel Carreira*¹, Luís Roma², João Serrano¹, José Marques da Silva¹, Rui Charneca¹, José Lopes de Castro¹, Mário de Carvalho¹ & Alfredo Pereira¹

¹MED (Instituto Mediterrâneo para a Agricultura, Ambiente e Desenvolvimento) & CHANGE – Global Change and Sustainability Institute, Universidade de Évora, Pólo da Mitra, Ap. 94, 7002-554 Évora, Portugal.

²Aluno de Mestrado em Engenharia Agronómica, Universidade de Évora, Pólo da Mitra, Ap. 94, 7002-554 Évora, Portugal.

Montado is an agro-silvo-pastoral ecosystem, characteristic of the Alentejo region. Its soils fertility tends to be low, with imbalances between nutrients, low organic matter and acidic pH, which inhibits the growth and development of some plant species. The purpose of this presentation is to show some experimental works related to soil and pasture components, and their main results, carried out in the ECO-SPAA plot of the MED – Herdade da Mitra. A 4ha plot was sub-divided into 2 sub-plots of 2ha each. In October 2015, a characterization of the surface soil layer (0-0.30m deep) was carried out, obtaining acid pH values (average 5.4 ± 0.3), whereby two liming (dolomitic limestone, 2 tons/ha) in half of the area, in November 2017 and June 2019. In December 2018, fertilization (100kg/ha) was carried out in the 4ha plot, with binary fertilizer (18-46-0). In September 2019 those 2 sub-plots were splitted into 2 more. We now have 4 sub-plots with 1ha each (2 with liming and 2 without). Grazing trials began in November 2019, with different stocking rate and grazing periods (4 grazing groups). Soil samples were taken in March 2020 and June 2023, for summary laboratory analysis and subsequent decision-making, regarding fertilization and/or pH corrections. Over time, different technologies have been calibrated and validated to characterize and monitorize soil and pasture, helping decision-making in the Montado ecosystem. These works resulted in several scientific publications in indexed international journals.

Keywords: Soil, Montado, liming, pH corrections, grazing.



Land Use Management

Animal movement and ecological processes: from roads to disease transmission

Sara M Santos & Eduardo Ferreira

MED, Mediterranean Institute for Agriculture, Environment and Development & CHANGE—Global Change and Sustainability Institute, Institute for Advanced Studies and Research, Évora University, Pólo da Mitra, Ap. 94, 7006-554 Évora, Portugal

Corresponding author: smsantos@uevora.pt

The spatiotemporal distribution of resources shapes ecological processes, from individual fitness to population dynamics and species interactions. Animal movement is the primary link between these processes, allowing individuals to respond dynamically to heterogeneous environments. Roads are one of the most important causes of habitat fragmentation worldwide, posing an obstacle to animal movement. Some of the most negative impacts of roads include wildlife mortality, decreased ecological connectivity and reduced gene flow of populations. Road-dominated environments can prompt different behavioural responses, wherein species may exhibit different movement patterns, depending on their sex, age, life-history and landscape context. Information on animal behavioural patterns when close to roads is fundamental when planning road mitigation measures. On the other hand, animal movement has important implications on disease transmission risk. Animal tuberculosis is amongst one of the most widespread zoonotic diseases and has serious economic repercussions. It can be transmitted within and between wildlife species and cattle, in a multi-host system. When contaminated areas are highly used by different species in specific time-windows, animals have a higher risk for becoming infected. Thus, the spatial-temporal interactions between wildlife species and livestock have progressively been recognized as main drivers of inter-species transmission. In this context, host movement behaviour is a major factor affecting the likelihood of transmission by defining inter-specific contacts and environmental exposure. We here discuss the i) potential for assessing the behavioural impacts of roads presence on mammals and ii) the potential of species interactions for understanding dynamics of disease risk transmission.

Keywords: Animal movement; road barrier; disease transmission risk; mammals; movement ecology.

Mating strategies of a threatened vole in Mediterranean agroecosystems: Investigating density-dependent variation using genetic non-invasive sampling

Ricardo Pita ^a, José Jiménez ^b, Joana Paupério ^{c,d}, Benigno Cienfuegos ^e, Alejandro Chamizo de Castro ^e, Joshua Díaz-Caballero ^f, João Queirós ^{c,d}, Clara Ferreira ^{c,g}, François Mougeot ^b, Juan José Luque-Larena ^h, Alfredo Anega ^f, Maria Jesús Palacios ^f

^a MED - Mediterranean Institute for Agriculture, Environment and Development; CHANGE - Global Change and Sustainability Institute; Institute for Advanced Studies and Research; Unidade de Biologia da Conservação, Universidade de Évora, Portugal.

^b Instituto de Investigación en Recursos Cinegéticos (IREC, CSIC-UCLM-JCCM), Ciudad Real, Spain

^c CIBIO - Centro de Investigação em Biodiversidade e Recursos Genéticos, InBIO Laboratório Associado, Universidade do Porto, Vairão, Portugal

^d BIOPOLIS - Program in Genomics, Biodiversity and Land Planning, CIBIO, Vairão, Portugal

^e FOTEX – Fomento de Técnicas Extremañas, Badajoz, Spain

^f Dirección General de Medio Ambiente de la Junta de Extremadura, Mérida, Spain

^g Animal Ecology, Institute for Biochemistry and Biology, University of Potsdam, Germany

^h Dpto. Ciencias Agroforestales, ETSIIAA & Instituto Universitario de Investigación en Gestión Forestal Sostenible, Universidad de Valladolid, Palencia, Spain

Corresponding author rpita@uevora.pt

Assessing reproductive behaviours (e.g. mating strategies) of threatened wildlife in agroecosystems is crucial to understand their population dynamics and improve conservation planning. Population density is considered a key factor influencing variations in mating strategies within species, given its effects on the socioecological context of local populations. Here we investigated the potential impact of population density on the mating strategies of the Cabrera vole (*Microtus cabrae*), a typically monogamous Iberian endemism, often found at low densities in Mediterranean farmland. Specifically, we tested possible shifts towards polygyny strategies under high local population density, resulting from increased exposure to potential mates, as observed in other monogamous species. Based on genetic non-invasive sampling in two habitat patches in Extremadura, Spain, where vole signs indicated high population density, we genotyped 154 faecal samples at 11 microsatellite loci. We employed spatially explicit capture-recapture models within a Bayesian framework to estimate local population density, and assessed genetic mating strategy through parentage analysis using a full-pedigree likelihood approach. Results confirmed the relatively high densities (point estimates >90 ind/ha) compared to those obtained elsewhere using similar methods (<20 ind/ha). Notably, genetic monogamy prevailed the most supported mating strategy in the high-density patches. This suggests limited plasticity and adaptive potential in the reproductive behaviour of Cabrera voles across variable population densities, which may be linked to the remarkable low sperm competition observed in this species. Overall, results emphasize the need for protecting and maintaining suitable habitat patches, while promoting connectivity to facilitate mate selection and gene flow in Mediterranean agroecosystems.

Keywords: Cabrera vole; Conservation; Spatial capture-recapture; Parentage analysis; Genetic monogamy.

From bare soil to self-sustainable ecosystems: 16 years restoring animal communities in degraded areas.

Salgueiro PA¹, Sampaio A¹, Mira A¹

¹MED - Mediterranean Institute for Agriculture, Environment and Development & CHANGE – Global Change and Sustainability Institute, Institute for Advanced Studies and Research; UBC – Conservation Biology Lab, Department of Biology, University of Évora, Mitra, Ap. 94, 7006-554, Évora, Portugal
Corresponding author: pas@uevora.pt

Despite their limited coverage, extraction activities have long-lasting impacts on local ecosystems, inevitably damaging biodiversity and depleting ecosystem services. Restoring degraded sites such as quarries and mines offer utter challenges to the extractive industry, and as political enforcement grows and environmental awareness settles, stakeholders demand concrete solutions from researchers to reverse the effects of exploitation. In this presentation, we compile and synthesize the contributions of a 16-year project aiming to re-establish the structure and functioning of the original ecosystems in quarried areas through the creation of long-term conditions to promote the natural colonization of animal communities. We depict studies encompassing abiotic (soil properties and landform) and biotic (vegetation) constraints determining the movement, population dynamics, composition, structure, and function of species and animal communities. We later explore the interdependent responses between them to measure the provision of ecosystem services through the establishment of animal-mediated ecological processes, like seed-dispersal and pollination. Our studies have been providing evidence-based guidance to encourage the self-sustainability of the system and help achieve no-net-loss or net-positive outcomes through applied ecological research and demonstrative actions based on long-term monitoring, ecosystem service provision valuation, net-impact assessment, and implementation of nature-based solutions. We expect these procedures and outcomes can fuel best-practice guidance and policies leveraging large-scale effective strategies to entail nature-positive outcomes in the restoration of degraded areas, identifying the needs, opportunities, and solutions demanded to achieve restoration targets.

Keywords: Ecological restoration; Ecosystem Services; Biodiversity indicators; Quarries

**The role of land management practices on soil biodiversity in olive groves of Alentejo
(Portugal).**

Brígido C¹., Rodríguez Sousa A.A.^{1,2}, Prats S.A.¹, Muñoz-Rojas J.^{3*}

¹MED - Mediterranean Institute for Agriculture, Environment and Development & CHANGE - Global Change and Sustainability Institute, Institute for Advanced Studies and Research, Universidade de Évora, Pólo da Mitra, Ap. 94, 7006-554 Évora, Portugal

²Department of Statistics and Operations Research, Faculty of Mathematical Sciences, University Complutense of Madrid, Pl. De las Ciencias 3, 28040 Madrid, Spain

³MED - Mediterranean Institute for Agriculture, Environment and Development & CHANGE - Global Change and Sustainability Institute, Departamento de Geociências, Universidade de Évora, Pólo da Mitra, Ap. 94, 7006-554 Évora, Portugal

* Corresponding Author: jmrojas@uevora.pt

The Alentejo have changed greatly in the last 15 years due to the intensification (i.e., the increase in tree density) of irrigated olive groves, which may compromise the quality, biodiversity, habitat and fertility of these soils. It is mandatory to bring together agriculture sustainability and intensification to not jeopardize olive groves production or compromise soil use in the future. In this sense, monitoring ecological functions and soil biodiversity will allow to determine how olive groves sustainability is impacted by different agricultural management options and decisions. In this work, we hypothesize that different olive groves management practices, such as using cover crops, tillage or herbicides, can significantly affect soil biodiversity in six distinct olive groves and four oak agrosilvopastoral “montado” system in the Alentejo region. The soil microbial, mesofauna and insect diversity was assessed for different: i) olive management practices (cover crop, tillage, herbicide), ii) land uses (montado, extensive, intensive and superintensive olive groves) and iii) olive grove microsite (tree row vs interrow). Three composite soil samples were collected from each site and processed for amplicon sequencing targeting the 16S rRNA gene for bacteria as well as the Internal transcribed spacer (ITS) for fungi. Soil mesofauna diversity was assessed using the Berlese-Tullgren method in three soil samples from each site and insects diversity was assessed with three pitfall traps in each site. Preliminary results showed that using cover crops instead of tillage or herbicide in olive groves can significantly increase microbial abundance, soil mesofauna (mites) and insect diversity (ants and coleoptera).

Keywords: cover crops, herbicides; soil biodiversity, soil management, sustainability.

BIOMONTADO – Montado ecosystem and vineyards

Carla Pinto-Cruz¹, Anabela Belo¹, Erika Almeida¹, Carla Janeiro¹, Isabel Brito, Ana Alexandre, Sérgio Prats, Oscar Pelayos, Nuno Pedroso, Rui Lourenço

¹MED - Mediterranean Institute for Agriculture, Environment and Development & CHANGE - Global Change and Sustainability Institute, Institute for Advanced Studies and Research, Universidade de Évora, Pólo da Mitra, Ap. 94, 7006-554 Évora, Portugal

¹Botany Laboratory, APPLIED ECOLOGY AND CONSERVATION
Corresponding Author: ccruz@uevora.pt

The *montado* is considered a high nature value (HNV) agro-silvopastoral system that provides important ecosystem services, in addition to tradable products, namely biodiversity conservation, soil conservation, carbon sequestration, organic matter storage and water cycle regulation. In the Alentejo region, its matrix is often interrupted by patches of agricultural systems, such as vineyards. The BIOMONTADO project aims to promote the sustainability and resilience of the *Montado*-Vineyard combination as a factor of competitiveness for wine-producing companies. In this context, we are implementing pilot plots focused on conserving the structure, health and functionality of the soil (direct seeding, mulching, biochar), restoring patches of natural habitats (groves, Mediterranean shrubs, temporary ponds, rocky outcrops), enhancing biodiversity (refuge and feeding areas for fauna, promotion of pollinators and beneficial insects), and promoting habitat connectivity (ecological restoration of watercourses, multifunctional biodiversity field hedges).

Keywords: montado, ecosystem services, biodiversity, vineyards, soil

The energy transition as an element that affects the use of agricultural soil and livestock land in Iberian Peninsula, and the agrivoltaics concept

^{1*}Miguel-Ángel Muñoz-García, ¹David Pérez-López, ¹Guillermo-Pedro Moreda-Cantero, ²Luís Fialho, ²Fátima Baptista, ²Lisa Bunge, ³Carmen Alonso-García, ³Beatriz Nieto Morone, ⁴Alfonso Moriana, ⁴Mireia Corell

¹ ETSIAAB, Universidad Politécnica de Madrid, Spain

² MED, Universidade de Évora, Cátedra de Energia Renováveis, Portugal

³ Dep. Energías Renovables, CIEMAT, Spain

⁴ Dep. Agronomía, Universidad de Sevilla, Spain

Corresponding Author: miguelangel.munoz@upm.es

Energy transition towards a more sustainable model, which has less impact on CO₂ emissions and leads to a circular economy system, where emissions can be offset by the environment, is one of the greatest challenges for the European Union and for worldwide society. To achieve these objectives, which in the case of the Iberian Peninsula are set in 2050 for both Portugal and Spain, as members of the European Union and therefore affected by the European Climate Law, where the EU is committing to carbon neutrality by 2050. Agrivoltaics is a concept of joining agricultural production with photovoltaic energy coexisting on the same land. Preliminary studies indicate that some crops can benefit from solar panel coverage when radiation is excessive or aggressive weather conditions. While other crops may see reduced production, this being offset by the additional benefit of the combined use of land for energy production. The presentation describes two agrovoltaic pilots that are being developed: one at MED (Evora, Portugal), under the direction of Dr. Luís Fialho, and the other at UPM (Madrid, Spain) in a collaborative project of various entities: Universidad de Sevilla, Universidad Politécnica de Madrid and CIEMAT. These pilots are intended to seek alternatives that prevent the loss of agricultural land, as well as the inclusion of the concept of circular economy, through the reuse of repaired or removed photovoltaic panels from other plants.

Keywords: Agrivoltaics, photovoltaics, solar land use, energy transition



Food Production

Decoding chemical composition and food safety in grapes, wines and olive oil matrices

Raquel Garcia, Nuno Martins, Daniela Fonseca and Maria João Cabrita

¹MED - Mediterranean Institute for Agriculture, Environment and Development & CHANGE - Global Change and Sustainability Institute, Institute for Advanced Studies and Research, Universidade de Évora, Pólo da Mitra, Ap. 94, 7006-554 Évora, Portugal

Laboratório de Enologia Colaço do Rosário, grupo Ciência e Tecnologia dos Alimentos

The present work aims to highlight the research carried out at the Oenology Lab Colaço do Rosário- MED, which is mainly focused on the two most relevant food matrices in the Mediterranean context- grapes and olives. Within this communication will be given an overview of our most recent investigation, namely on: i) Comprehensive characterization of the chemical composition of grapes, wines and olive oil matrices, using advanced chromatographic techniques -GC-TOFMS and GC x GC-TOFMS, and their usefulness for the building of a database of the corresponding chemical composition and further establishment of a fingerprint pattern; ii) Study of nutraceutical potential of some Portuguese monovarietal olive oils using a combined analytical tool comprising a sample preparation step for the pre-concentration of relevant compounds and further quantification by liquid chromatography. iii) Development of a sensor tool based on molecular imprinting technology for the trace analysis of pesticide residues in olive oil samples. Altogether, within this work we intend to address some hot topics in agrifood area, like: deeper knowledge on grape and olives varieties and correlation with climatic changes, nutraceutical potential of olive oils and an innovative portable food safety tools for the assessment of chemical contaminants in olive oil samples.

Keywords: volatiles, phenolics, pesticides, chromatography, sample preparation.

Mediterranean fermented foods: promoting innovation while preserving local diversity

MARTA LARANJO*, SARA CONCEIÇÃO, SARA RICARDO-RODRIGUES, MARIA INÊS ROUXINOL, MARIA EDUARDA POTES, MARIA CRISTINA QUEIROGA, ANA CRISTINA AGULHEIRO-SANTOS & MIGUEL ELIAS

MED – Mediterranean Institute for Agriculture, Environment and Development & CHANGE – Global Change and Sustainability Institute, Institute for Advanced Studies and Research, Universidade de Évora, Pólo da Mitra, Ap. 94, 7006-554 Évora, Portugal
Corresponding Author: mlaranjo@uevora.pt

Fermented foods (FF) have played a key role in human diets for millennia. Historically, the main role of starters and fermentative microorganisms was to reduce the spoilage and pathogenic microbiota. Present in all European diets, fermented foods (FF) hold a strategic place due to the benefits they offer in terms of nutrition, sustainability, innovation, cultural heritage, added sensory value and consumer interest. Furthermore, these microbial foods promote health, while preserving regional diversity, and boosting local production. To preserve the diversity of local FF, it is important to study their microbiome and preserve traditional fermentation processes combined with innovative raw materials and preservation techniques. All recent strategies and initiatives of the European Commission point towards the development of innovative, safe, tasty, and nutritious foods that provide us healthy and sustainable diets. Moreover, the topic of fermented foods is central to the European Green Deal and its Farm-to-Fork Strategy, which is evident from the number of projects recently financed as well as their total budget: PIMENTO (<https://fermentedfoods.eu/>), HealthFerm (<https://healthferm.eu/>) and DOMINO (<https://fme.micalis.fr/projects/domino/>). The latter two focus on plant-based fermented foods PBFF, and for this reason, it is important and urgent to assess the food safety risks, as well as evaluate the potential health benefits of PBFF.

Keywords: Fermented foods; Food safety; Food microbiome; Health benefits; Sustainable food production systems

Hedge training system for Portuguese olive varieties

Dias, A.B.¹; Dias, I.L.²; Pinheiro, A.¹

MED – Mediterranean Institute for Agriculture, Environment and Development & CHANGE – Global Change and Sustainability Institute, Institute for Advanced Studies and Research, Universidade de Évora, Pólo da Mitra, Ap. 94, 7006-554 Évora, Portugal
Corresponding Author: adias@uevora.pt

In the last 20 years there has been a revolution in the Alentejo olive sector. The olive landscape changed from rainfed olive groves, with low planting density and production level to irrigated olive groves with high planting densities and high use of production factors. The combination of high olive yields with a fully mechanized olive harvest made the hedge olive system extremely attractive to companies. The need to diversify the olive oils produced as well as the adaptability to adverse weather conditions requires the development of sustainable training systems adapted to Portuguese varieties. In this work, some results of the evaluation of a hedge training system for Portuguese olive varieties are presented.

Keywords: olive groves; sustainability; training system; Portuguese varieties

The assessment of quality as a contribution to a raspberry (*Rubus idaeus* L.) breeding program

Francisco Aires¹, Francisco R. Luz^{2,3}, Pedro Brás de Oliveira², Ana Cristina Agulheiro-Santos^{1,4}

¹ University of Évora, Ap. 94, 7006-554 Évora, Portugal;

² INIAV, I.P., Av. da República, Nova-Oeiras, 2784-505 Oeiras;

³ BeiraBaga, Pólo de Inovação da Fataca, 7630-580, São Teotónio;

⁴ MED-Mediterranean Institute for Agriculture, Environment and Development & CHANGE–Global Change and Sustainability Institute.

In recent years, raspberry production in Portugal has been breaking records, exceeding the value of 181 million euros in 2021 (GPP, 2022). Foreign companies have been increasingly present in the sector leading to new export channels and their own specific varieties. There is a growing demand for new raspberry varieties for national producers, with a focus on obtaining raspberries for longer periods of time, high quality standards, and an extended shelf-life. To address this need, a raspberry breeding program has been in progress at INIAV, in collaboration with the company Beirabaga and with the participation of UEvora/MED. The objective of this study was to annually select new raspberry genotypes, based on their behavior in field trials, (phenotypical parameters such as thinning, yield, and cane architecture), and quality evaluation. The evaluation included tests such as weight loss, colour, texture profile analysis, puncture test on a drupelet, total soluble solids (TSS), titratable acidity (TA), ripeness index, total polyphenols, and antioxidant capacity, as well as sensory evaluation. To ensure accuracy, 30 fruits were analysed per repetition and storage time (0, 7, and 15 days), and an ANOVA and Tukey HSD comparison of means were performed. Genotype G5 was the best for firmness and TSS. G3 showed the highest TA, and ripeness index and total phenolic compounds. The G5 genotype was the best classified by the sensory panel. Comparing their results with commercial varieties, G3 and G5 genotypes were highlighted as the most promising and have been selected to continue in the breeding program.

Keywords: *Rubus idaeus* L.; breeding program; quality; shelf life; sensory evaluation

Influence of a high transmittance film cover on the agronomic and microclimatic parameters of a greenhouse tomato crop

Moreno-Teruel M.A.^{1,2}, Baptista F.¹, Molina-Aiz F.D.², Valera D.L.², López-Martínez A.²

¹MED—Instituto Mediterrâneo para a Agricultura, Ambiente e Desenvolvimento. Grupo de investigação:Tecnologia Agrícola e Eficiência Energética. Universidade de Évora, 7000-849 Évora, Portugal.

²CIAMBITAL—Centro de Investigación en Agrosistemas Intensivos Mediterráneos y Biotecnología Agroalimentaria. Universidad de Almería, Ctra. Sacramento s/n, 04120 Almería, Spain.

Corresponding Author: maria.teruel@uevora.pt

The increase of transmittance to photosynthetically active radiation (PAR) of the greenhouse cover improves photosynthetic activity and consequently can enhance crop yields. The main objective of this study was to compare a standard film cover with a high transmittance experimental film cover on growth, yield, fruit quality and microclimatic plant parameters of a tomato crop (*Solanum lycopersicum* L.). The experiment trial was carried out inside a multispan greenhouse located in the Centre for Innovation and Technology Transfer “UAL-ANECOOP Foundation” in Almería (Spain). The naturally ventilated greenhouse (1800 m²) was divided transversely by a polyethylene sheet, creating two isolated sectors. The experimental cover film (90% transmittance) was installed in the West sector while the standard film (85% transmittance) was located in the East sector. On 8 September 2021, a tomato crop of variety ‘Ramyle’ was transplanted with a density of 1.2 plants/m². The use of experimental film cover increased PAR radiation by 6% (not statistically significant). Leaf temperature increased by 5.4% in plants grown under the experimental film in comparison to the standard film, with statistically significant differences. The results of the tomato crop production show an increase in marketable and total yield of 0.21 kg/m² (+4.2%) and 0.15 kg/m² (+2.2%), respectively, in the West sector with experimental film cover. No significant differences were observed in any of the plant growth parameters (length and thickness of the stem, number of nodes and length of internodes) or fruit quality (weight, fruit diameter, firmness, soluble solids content, dry matter and colour parameters).

Keywords: protected crop, yield, PAR radiation, growth, fruit quality.



**Microbiology
Applications**

Antagonistic fungi in the fight against the pinewood nematode

David Pires^{1,2*}, Cláudia Vicente^{2,1}, Manuel Mota², Maria L. Inácio^{1,3}

¹Instituto Nacional de Investigação Agrária e Veterinária (INIAV, I.P.), Av. da República, Quinta do Marquês – Edifício Florestal, Oeiras, Portugal

²Mediterranean Institute for Agriculture, Environment and Development (MED) & Global Change and Sustainability Institute (CHANGE), Institute for Advanced Studies and Research, University of Évora, Pólo da Mitra, Apartado 94, 7006-554 Évora, Portugal

³GREEN-IT Bioresources for Sustainability, ITQB NOVA, Av. da República, Oeiras Portugal.
Corresponding Author: david.pires@iniav.pt

The pinewood nematode (PWN), *Bursaphelenchus xylophilus*, is the causal agent of pine wilt disease (PWD) and a quarantine organism in many countries. Due to its economic importance and widespread distribution, an enormous effort is devoted to study the virulence of *B. xylophilus* and the epidemiology of PWD. Understandably, the non-specificity of synthetic chemicals and lack of environmental-friendly options to control this parasite has led to an increasing focus on antagonists capable of suppressing the PWN. *Esteya* spp. are nematophagous fungi and promising biocontrol agents against the PWN. Two species are described: *E. vermicola* and *E. floridanum*. In a quest to explore compatibility for a potential combined application of PWN antagonists in maritime pine, *Pinus pinaster*, the main and most affected species in Portuguese forests, we carried out fungus-fungus interaction assays on agar plates. These results should set the foundations for future research on exploring a synergistic effect and combined application of PWN antagonists in maritime pine, allowing us to devise new strategies for the management of PWD.

Keywords: biological control, *Bursaphelenchus xylophilus*, maritime pine, nematophagous fungi, pine wilt disease

Aiding Cork oak: a soil-plant-microbe approach

Celeste Santos-Silva¹, Rogério Louro², Tânia Nobre, Carlos Alexandre³

¹Mediterranean Institute for Agriculture, Environment and Development, Macromycology Laboratory, Applied Ecology and Conservation Group, Biology Department

²Mediterranean Institute for Agriculture, Environment and Development, Macromycology Laboratory, Applied Ecology and Conservation Group

³Mediterranean Institute for Agriculture, Environment and Development, Soil, water and climate Group, Geosciences Department

The present research aimed to apply several approaches to compare declining and non-declining *Quercus suber* stands. The study was conducted between 2020 and 2022, on declining (D) and non-declining (ND) *Q. suber* areas, with soils formed on sands and clay deposits from the Miocene. In each area, sampling procedures included: 1) sporocarp survey; 2) soil sampling to identify microbial taxa; 3) soil core sampling for nutrient and organic matter determination; 4) dig soil profiles to study soil horizons; 5) tree leaves sampling for nutrient determination. Leaf nutrient analysis suggested differences between *Q. suber* nutritional status, with higher P, K, Ca, S, Mn, Cu and B values for ND areas and higher Fe values for D areas. Although N, Mg and Zn contents were similar in leaves from both areas, C/N ratio was higher for ND stands. ND areas have thicker sandy loam soils (> 130 cm) than D areas (~60 cm), with sandier soils. Plus, usable water capacity and soil aeration were twice as high at ND areas. Soil organic matter, most nutrient levels (K, Mg, Mn, B), C/N ratio and pH were higher at ND areas. Macrofungal richness and mycorrhizal/saprotrophic rate (110; 3:1) were higher at ND areas compared with D areas (30; 1:4). More than 390 fungi OUT's were identified, with a mycorrhizal/saprotrophic rate superior for ND (1:1,35) relating to D areas (1:1,67). However, at ND areas prevailed the genus *Russula*, *Cortinarius* and *Inocybe*, and at D areas, *Tuber*, *Laccaria*, *Phallus* and *Entoloma* were the more abundant.

Keywords: Cork oak, macrofungi, soil properties, OUT's,

Metabolome Analysis and Immunity of *Phlomis purpurea* against *Phytophthora cinnamomi*

¹MED – Mediterranean Institute for Agriculture, Environment and Development & CHANGE – Global Change and Sustainability Institute, Institute for Advanced Studies and Research, Universidade de Évora, Pólo da Mitra, Ap. 94, 7006-554 Évora, Portugal

Phlomis purpurea grows spontaneously in the southern Iberian Peninsula, namely in cork oak (*Quercus suber*) forests. In a previous transcriptome analysis, we reported on its immunity against *Phytophthora cinnamomi*. However, little is known about the involvement of secondary metabolites in the *P. purpurea* defense response. It is known, though, that root exudates are toxic to this pathogen. To understand the involvement of secondary metabolites in the defense of *P. purpurea*, a metabolome analysis was performed using the leaves and roots of plants challenged with the pathogen for over 72 h. The putatively identified compounds were constitutively produced. Alkaloids, fatty acids, flavonoids, glucosinolates, polyketides, prenol lipids, phenylpropanoids, sterols, and terpenoids were differentially produced in these leaves and roots along the experiment timescale. It must be emphasized that the constitutive production of taurine in leaves and its increase soon after challenging suggests its role in *P. purpurea* immunity against the stress imposed by the oomycete. The rapid increase in secondary metabolite production by this plant species accounts for a concerted action of multiple compounds and genes on the innate protection of *Phlomis purpurea* against *Phytophthora cinnamomi*. The combination of the metabolome with the transcriptome data previously disclosed confirms the mentioned innate immunity of this plant against a devastating pathogen. It suggests its potential as an antagonist in phytopathogens' biological control. Its application in green forestry/agriculture is therefore possible.

Keywords: *Phlomis purpurea*; *Phytophthora cinnamomi*; biotic stress; metabolomic and transcriptomic integration; plant immune response

Monitoring soil microbial activity under different inter-row management practices: the importance of cover crops in the vineyard

V. Silva¹, I. Brito², A. Alexandre²

¹MED (Instituto Mediterrâneo para a Agricultura, Ambiente e Desenvolvimento) & CHANGE – Global Change and Sustainability Institute, IIFA (Instituto de Investigação e Formação Avançada), Universidade de Évora, Pólo da Mitra, Ap. 94, 7002-554 Évora, Portugal.

²MED (Instituto Mediterrâneo para a Agricultura, Ambiente e Desenvolvimento) & CHANGE – Global Change and Sustainability Institute, Departamento de Biologia, Escola de Ciências e Tecnologia, Universidade de Évora, Pólo da Mitra, Ap. 94, 7002-554 Évora, Portugal.
Corresponding Author: d38740@alunos.uevora.pt

The importance of soil health to maintain crop yield and grape quality has led to several wine growing regions worldwide to adopt soil sustainable management practices. Cover cropping is commonly associated with increased soil health [1]. However, there is a lack of knowledge on the way of action of different management practices on soil health and plant growth as well as on the extent and dynamic of these effects. Soil microbial activity is considered one of the most important indicators for soil biological and biochemical processes because of the impact on the organic matter transformation and nutrient availability [2]. Therefore, the overall goal of this investigation was to analyse how soil microbial activity was influenced by the inter-row soil management. Two soil management practices were analysed: absence and presence of cover crop in inter-row with *Vitis vinifera* L. cv. Alicante Bouschet and Arinto. Our objective was to quantify basal respiration and enzymatic activities of Arylsulfatase, β -glucosidase and Urease on soil samples collected at different growing seasons of the vineyard: flowering and veraison. Overall, the present study confirmed the positive effects on microbial activity of the presence of cover crops in the inter-row. The highest soil basal respiration was found in the soils with cover crop treatment. Additionally, the enzymatic activity was also greater under the presence of cover crop comparing to the conventional treatment. Nevertheless, more research is needed to better understand the effects of the cover crops in the vineyard ecosystem.

Keywords: sustainable soil management; soil health; cover crop; grape quality

Effect of tree canopy and dolomitic limestone application on soil microbial activity, floristic diversity and quality of the pasture in the *Montado* ecosystem

D. Bailote¹, J. Serrano², A. Belo³, A.E. Rato⁴, I. Brito³

¹MED – Mediterranean Institute for Agriculture, Environment and Development & CHANGE – Global Change and Sustainability Institute, Apartado 94, 7002 – 554 Évora, Portugal

²MED – Mediterranean Institute for Agriculture, Environment and Development & CHANGE – Global Change and Sustainability Institute, Departamento de Engenharia Rural, Escola de Ciências e Tecnologia, Universidade de Évora, Pólo da Mitra, Ap. 94, 7006-554 Évora, Portugal.

³MED – Mediterranean Institute for Agriculture, Environment and Development & CHANGE – Global Change and Sustainability Institute, Departamento de Biologia, Escola de Ciências e Tecnologia, Universidade de Évora, Pólo da Mitra, Ap. 94, 7006-554 Évora, Portugal.

⁴MED – Mediterranean Institute for Agriculture, Environment and Development & CHANGE – Global Change and Sustainability Institute, Departamento de Fitotecnia, Escola de Ciências e Tecnologia, Universidade de Évora, Pólo da Mitra, Ap. 94, 7006-554 Évora, Portugal.

Corresponding Author: ibrito@uevora.pt

The *Montado* is an agro-silvo-pastoral ecosystem, composed of cork oaks and holm oaks, while the vegetation cover is formed by natural biodiverse pastures, that grow on poor and generally acidic soils, grazed by animals in an extensive regime. The aim of this work was to evaluate the effect of the tree canopy and dolomitic limestone application on soil acidity correction, soil microbial activity (dehydrogenase, β -glucosidase, phosphatase, arylsulfatase and soil basal respiration), colonization rate by arbuscular mycorrhizal fungi, floristic diversity, and quality of pasture. Near infrared spectroscopy was also used on the soil samples to assess soil microbial activity. Soil and root samples were collected under and outside the canopy, in amended and unamended areas (6 replicates) in an experimental field (4ha) located in Mitra Farm in February 2022. In April, the floristic composition and pasture quality were monitored. The results show that there was a positive significant effect of the canopy on microbial activity, except for mycorrhizal colonisation. In general, acidity correction increased microbial activity, particularly outside the tree canopy, where *Brassicaceae* plants also became more abundant. Quality parameters of the pasture (crude protein and fibre) were not significantly affected by treatments. NIR signature of the soil was able to discriminate the effect of canopy and dolomitic limestone application. These results allow us to understand the effect of the tree canopy on the soil as a habitat for microbial development and the effects of soil acidity correction on the *Montado*, providing important information for the holistic management of this ecosystem.

Keywords: soil quality, mycorrhiza, soil enzymes, pasture quality, NIR.



Public Policy Application

Living Labs in agriculture and forestry: A systematic review of H2020 and Horizon Europe projects

María Rivera*, Catarina Esgalhado*

LABscape/MED – Mediterranean Institute for Agriculture, Environment and Development & CHANGE – Global Change and Sustainability Institute, Instituto de Investigação e Formação Avançada, Universidade de Évora, Pólo da Mitra, Ap. 94, 7006-554 Évora, Portugal*
Corresponding Author: mrmendez@uevora.pt

Living Labs (LLs) have become increasingly popular as a multi-actor approach to address complex issues in the agriculture and forestry sectors. LLs enable the integration of diverse knowledge and experiences from multiple actors and disciplines, bringing farmers, scientists, businesses, policymakers, and other agri-food system actors together to co-develop, test, and evaluate new practices and technologies. While there is no single definition for LLs, multi-actor partnerships, user-centred innovation, and real-life environments are recognized as key features. LLs are distinct from other science-policy-practice collaborations in their experimental nature and the central role of end users in co-creating innovations. However, the lack of clarity on how to implement the LL approach and the lack of a clear definition in EU-funded research could be leading to different interpretations and applications of the concept. To contribute to a clearer definition and help evaluate LLs more accurately in future calls, a systematic review will be performed on all projects that have used LLs within H2020 and Horizon Europe programs (N~ 74). The goal is to systematize how LLs are being conceptualized and operationalized in the context of European research and innovation projects in the fields of agriculture and forestry. This analysis will serve as a reference to help build proposals with sharper expectations in terms of potential impacts. The work presented in this paper is the first step of the analysis whereby we provide an initial overall description of the projects using living labs.

Keywords: Transdisciplinarity, multi-actor partnerships, innovation, agriculture/forestry, co-creation

From Research to Innovation in public policies: the pilot measure in PEPAC

“Management of the Montado for results”

M^a Isabel Ferraz-de-Oliveira^a, Teresa Pinto Correia^b, M^a Helena Guimarães^c, André Oliveira^c, Maria Dragão Coelho^c, Elvira Sales-Batista^a, Maria de Belém Costa Freitas^d, Tiago Marques^c

^{a)} MED – Mediterranean Institute for Agriculture, Environment and Development; CHANGE – Global Change and Sustainability Institute; Departamento de Zootecnia, Escola de Ciências e Tecnologia, Universidade de Évora, Portugal

^{b)} MED – Mediterranean Institute for Agriculture, Environment and Development, CHANGE – Global Change and Sustainability Institute; Departamento de Paisagem Ambiente e Ordenamento, Escola de Ciências e Tecnologia, Universidade de Évora, Portugal

^{c)} MED – Mediterranean Institute for Agriculture, Environment and Development, CHANGE – Global Change and Sustainability Institute; IIFA - Institute for Advanced Studies and Research, Universidade de Évora, Portugal

^{d)} MED—Mediterranean Institute for Agriculture, Environment and Development, Universidade do Algarve, Faculdade de Ciências e Tecnologia, Campus de Gambelas, Edif. 8, 8005-139 Faro, Portugal

The Montado faces challenges related mostly to intensification and specialization that have been responsible for the loss of tree density and total area over the last decades. Reconciling an efficient farming production with the conservation of natural resources under the multifunctional Montado is paramount to the long-term resilience of the system. Public policies may function as drivers of change and may have a role in halting or even reversing this decaying trend. In this context the European Community through the discussions of the Common Agriculture Policy, has asked Member States for a more environmental ambitious and outcome based public policy.

In this paper we present the construction process of a result based agri-environmental payment scheme for the Montado, highlighting the relevance of the multiactor approach adopted. Furthermore, we describe the first stages of the pilote scheme implementation within the Portuguese PEPAC, in two different locations in Alentejo: The Special Area of Conservation (SAC) of Monfurado and neighbor municipalities and the Special Protection Area (SPA) of Vale do Guadiana and neighbor municipalities.

Cows and Montado: Friends or Foes? Managing grazing pressure for soil health

Elvira Sales-Baptista^a, Isabel Ferraz-de-Oliveira^a, João Serrano^b, José Rafael Marques^b,
André Oliveira^c, Maria Dragão Coelho^c, M^a Helena Guimarães^c, Teresa Pinto Correia^d

^{a)} MED – Mediterranean Institute for Agriculture, Environment and Development; CHANGE – Global Change and Sustainability Institute; Departamento de Zootecnia, Escola de Ciências e Tecnologia, Universidade de Évora, Évora, Portugal

^{b)} MED – Mediterranean Institute for Agriculture, CHANGE – Global Change and Sustainability Institute, Environment and Development; Departamento de Engenharia Rural, Escola de Ciências e Tecnologia, Universidade de Évora, Portugal

^{c)} MED – Mediterranean Institute for Agriculture, Environment and Development

^{d)} MED—Mediterranean Institute for Agriculture, Environment and Development, CHANGE – Global Change and Sustainability Institute, Environment and Development; Departamento de Paisagem, Ambiente e Ordenamento, Escola de Ciências e Tecnologia, Universidade de Évora, Portugal

Overall, Montados support half of the national beef cattle production and are showing a trend for steady increase since 2014. To ensure long-term sustainability and ecological resilience of Montado silvopastoral system, grazing pressure should be optimized. With appropriate grazing management, soil ecological functions can be regenerated or enhanced to improve essential ecosystem services. On the other end, even under low stocking rates, continuous grazing can cause grasslands deterioration due to high grazing pressure. Besides balancing conservation and production goals, Montado livestock producers must manage grazing in unpredictable weather and market prices scenarios. To take sound decisions on food supplementation, grazing schedules and stocking rates, information on the use of resources in time and space is highly valuable. Livestock grazing behaviour, assessed through the use of GPS sensors, can provide detailed data. This integrated approach where the ecosystem health is assessed through animal behaviour, has been used in several I&D projects of our team (SUMO-Sustentabilidade do Montado, LIFEScrubsnet- Regeneration and improvement of dehesas/montados through the appropriate management of scrubland/shrub areas, Managing Montado by Results, Adapt for Grazing). This talk will address our current knowledge on the subject.

How many trees to fall: how and where are we losing the Montado silvo-pastoral system?

Marques, J. Tiago¹; Guiomar, Nuno¹; Pinto-Correia, Teresa¹

¹MED – Mediterranean Institute for Agriculture, Environment and Development & CHANGE – Global Change and Sustainability Institute, Institute for Advanced Studies and Research, Universidade de Évora, Pólo da Mitra, Ap. 94, 7006-554 Évora, Portugal.

The montado is a traditional agroforestry system in Portugal that combines cork or holm oak trees with pastures and crops. It provides multiple ecosystem services and supports rural livelihoods. However, in recent decades, the montado has faced several threats that have caused its decline and degradation. The decline of this system has been identified by several researchers and stakeholders. However, the recent quantification of the declining montado areas is missing. Here, we provide an updated and extensive estimation of the decline of the montado in Portugal. We used a 2006 montado cover map as a baseline and overlaid it with aerial photographs of 2018. We checked the montado drawn areas for land use change by installation of intensive crops, wildfire occurrences or the plantation of new areas of montado. We categorized the main driver of change and quantified its overall effect. Most of the areas were in average condition but 3.2% have changed to intensive agriculture (olive groves, almond-tree orchards). We also identified burned montado areas from previous wildfires (3.7%). In contrast, afforestation areas occupied 7.1% of the total area but a few areas had very low tree growth (4.3%) or had wildfire markings (7.8%). However, the most pervasive negative impact identified was the reduction on tree density (in 43% of the areas) and had a stronger impact on inland and southern locations. In fact, inland areas showed the tree loss in a more advanced stage, with the formation of wide clearings (>1ha). Our results are an up-to-date baseline map that is essential for research and to find solutions for its conservation and restoration.

Healthy collaboration for healthy soils – the case of the results-based model in the Montado

M^a Helena Guimarães^a, Isabel Ferraz-de-Oliveira^b, Teresa Pinto Correia^c, André Oliveira^a, Maria Dragão Coelho^a Maria de Belém Costa Freitas^d, Elvira Sales-Batista^b, Tiago Marques^a

^aMED – Mediterranean Institute for Agriculture, Environment and Development, CHANGE – Global Change and Sustainability Institute, & Institute for Advanced Studies and Research, Universidade de Évora, Portugal

^bMED – Mediterranean Institute for Agriculture, Environment and Development & Departamento de Zootecnia, Escola de Ciências e Tecnologia, Universidade de Évora, Évora, Portugal

^cMED – Mediterranean Institute for Agriculture, CHANGE – Global Change and Sustainability Institute, Environment and Development & Departamento de Paisagem Ambiente e Ordenamento, Escola de Ciências e Tecnologia, Universidade de Évora, Portugal

^dMED—Mediterranean Institute for Agriculture, Environment and Development, Universidade do Algarve, Faculdade de Ciências e Tecnologia, Campus de Gambelas, Edf. 8, 8005-139 Faro, Portugal

Achieving healthy soils is a social challenge. It implies changes in decision making at different scales from farming practices to policy making. It is not just about awareness and it's not just about creating good incentives for research and innovation (R&I). Unprecedented European initiatives are driving R&I around soil issues. In parallel to the efforts of assessing and monitoring soil health, in parallel to creating common protocols and in parallel to defining farming and policy practices towards soil health, there is the need to deal with the social challenge this objective implies. In this talk we will use the current application of a results-based model to the Montado to illustrate this need.



Sustainability of Resources

The role of land management practices on carbon balance in olive groves of Alentejo (Portugal).

Rodríguez Sousa A.A.^{1,2}, Muñoz-Rojas J.^{3*}, Brígido C.¹, Garcia-Ruiz, R.⁴, Liétor J.⁴, Prats S.A.¹

¹MED - Mediterranean Institute for Agriculture, Environment and Development & CHANGE - Global Change and Sustainability Institute, Institute for Advanced Studies and Research, Universidade de Évora, Pólo da Mitra, Ap. 94, 7006-554 Évora, Portugal

²Department of Statistics and Operations Research, Faculty of Mathematical Sciences, University Complutense of Madrid, Pl. De las Ciencias 3, 28040 Madrid, Spain

³MED - Mediterranean Institute for Agriculture, Environment and Development & CHANGE - Global Change and Sustainability Institute, Departamento de Geociências, Universidade de Évora, Pólo da Mitra, Ap. 94, 7006-554 Évora, Portugal

⁴Department of Animal Biology, Plant Biology and Ecology, University Institute of Research on Olive Groves and Olive Oils, Universidad de Jaén, 23071 Jaén, Spain

Corresponding Author: jmrojas@uevora.pt

Rural landscapes in Alentejo have changed greatly during the last 15 years, largely due to the expansion and technological intensification of olive groves. The application of agrochemicals (fertilizers and herbicides) along with crop intensification (increasing tree density) likely affect C balance of olive groves. We assess the C contents of different farming system components affecting the final farm, tree and soil C balances during one hydrologic year. Seven groves were selected with different soil management practices and production models, including organic vs integrated, as well as contrasting tree densities, 100, 300 and more than 1000 trees per hectare. The annual C inflows include that C which accumulates annually in the trees, olive leaves/flowers, tree pruning, olive fruits and cover crop biomass, and that inflow due to organic fertilizer applications. The annual C outflows include harvested olive fruits plus olive leaves, soil erosion and soil CO₂ emissions. Preliminary results showed that C balances are mostly positive mainly due to the accumulation of C in the tree permanent structure. Some of the farms showed negative farm C balances, indicating that more C was lost than entered, mainly in the farms which applied herbicide and, as a consequence, exhibited both lower annual CO₂ entry in the biomass of cover crops, and higher annual C erosion losses. Results indicate that: i) olive cover cropping contribute to climate change mitigation, and ii) there is a great potential to enlarge this contribution by, for instance, reducing herbicide application to allow positive C balance in olive groves.

Keywords: cover crops, herbicides, soil management, sustainability.

Carbon footprint in horticulture

Maria João P. Caldinhas¹, José Rafael M. da Silva²

¹MED - Mediterranean Institute for Agriculture, Environment and Development & CHANGE - Global Change and Sustainability Institute, Institute for Advanced Studies and Research, Universidade de Évora, Pólo da Mitra, Ap. 94, 7006-554 Évora, Portugal

Corresponding Author: maria.caldinhas@uevora.pt | jmsilva@uevora.pt

The agricultural sector contributes between 30 to 40 % of the global carbon footprint. Portugal assumed the goal of carbon neutrality by 2035. Thus, all sectors of society, including the agricultural sector, must be committed to achieving this goal. The objective of this study is to better understand the productive system of horticultural crops, what is the carbon footprint of potato, onion, carrot, melon and watermelon crops? Which cultural operations contribute the most to emissions? How to optimize the production system? The CP assessment was carried out by collecting data on each of the productions and calculating the carbon balance using the IPCC methodology (2006). The final result of average CO₂-eq emissions was: Potato GWP = 0.059, Onion GWP = 0.056; carrot GWP = 0.045; watermelon GWP = 0.043; Melon GWP = 0.061 (with GWP in Ton CO₂-eq/Ton product).

Keywords: CO₂-eq, GHG, GWP, Horticulture, Footprint.

Energy valorization of wastewater from the wine industry through bioelectrochemical remediation systems

M. Conceição Fernandes^{1,2*}, Alonso I. Arroyo-Escoto^{1,2}, Ana Mota Baía³, Nuno Ramos³,
Ana Lopes³, Annabel Fernandes³

¹Alentejo Biotechnology Center for Agriculture and Agro-Food (CEBAL)/ Polytechnical Institute of Beja (IPBeja), Apartado 6158, 7801-908 Beja, Portugal

²MED – Mediterranean Institute for Agriculture, Environment and Development - CEBAL, Farming Technology and Energy Efficiency

³ FibEnTech-UBI, Department of Chemistry, University Beira Interior, 6201-001 Covilhã, Portugal

*e-mail: maria.fernandes@cebal.pt

The Mediterranean wine industry is a culturally and economically icon. Portugal alone annually produces more than 6.5 million hectolitres average. Despite being one of the most profitable economic activities in the country, it generates a high amount of wastewater containing recalcitrant compounds and requiring treatment prior to discharge due to its likely water and subsoil pollution. Conventional wastewater treatments systems involve a significant expenditure; both energy and chemicals associated, without an economic return beyond the ecological maintenance of the discharge water and soil means. The applicability of systems that allow treatment and recovery of these wastes becomes quite relevant in terms of making waste treatment an economically attractive activity for industry, and not just a compulsory expense. Utilizing the oxidative respiration metabolism of microorganisms capable of generating a direct extracellular electronic transfer within a device known as electrochemical fuel cells, it is possible to harness the transformation of these recalcitrant compounds (organic acids, metal oxides) into primary metabolism sources to produce electrons, protons, and carbon dioxide by the bioanode into the anodic chamber. Electrons are recovered as electric power, while protons are selectively transferred to the cathodic chamber for green hydrogen electrochemical transformation. The two chambers separation allows to recover gases separately, thus avoiding the need to generate additional expenses for hydrogen purification. Overall, the system provides technical-economic robustness to one of the most important industries in the country and allows extrapolation for other classes of wastewater, only adapting appropriate microbial consortium for its specific conditions.

Keywords: Microbial electrochemical cell, green hydrogen, bioanode, extracellular electronic transfer, oxidative respiration metabolism.

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On the valorization of agroforestry residues into novel bio-based materials

Elodie Melro^{1,2}, Solange Magalhães³, Catarina Fernandes³, Luis Alves³, Maria Graça Rasteiro³, Anabela Romano⁴, Hugo Duarte⁴, María José Aliaño-González^{4,5}, Filipe Antunes^{1,2}, Artur J. Valente¹ and Bruno Medronho^{4,6*}

¹University of Coimbra, CQC, Department of Chemistry, Rua Larga, 3004-535 Coimbra, Portugal; ²Science351—Disruptive & Sustainable R&D Innovations, Instituto Pedro Nunes, Ed. C, 3030-199 Coimbra, Portugal; ³Department of Chemical Engineering, CIEPQPF, University of Coimbra, Pólo II – R. Silvio Lima, 3030-790 Coimbra, Portugal; ⁴MED-Mediterranean Institute for Agriculture, Environment and Development, CHANGE—Global Change and Sustainability Institute, Faculdade de Ciências e Tecnologia, Universidade do Algarve, Campus de Gambelas, Ed. 8, 8005-139 Faro, Portugal; ⁵Departamento de Química Analítica, Facultad de Ciencias, Universidad de Cádiz, 11510 Cadiz, Spain; ⁶Surface and Colloid Engineering, FSCN Research Centre, Mid Sweden University, SE-851 70 Sundsvall, Sweden.

Corresponding Author: bfmedronho@ualg.pt

Lignin is an amorphous aromatic polymer found in the plant cell wall with an estimated global production of 1 ca. 100 million tons/year, mostly being generated as a co-product from the paper and ethanol industries. However, most of it is still burned for energy or simply discarded, while about 2% is used to produce value-added products. Due to the numerous advantages of lignin (natural polyphenol, high carbon content, high thermal stability, biodegradability, and antioxidant activity) and the growing environmental awareness, there is a great interest in the development of value-added lignin products for various applications that reduce the use of petrochemical compounds. In this communication, some of our recent work on lignin dissolution, extraction and valorization into novel bio-based materials (resins, foams, composites, flocculant agents) is briefly introduced. A new lignin type extracted with novel sustainable solvents is highlighted.

Keywords: Lignocellulose; bio-based materials; agroforestry residues; circular economy

The cross between valuing fish and sustainability of resources

André Jorge¹, Marta Almeida, Hugo Ventura, Graça Machado¹, P.R. Almeida², Carlos Alexandre² and Maria João Lança¹

¹ Food Science and Technology Group - MED – Mediterranean Institute for Agriculture, Environment and Development & CHANGE – Global Change and Sustainability Institute, Instituto de Investigação e Formação Avançada, Universidade de Évora, Pólo da Mitra, Ap. 94, 7006-554 Évora, Portugal

² MARE – Centro de Ciências do Mar e do Ambiente / ARNET- Rede de Investigação Aquática, Instituto de Investigação e Formação Avançada, Universidade de Évora, 7002-554, Évora, Portugal

Corresponding Author: mjlanca@uevora.pt

As members of the Animal Science and Technology group (FST), our area of intervention are: on diadromous species (migratory) in the 7 Portuguese river basins; on a very relevant exotic species in main reservoirs in Alentejo (largemouth bass) and on experimental diets for breeding of wild trout in Campelo Aquaculture Station. Diadromous fish are those that migrate between freshwater and saltwater. Only 1% of the known fish species are included in this group, but many of those are that we appreciate gastronomically. We are talking about sea lamprey, shad, sturgeon, European eel, among others. Our team has been developing a partnership with fishermen so that the biological resource is valued, through an analysis of its nutritional, sensory and safety characteristics. The largemouth bass is a freshwater species originating in the Great Lakes region of the USA. In Portugal, after its introduction, this is one of the most caught species of fish in sport fishing. In this way, our efforts have been towards the characterization of the species to combine sport fishing with its consumption. This action allows the control of this invasive species and the gastronomic enhancement of it. In association with the other members of the team, our project CRER project - Adaptation of the Campelo Aquaculture Station for Experimental Breeding of Wild Trout” (PORTUGAL2020) allows us to develop research related to different diets to produce wild trout with a view to the subsequent sustainable restocking of the water courses in the region.

Keywords: diadromous fishes, food quality, product valorization, resources sustainability



**Exhibition 1| A circular bioeconomy strategy based on *Cynara cardunculus* production:
from cheese manufacturing to biotechnology applications**

Teresa Brás^{a,b}, Helena Caiado^{a,b}, Inês Caeiro^c, Daniela Rosa^{a,b,d}, Ana Paulino^{a,e}, Liliana Marum^{a,b}, Elsa Lamy^f, Anabela F. Belo^g, Cristina Conceição^h, Maria F. Duarte^{a,b*}

^a Alentejo Biotechnology Center for Agriculture and Agro-food (CEBAL)/ Polytechnic Institute of Beja (IPBeja), 7801-908 Beja, Portugal

^b MED – Mediterranean Institute for Agriculture, Environment and Development & CHANGE – Global Change and Sustainability Institute, CEBAL, 7801-908, Beja, Portugal

^c MED - Laboratório de Fisiologia Animal Aplicada, Universidade de Évora, Pólo da Mitra, Ap. 94, 7006-554 Évora, Portugal

^d Allelopathy Group, Department of Organic Chemistry, INBIO Institute of Biomolecules, Campus de Excelencia Internacional Agroalimentario (ceiA3), University of Cádiz, Avda. República Saharaui, s/n, 11510 Puerto Real, Cádiz Spain

^e Centre for Ecology, Faculdade de Ciência, Evolution and Environmental Changes (cE3c), Universidade de Lisboa, Lisboa, Portugal

^f MED – Mediterranean Institute for Agriculture, Environment and Development & CHANGE – Global Change and Sustainability Institute Universidade de Évora, Pólo da Mitra, Ap. 94, 7006-554 Évora, Portugal

^g MED – Mediterranean Institute for Agriculture, Environment and Development & CHANGE – Global Change and Sustainability Institute, Departamento de Biologia, Escola de Ciências e Tecnologia, Universidade de Évora, Pólo da Mitra, Ap. 94, 7006-554 Évora, Portugal;

^h MED – Mediterranean Institute for Agriculture, Environment and Development & CHANGE – Global Change and Sustainability Institute, Departamento de Zootecnia, Escola de Ciências e Tecnologia, Universidade de Évora, Pólo da Mitra, Ap. 94, 7006-554 Évora, Portugal;

Corresponding Author: fatima.duarte@cebal.pt and cristinaconceicao@uevora.pt

Cardoon (*Cynara cardunculus* L.) is Mediterranean crop, adapted to climate change, with a wide spectrum of applications. With an estimated biomass production that can range from 7.8 – 20.0 ton DW/ha, cardoon presents a high potential for a complete plant exploitation, with leaves representing from 33.1% till 48.4% of the total biomass average weight. Cardoon flowers are used, in the form of aqueous extract, as a vegetable coagulant in the production of sheep's cheese with Protected Designation of Origin (PDO) in the Mediterranean basin. The presence of aspartic proteases, cardosins, promote milk coagulation and proteolysis during cheese ripening. Variability among the enzyme profiles of cardoon plants has been evidenced, which has encouraged research to study their effect on the biochemical and sensory characteristics of cheeses. We intend to demonstrate the effect of the variability of the cardosins profiles of two lots of cardoon, promoting a commented sensorial analysis in Serpa cheese samples. Among the bioactive compounds that can be extracted from cardoon leaves, sesquiterpene lactones are the most prevalent group detected (≈ 94.5 g/kg DW), mostly represented by cynaropicrin (≈ 87.4 g/kg DW). Valorizations associated to leaves valorization will be demonstrated, namely the extraction of add-value compounds, and their anti-cancer and anti-inflammatory potential. We also intend to share the work we have been developed related to a bioherbicide development using cardoon-leaves-sesquiterpene derived extracts.

Exhibitions

The multiplicity of cardoon applications, mainly due to its biochemical richness lights-up its use in circular strategies, capable of potentiate new biobased valorizations.

Exhibition 1| Cardoon seed – An alternative oilseed for application in ruminant feed

Patrícia Lage^{1,2*}, Alexandra Francisco^{3,4,5}, Cristina Conceição^{2,6,7*}, Eliana Jerónimo^{1,2,6**}

¹ Centro de Biotecnologia Agrícola e Agro-Alimentar do Alentejo (CEBAL) / Instituto Politécnico de Beja (IPBeja), Beja, Portugal

² MED – Mediterranean Institute for Agriculture, Environment and Development, Portugal

³ Instituto Nacional de Investigação Agrária e Veterinária, Polo de Investigação de Santarém (INIAV-Fonte Boa), Vale de Santarém, Portugal

⁴ CIISA - Centro de Investigação Interdisciplinar em Sanidade Animal, Lisboa, Portugal

⁵ AL4AnimalS – Associate Laboratory for Animal and Veterinary Sciences, Portugal

⁶ CHANGE – Instituto para as Alterações Globais e Sustentabilidade, Portugal

⁷ Departamento de Zootecnia, Escola de Ciências e Tecnologia, Universidade de Évora, Pólo da Mitra, Évora, Portugal

* FOOD SCIENCE AND TECHNOLOGY

** ANIMAL BIOSCIENCES

Corresponding Author: patricia.lage@cebal.pt; eliana.jeronimo@cebal.pt

Cardoon seed (*Cynara cardunculus* L.) is mainly used for biodiesel production, but its incorporation in animal nutrition seems to be an alternative use with several benefits. Due to its chemical composition and nutritional value, cardoon seed can be very interesting for application in ruminant nutrition, particularly as a lipid source of polyunsaturated fatty acids. Cardoon seed has a high ether extract content, mainly composed of unsaturated fatty acids such as linoleic (18:2n-6) and oleic (18:1 *cis*-9) acids. Many nutritional strategies can be adopted to improve the fatty acid composition of ruminant fat and reduce their enteric methane emissions. Lipid supplementation, for instance, has been explored for both purposes. Supplementation of high-forage diets with vegetable seeds and/or oils rich in linoleic and linolenic acids has been successfully applied to increase the deposition of healthy fatty acids in ruminant meat. In addition, this nutritional strategy can decrease enteric methane production from ruminants. The use of cardoon seed as a ruminant feed source is little explored, and its effectiveness for improving the fatty acid composition of ruminant products and mitigating methane production is not yet studied. In this context, we are investigating the inclusion of cardoon seed in growing lamb diets to explore the potential of this feed source for increasing the health-promoting fatty acids in meat and, simultaneously, reducing enteric methane production without compromising animal performance.

Keywords: Cardoon seed; lamb; fatty acids; meat; methane

Exhibition 2| Behind the scenes: a “worm” relation between plants and parasitic nematodes

Margarida Espada¹, Pedro Barbosa¹, Carlos Gutiérrez-Gutiérrez¹, Cláudia Vicente¹

¹MED - Mediterranean Institute for Agriculture, Environment and Development & CHANGE - Global Change and Sustainability Institute, Institute for Advanced Studies and Research, Universidade de Évora, Pólo da Mitra, Ap. 94, 7006-554 Évora, Portugal

Soil health is the capacity of soil to maintain important ecosystem functions, such as sustaining living organisms (*i.e.*, plants, animals, and humans). In general, free-living nematodes contribute for soil health as important key species in nutrient cycles and in the multitrophic interactions with other soil microbes. However, the presence of plant-parasitic nematodes (PPN), may cause detrimental effects on plant hosts and other soil microorganisms, disrupting the equilibrium of soil ecosystem services. PPNs cause severe economic losses in a wide range of crops and forestry plant species worldwide being a major obstacle towards achieving sustainable agriculture.

The main objective of the Laboratory of Nematology (NemaLab) is the study of plant-parasitic nematodes (PPN) that affect agricultural and forestry plants of high economic value (examples: grapevine, potato, maritime pine), with a special interest in nematode-plant and nematode-microorganism interactions (such as bacteria), as well as in diagnosis/consultancy, and development of sustainable biocontrol methods. In this demonstration we will show the backstage of NemaLab, which has an extensive experience (over 25 years) in diagnosing the presence of pinewood nematode in national forestry surveys, as well as, in the detection of other important PPNs like grapevine virus vector nematodes, root-knot nematodes and root lesion nematodes.

Exhibition 3| Birds call for public engagement in science

Inês Roque, Inês Almeida, Rui Lourenço, Carlos Godinho, Pedro Pereira, Teresa Gomes,

Mariana Tomaz, João E. Rabaça

MED - Mediterranean Institute for Agriculture, Environment and Development & CHANGE - Global Change and Sustainability Institute, Institute for Advanced Studies and Research, Universidade de Évora, Pólo da Mitra, Ap. 94, 7006-554 Évora, Portugal

LabOr – Laboratory of Ornithology, MED-UEvora
Applied Ecology and Conservation Research Group
Corresponding Author: iroque@uevora.pt

Birds are attractive to humans mainly for aesthetic reasons, related to their diversity of shapes, colors, and behaviour. In addition, many birds are ubiquitous and easily detectable. Birds thus appear to be particularly appealing for recruiting people to environmental monitoring and nature conservation efforts, and there is a good base for public participation in collecting bird data for science. Birds are also very appealing for creating meaningful learning experiences in many contexts. Our demonstration illustrates owl pellet analysis, a methodology used to research the regulatory ecosystem services provided by predatory birds. We also used this demonstration to recruit volunteers for the National Barn Owl Census, one of our three current citizen science projects. This census aimed to improve estimates of the distribution and abundance of the Barn Owl in Portugal, and to contribute to the knowledge of its long-term population trend. Since the species is easy to identify, this was an opportunity to engage more than 700 new people in birdwatching, along with 268 regular participants in voluntary bird census, who together reported 597 Barn Owl presences (preliminary results). Our team is coordinating two other citizen science projects at different geographical scales: the Bird Atlas of the City of Évora (BACE), and the Introduced Bird Interaction Survey (IBISURVEY). BACE aims to record the distribution and abundance of birds in the urban centre of Évora, to support urban management and environmental education. IBISURVEY aims to assess the environmental, societal, and economic impacts of introduced birds in Europe, by collecting information on their distribution, abundance, and behaviour.

Keywords: barn owl; bird atlas; citizen science; invasive bird species; pellet analysis

Exhibition 4| From thinking to eat: oral biochemistry involved in sensory perception and food choices

Elsa Lamy^{1,2}, Carla Simões^{1,2}, Laura Carreira^{1,2}, Maria Jimenez^{1,2}, Inês Caeiro¹, Fernando Capela e Silva^{1,3}

¹ Oral Biology and Salivary Proteomics Laboratory (MED)

² Food Science and Technology Group

³ Animal Bioscience Group

Food systems are at the center of environmental, social and economic concerns, at the present moment. What we eat affects, not only, our health, but also the health of the planet. Despite the recognition that dietary habits need adjustments, no effective changes can be made without consumer acceptance. Food preferences and dietary habits are very hard to change. Health and sustainable claims can draw the attention of consumers, motivating them to try new food products, but if the sensory characteristics of these last are not perceived as pleasurable, they will be rejected.

Food sensory perception is a complex phenomenon, originating even before food enters the mouth and continuing inside this one. During this process, biochemical reactions occur, resulting in final perception, which may be different from one person to another.

The present demonstration aims to go deep into what happens in oral medium and how different factors change this. This will be divided in two complementary parts, which consist in: 1) the demonstration of the potential of a technology based on the use of artificial saliva to “taste outside the mouth”, being developed under the SensePredict project; 2) olfactory challenge to test the individuals’ ability for identifying food odors and to assess how this pre-ingestive stimulus has the potential of modifying salivation and taste perception.

During the time demonstration occurs, informative materials will be also present, together with the opportunity of discussing the research lines that are running in Oral Biology and Salivary Proteomics Laboratory.

Keywords: Saliva; Sensory perception; Food preferences; Consumer

Exhibition 5| Hands on activities to promote soil knowledge and environmental

E. Macedo¹, R. Espinho¹, P. Passinha¹, F. Duarte^{1,2}, R. Martins*^{1,2}

¹ CEBAL – Centro de Biotecnologia Agrícola e Agro-Alimentar do Alentejo / IPBeja – Instituto Politécnico de Beja,7801-908 Beja;

² MED – Mediterranean Institute for Agriculture, Environment and Development & CHANGE – Global Change and Sustainability Institute, CEBAL — Centro de Biotecnologia Agrícola e Agro-Alimentar do Alentejo, / IPBeja – Instituto Politécnico de Beja,7801-908 Beja, Portugal.

*Corresponding author: rita.martins@cebal.pt.

Science communication (science outreach) for children and young people is one of the areas of applied research MED-CEBAL is recently focus on. Build on an action research concept, MED-CEBAL is developing the “- a complementary educative strategy based on scientific method” project. *És(col)Ciência* intends to scientifically explore the application of non-formal science education methods, and the development of socioemotional skills. Science is introduced on natural sciences classes, to students from 5th to 7th grade, through playful-scientific activities, in concepts of "hands-on" and "learning by doing, so that students experience the curricula in a practical and simple way, stimulating their curiosity and awakening their motivation and involvement with school and knowledge. The demonstration action we propose here intends to show how issues related to environment/nature and sustainability are explored with students, namely in the topic of “Healthy soils, for food, for life and for the future”. The experiments performed and the type of materials used, the speeches employed, and the calls to action, connecting students with nature and the territory, are strategies used in the project. Along with this, socio emotional skills are worked with children, namely empathy-sustainability, which involves empathy with others and empathy with nature, mediated through place and identity. Understanding a progressive deterioration of a natural environment or resources, such as soil, is an example of it. The overall approach aims to provide an emotional experience with science and knowledge, consciousness and sensibilization, contributing to the development of principles, values, and skills on children that shape their personality.

Keywords: Alentejo; Children; Empathy; Playful-scientific experiences; Soft skills; Soil; Sustainability.

Exhibition 6| LÍQUENES – Estranhas Formas de Vida

Erika Almeida

Laboratório de Botânica | Grupo Ecologia Aplicada e Conservação
Corresponding author: erikaroldao@gmail.com

Líquenes - estranhas formas de vida, é uma sessão de promoção de conhecimento de um dos laços mais bonitos da natureza - os líquenes - e que indicação nos dão sobre o meio envolvente. Nesta demonstração serão apresentadas várias espécies de líquenes, os principais aspetos morfológicos e anatómicos inerentes a este grupo de seres vivos, preferências ecológicas, desafios na sua identificação, assim como algumas curiosidades.

Keywords: simbiose; monitorização ambiental; bioindicadores; associação; resistência

Exhibition 7| Molecular Diagnosis of Plant Pathogens in Mediterranean Crops

Maria Doroteia Campos ^{1*}, Mariana Patanita ¹, Joana Amaro Ribeiro ¹, André Albuquerque¹,
Nicolás Garrido¹, Carla Varanda ^{2,3}, Patrick Materatski¹, Filipa Santos⁴, Tomás Monteiro¹,
Maria do Rosário Félix⁴

¹MED - Mediterranean Institute for Agriculture, Environment and Development & CHANGE - Global Change and Sustainability Institute, Institute for Advanced Studies and Research, Universidade de Évora.

²ESAS, UIIPS, Instituto Politécnico de Santarém.

³MED - Mediterranean Institute for Agriculture, Environment and Development & CHANGE - Global Change and Sustainability Institute.

⁴MED - Mediterranean Institute for Agriculture, Environment and Development & CHANGE - Global Change and Sustainability Institute, Departamento de Fitotecnia, Escola de Ciências e Tecnologia, Universidade de Évora.

* Corresponding author: mdcc@uevora.pt

Mediterranean crops are a very important group of species closely associated with the climate of the Mediterranean region. The most relevant crops of this kind of systems are permanent crops, such as olive, grapevine, and nuts but also fresh vegetables, and cereals. Plant pathogens cause huge losses and have been an important worldwide and Mediterranean constraint to increase crop production and productivity. They are aggravated by agricultural intensification and monocultures, leading to new emergent diseases. The need to increase food production, together with the demand to reduce the application of synthetic chemicals has led to the search for alternative methods to protect plants against pathogens. The use of highly sensitive molecular methods arise as extremely useful tools for studying various agents of infection in plants, since early diagnostic is crucial for better disease control and limit the use of chemical defence strategies. The Virology and Micology Laboratories from MED/UÉvora are highly specialized on the detection of crop pathogens for investigation and diagnostic purposes. The available services provided by the laboratories and here demonstrated, include the use of highly sensitive methods for a target pathogen detection following a PCR approach, including real-time PCR. Molecular methodologies for relevant diseases such as olive and sweet-potato viruses, late wilt and fusarium ear rot in maize, tomato wild and rot diseases among others, were already successfully established. More recently, the use of high-throughput sequencing technologies data analysis, that allow the identification of pathogenic and endophytic communities in Mediterranean species are also available in the laboratories.

Exhibition 8| NEGHTRA & TANGO – Training projects for the new generation of farmers and agricultural entrepreneurs

Fátima Baptista¹, José Carlos Rico^{2*}, Diogo Rezende Coelho², Marcela Barbosa² and Vasco Fitas Cruz¹

¹MED – Mediterranean Institute for Agriculture, Environment and Development & CHANGE – Global Change and Sustainability Institute, Departamento de Engenharia Rural, Escola de Ciências e Tecnologia, Universidade de Évora, Pólo da Mitra, Ap. 94, 7006-554 Évora, Portugal; fb@uevora.pt; vfc@uevora.pt

²MED – Mediterranean Institute for Agriculture, Environment and Development & CHANGE – Global Change and Sustainability Institute, Institute for Advanced Studies and Research, Universidade de Évora, Pólo da Mitra, Ap. 94, 7006-554 Évora, Portugal. jcsr@uevora.pt; diogojrc@uevora.pt; marcela.barbosa@uevora.pt

* Corresponding author: jcsr@uevora.pt

The significant digital transformation and increasing concern for sustainability issues in the agri-food sector in recent years have been at the centre of governance decisions. As a result, the EU has been encouraging the implementation of projects that develop training programs, aiming to empower farmers and facilitate sector intermediation through knowledge transfer. The NEGHTRA and TANGO-Circular projects are two examples of these initiatives. These Erasmus+ projects are comprised of a multidisciplinary consortium, with the University of Évora as a partner. The NEGHTRA Project (Next Generation Training on Intelligent Greenhouses) is a specialized training project that addresses knowledge transfer in precision agriculture based on specific needs and challenges, identified from a comprehensive need analysis. The main goal of the project is to design, develop and deliver training on intelligent sustainable and cost-effective greenhouses, suitable for individual farmers/farming schools and especially useful to remote and vulnerable communities. The aim of TANGO-Circular Project (Training A New Generation Of Farmers And Agricultural Entrepreneurs To Implement The Concept Of Circular Economy In Agriculture) is to provide interested farmers and breeders with free training to acquire knowledge, skills and competence in the field of agro-environmental technology for a sustainable agriculture, through a new curriculum created in the context of Circular Economy. The objective of this demonstration activity will be to promote the projects and their programmatic contents, aiming to increase visibility and reach as many interested parties as possible.

Keywords: training material; sustainability; intelligent greenhouses; and circular economy

Exhibition 9| Plant growth-promoting bacteria: from lab to field research

Roukaya Ben Gaied; Esther Menéndez; Luís Alho; Clarisse Brígido

MED-Mediterranean Institute for Agriculture, Environment and Development & CHANGE-Global Change and Sustainability Institute, Institute for Advanced Studies and Research, Évora University
Soil Microbiology lab/ Plant protection / MED-Uévora
Corresponding author: ccb@uevora.pt

The “First Green Revolution” entailed intensive agricultural practices aiming to increase agricultural production [1]. While this allowed a fast increase in food production and food security, it came with a cost for the environment and society. It is now admitted that intensive agriculture and food production has multiple negative impacts both on and off the farm. An alternative to this situation is the promotion of cropping systems that rely on ecological services, such as those provided by beneficial soil microorganisms [2]. Among them, plant growth-promoting bacteria (PGPB) can boost plant growth, as well as protect plants from several biotic and abiotic stresses through a variety of mechanisms, such as the secretion of a variety of metabolites and hormones, nitrogen fixation, and augment of nutrients’ bioavailability through mineral solubilization. Therefore, the exploitation of PGPB in agriculture is feasible as it offers sustainable and eco-friendly approaches to maintain soil health while increasing crop productivity. To better understand the potential and use of these bacteria, we devote our efforts on i) studying the molecular mechanisms of the beneficial plant-microbe interactions, ii) understanding the driving factors of the belowground microbial communities’ assemblies, and iii) evaluating the ability of synthetic microbial communities (SynCom’s) to protect plants from (a)biotic stresses. For that, we employ multidisciplinary techniques that allow us to study in-depth binary plant-bacteria systems to more complex networks involving multiple bacteria to mimic the soil-plant ecosystem. Our work helps to identify the molecular mechanisms involved in the promotion of plant growth under different stressful conditions and contributes to fill the gaps in the current knowledge on plant-bacteria interactions to recommend methodologies and strategies for implementing or improving crop interactions with beneficial bacteria.

Keywords: sustainability; plant growth promotion; soil health; food security; beneficial microbes.

Exhibition 10| Study of Portuguese extra virgin olive oils according to the producing agricultural method: a qualitative and ecological approach

Miguel D. Ferro^{1,2+}, Maria F. Duarte^{1,2°}, Maria J. Cabrita³, José M. Herrera^{4, Φ}

¹Alentejo Biotechnology Center for Agriculture and Agro-Food (CEBAL)/Instituto Politécnico de Beja (IPBeja), 7801-908 Beja, Portugal;

²MED—Mediterranean Institute for Agriculture, Environment and Development & CHANGE – Global Change and Sustainability Institute, CEBAL, 7801-908 Beja, Portugal

³MED – Mediterranean Institute for Agriculture, Environment and Development & CHANGE – Global Change and Sustainability Institute, Departamento de Fitotecnia, Escola de Ciências e Tecnologia, Universidade de Évora, Pólo da Mitra, Ap. 94, 7006-554 Évora, Portugal;

⁴MED – Mediterranean Institute for Agriculture, Environment and Development & CHANGE, Universidade de Évora, Casa Cordovil, 2nd Floor, R. Dom Augusto Eduardo Nunes 7, 7000-651, Évora, Portugal;

ΦCurrent address: Departamento de Biología - Instituto de Investigación Vitivinícola y Agroalimentaria - Universidad de Cádiz, Campus Río San Pedro, 11510 Puerto Real, Spain
Corresponding author: miguel.ferro@cebal.pt and fatima.duarte@cebal.pt

Being Portugal among the biggest olive oil producing countries in European Union, it is of crucial importance to assure the unique nutritional and chemical composition of this so valuable food product. Taking also into consideration the 2030 Agenda for the Sustainable Development, it becomes even more critical to study this food product, considering the environmental impact behind the different olive oil (OO) agricultural approaches. Thus, the present work aims to compare monovarietal OO produces from distinct agricultural management systems, integrated and organic production. This comparison reveals distinct chemical and nutritional compositions of produced OO, showing that in fact agricultural practices do induce different chemical responses in the olive fruit, which will give origin to distinct OO. In terms of the ecological assessment, both agricultural management systems present distinct behaviors in terms of the presence and abundance of naturally occurring auxiliary fauna for pests control, namely the olive fruit fly (*Bactrocera oleae*).

Keywords: olive oil, portuguese cultivars, organic, integrated

Exhibition 11| The contribution of plant breeding towards a more sustainable agriculture

Hélia Cardoso¹, Catarina Campos², Lénia Rodrigues², Catarina Estevão², Valeriya Ustyomenko², Carolina Morais², Raquel Martins², Rafaela Santos², Pedro Tavares², Rita Pires², Augusto Peixe³

¹MED—Mediterranean Institute for Agriculture, Environment and Development & CHANGE — Global Change and Sustainability Institute, Escola de Ciências e Tecnologia, Departamento de Biologia, Universidade de Évora, Pólo da Mitra, Ap. 94, 7006-554 Évora, Portugal. hcardoso@uevora.pt

²MED—Mediterranean Institute for Agriculture, Environment and Development & CHANGE — Global Change and Sustainability Institute, Instituto de Investigação e Formação Avançada, Universidade de Évora, Pólo da Mitra, Ap. 94, 7006-554 Évora, Portugal.

³MED—Mediterranean Institute for Agriculture, Environment and Development & CHANGE — Global Change and Sustainability Institute, Escola de Ciências e Tecnologia, Departamento de Fitotecnia, Universidade de Évora, Pólo da Mitra, Ap. 94, 7006-554 Évora, Portugal.

Conventional agricultural practices currently associated with high yields have been supported by the routine application of chemical fertilizers, and pesticides to control pests, diseases and weeds. The negative impacts of those practices on soil and water health, not only due to the contamination but also by the decrease in the biodiversity of plants, animals and microorganisms, have been moving farmers to adopt a more sustainable agricultural practice. The option for organic agriculture, with strong restrictions on the use of fertilizers and synthetic pesticides, as well the regenerative agriculture, by minimizing soil disturbance, are two strategies that are nowadays very valuable. Nevertheless, in parallel to the adaptation of the agricultural systems, academia and research institutions should also take a role in this changing panorama, by contributing to the development of elite genotypes that better cope with environmental stresses and have higher resource-use efficiencies, thus increasing the stability of plant biomass and crop yield. Researchers of MED-UÉVORA (Lab. of Plant Breeding and Biotechnology and Lab. of Molecular Biology) have different research lines focused on the breeding of Mediterranean species, which includes the characterization of genotypes upon biotic/abiotic stresses, and the development of new varieties by following a conventional breeding approach. The use of calorimetry, a phenotyping tool established to select more resilient genotypes based on seed analysis, and the application of molecular markers to assist a grapevine breeding program to develop fungal-resistant cultivars will be highlighted. Additionally, the techniques that are available at MED-UÉVORA that could be applied in a similar context will be presented.

Keywords: plant breeding, stress tolerance, resilience, phenotyping, genotyping

Exhibition 12| Valorization of biomass: Lignin as a sustainable alternative for hair conditioning

Catarina Fernandes^{1,2*}, Bruno Medronho^{2,3}, Luís Alves¹, Graça Rasteiro¹, Carla Varela^{1,4,5}

¹University of Coimbra, CIEPQPF, Department of Chemical Engineering, Pólo II – R. Sílvio Lima, 3030-790 Coimbra, Portugal.

²MED – Mediterranean Institute for Agriculture, Environment and Development & CHANGE – Global Change and Sustainability Institute, Universidade do Algarve, Faculdade de Ciências e Tecnologia, Campus de Gambelas, Ed. 8, 8005-139 Faro, Portugal.

³FSCN, Surface and Colloid Engineering, Mid Sweden University, SE-851 70 Sundsvall, Sweden.

⁴University of Coimbra, Coimbra Institute for Clinical and Biomedical Research (iCBR), Clinic Academic Center of Coimbra (CACC), Coimbra, Portugal

⁵University of Coimbra, Center for Innovative Biomedicine and Biotechnology (CIBB), Coimbra, Portugal
Corresponding author: csfernandes@uc.pt

Hair is constantly exposed to thermal, chemical, or environmental damage that can leave the hair with an unpleasant feeling and appearance. Conditioning agents are incorporated into hair care formulations to reduce the friction between fibers and restore hair gloss and softness. In addition to the product's efficiency, its origin and environmental impact are becoming concerns for many consumers that are driving their preferences towards more sustainable and natural-based formulations¹. Cationic conditioners, designed to treat extremely damaged hair, are frequently produced from non-renewable resources, and pose some risks to aquatic life². Therefore, there is an increased need to find new components that can fulfill consumer expectations both in terms of efficiency and environmental impact, especially in the case of cationic conditioners. Biopolymers, such as lignin, are excellent candidates to be used in bio-based formulations. Lignin is a natural polyphenol that has been reported as a multi-functional cosmetic ingredient for hair and skin care, offering antibacterial, antioxidant, regenerative, and sun-protective activities¹. Despite its high potential for the development of novel value-added biomaterials, lignin is still highly underutilized, being mostly burned as low-grade fuel. The goal of this project is to develop novel sustainable cationic lignin-based derivatives that can act as conditioning agents in hair care products and thus compete with the traditional systems obtained from non-renewable sources. This project will promote the valorization of biomass wastes and contribute to the advancement of lignin-based materials application in the hair care sector.

Keywords: biomass valorization, biomaterials, hair care, lignin

Exhibition 13| Linear Infrastructure Networks with Ecological Solutions – showcasing the legacy of the LIFE-LINES project

Silva C¹, Sampaio A¹, Sousa LG¹, Oliveira A¹, Valerio F², Pinto, T¹, Craveiro J^{1,3}, Salgueiro P¹, Pedroso N.M.¹, Mira A¹

¹MED - Mediterranean Institute for Agriculture, Environment and Development & CHANGE – Global Change and Sustainability Institute, Institute for Advanced Studies and Research; UBC – Conservation Biology Lab, Department of Biology, University of Évora, Mitra, Ap. 94, 7006-554, Évora, Portugal

²BIOPOLIS Program in Genomics, Biodiversity and Land Planning, CIBIO, Campus de Vairão, 4485-661 Vairão, Portugal

³Centro de Ecologia Aplicada Prof. Baeta Neves, Instituto Superior de Agronomia, Tapada da Ajuda, Universidade de Lisboa, 1349 - 017 Lisboa, Portuga

Lab/Research Group: UBC – Conservation Biology Lab / Applied Ecology and Conservation

Corresponding author: carmoms@uevora.pt

The need for reversing the negative impacts of Linear Infrastructure Networks on the environment is increasingly acknowledged as a key to achieving national and international biodiversity commitments. LIFE-LINES project (LIFE14 NAT/PT/001081) employed and essayed a large and diverse number of interventions to reconcile biodiversity conservation and the presence of roads and powerlines. This was achieved through actions that enhanced ecological connectivity by reducing wildlife road-kills and road-barrier effect, promoting autochthonous vegetation, and creating refuges and corridors in linear infrastructures related habitats. The project outcomes of these demonstrative and innovative solutions proved that fostering Green Infrastructures across existing Grey Infrastructures without jeopardizing their ecological and social roles is reachable. Beyond socio-ecological results, several tools were created to support appropriate management choices by stakeholders and decision-makers aimed for the sustainability of linear infrastructures, from the planning to the maintenance phase. These included solutions to wildlife safe crossing on road, guidance to improve road verge management, and development of a National Roadkill Database to monitor and report large-scale mortality trends. The proposed practical demonstration will consist of a showcase of the project main results using teasers and tutorials as audiovisual support, and distribution of printed information (e.g., flyers, Layman's report). We will also engage participants to compete in a challenge about road design, testing the ability to comply with different social and ecological constraints. Prizes will be awarded to participants and the best proposal for road design.

Keywords: Biodiversity conservation, Road ecology, Green infrastructure, Animal communities



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www.med.uevora.pt



med@uevora.pt



266 760 848



MED | Universidade de Évora
Pólo da Mitra, Apartado 94
7006-554 Évora, Portugal