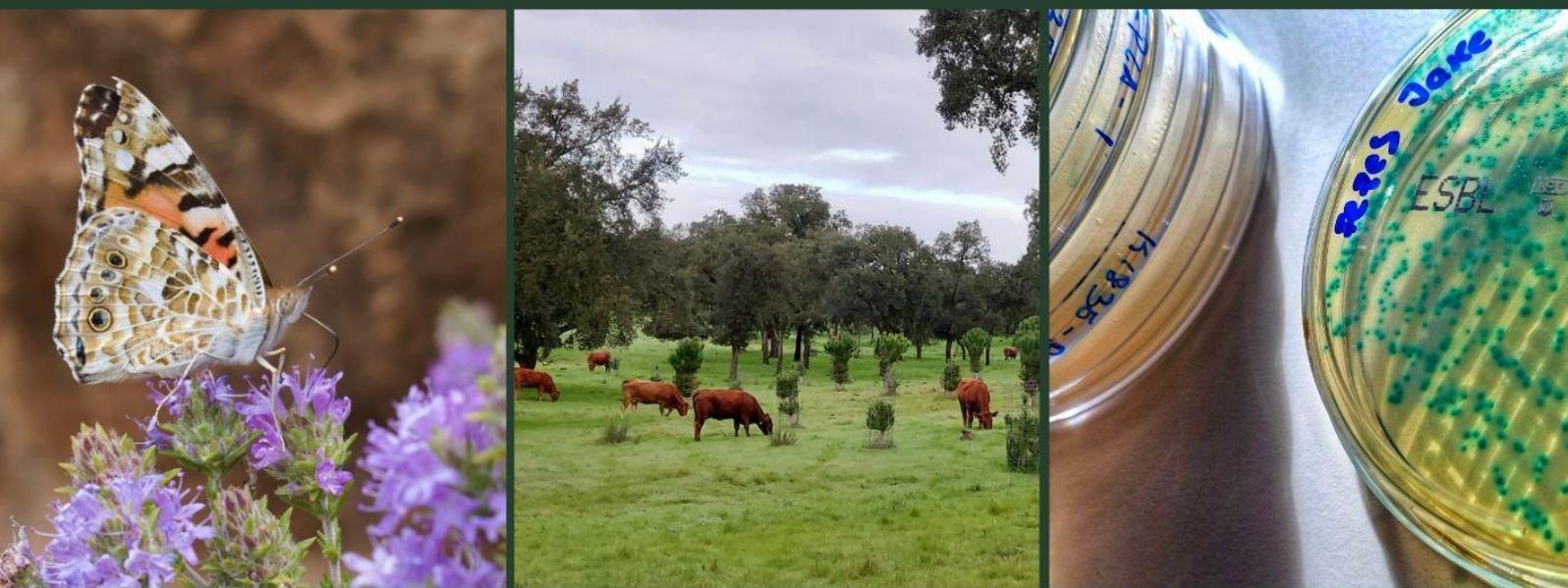


# 3<sup>rd</sup> MED Meeting

June 16-17, 2025 | UEVORA | Mitra Campus

## Science for Resilient Agroecosystems and Sustainable Future

### Book of Abstracts



# MED

Mediterranean Institute for Agriculture,  
Environment and Development

**3<sup>rd</sup> MED Meeting**  
University of Évora

Book of abstracts of the 3<sup>rd</sup> MED Meeting  
under the theme

“Science for resilient agroecosystems and sustainable  
future”

held in Évora (University of Évora – Mitra Campus), Portugal

June 16 - 17, 2025

**Edited by:**

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DE ÉVORA



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UNIVERSIDADE DO ALGARVE



**cebal**  
ALENTEJO BIOTECHNOLOGY CENTER FOR  
AGRICULTURE AND AGRO-FOOD

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Teresa Pinto Correia, MED&CHANGE – University of Évora

## FULL PROGRAMME

### Day 1 – June, 16

10:30–12:30

**MED Scientific Council Meeting**

12:30–14:00

**Lunch + Registration**

14:00–14:20

#### Opening Session

**Hermínia Vasconcelos Vilar**, University of Évora Rector

**Rui Salgado**, Institute for Research and Advanced Training (IIFA) Director

**Fátima Baptista**, MED Director

14:20–15:00

#### MED: Looking Back, Moving Forward

Nuno Pedroso, MED Executive Director

15:00–15:40

**Presentation of PRR projects coordinated by MED researchers**

**Chair: Anabela Romano**

15:00–15:10

**PEGADA 4.0 – Sustainability in agriculture supported by intelligent processes and technologies – assessing the biodiversity footprint**

Rui Lourenço – Ecology & Biogeography / José Rafael

Marques da Silva – Soil, Water, Plant & Farming Technology

15:10–15:20

**SUMO – Sustainability of the Montado**

Rui Charneca – Animal Biosciences

15:20–15:30

**Montados Net-Zero – Innovation networks to increase resilience and progress towards carbon neutrality in the rural areas of the South**

Teresa Pinto Correia – Landscape Dynamics & Management

**Questions & Answers (10min)**

## FULL PROGRAMME

15:40-16:10

**Coffee-break**

16:10-17:00

**Presentation of PRR projects  
coordinated by MED researchers**

**Chair: Anabela Romano**

16:10-16:20

**INOVCIRCOLVE - Innovation and circularity in the olive sector**

Diogo Rezende Coelho - Soil, Water, Plant & Farming  
Technology

16:20-16:30

**Vine and Wine Portugal - Driving Sustainable Growth  
Through Smart Innovation**

Maria João Cabrita - Food Science & Technology

16:30-16:40

**REVITALGARVE - Revitalization of rural areas in the  
Algarve: resilience and innovation in  
the creation of territorial food systems**

Jorge Pereira - Food Science & Technology

16:40-16:50

**NEXUS - Innovation agenda for digital and green  
transition**

Teresa Batista - Landscape Dynamics & Management

**Questions & Answers (10min)**

## FULL PROGRAMME

### Day 2 - June, 17

9:30-10:30

5min pitches aligned with  
MED Goals:

Chair: Cláudia Vicente

- 1) Improve resources use efficiency
- 5) Foster the resilience, mitigation, and adaptation of agroecosystems and biodiversity conservation to environmental and climate changes

**Evaluation of a manure spreader on localized application of olive leaves in vineyards**

António Bento Dias - Soil, Water, Plant & Farming Technology

**GEDICorrect: A python framework for GEDI geolocation correction using multiple criteria and parallel processing methods**

Leonel Corado - Ecology & Biogeography

**Understanding the dynamic patterns of quorum SENSing signals in ROOT colonization and biofilm formation**

Clarisse Brígido - Plant Protection, Genetics & Biotechnology

**Metabolomics as a phenotyping tool for *Vitis vinifera* cultivar characterization**

Lénia Rodrigues - Plant Protection, Genetics & Biotechnology

**RNA-Seq transcriptome analysis reveals novel molecular networks involved in Cynaropicrin Biosynthesis in *Cynara cardunculus* L.**

Ana Paulino - Plant Protection, Genetics & Biotechnology

#### **Questions & Answers (5min)**

**Exploring the potential of the Carob tree for sustainable agriculture in Alentejo**

Hélia Cardoso - Plant Protection, Genetics & Biotechnology

**Combining mulch and biochar to increase the carbon sink capacity in Mediterranean vineyards and olive orchards**

João Canedo - Soil, Water, Plant & Farming Technology

## FULL PROGRAMME

### Day 2 - June, 17

**Role of permanent crops in soil carbon sequestration: a comparative study between avocado orchard and fallow land**

Pedro Matias - Soil, Water, Plant & Farming Technology

***In vitro* culture as a sustainable strategy for secondary metabolite production**

Inês Mansinhos - Plant Protection, Genetics & Biotechnology

**Airborne pollen and fungal spores monitoring data: application on health, agronomy, environment and climate change fields**

Elsa Caeiro - Animal Biosciences

**Questions & Answers (5min)**

10:30-11:00

**Coffee-break**

11:00-12:45

Chair: Rui Lourenço

**5min pitches aligned with MED Goal:  
2) Improve sustainability of food systems**

**Mediterranean diet and brazilian red propolis: bioactive synergy in oral health promotion**

Rosana Solon Tajra - Animal Biosciences

**Epigenetic modulation in plants: exploring DNA methylation and miRNA dynamics across different environmental contexts**

Catarina Campos - Plant Protection, Genetics & Biotechnology

**AlBread: Bioactive Potential of Alentejo and Algarve Essential Oils in Functional Bread Formulation**

Bruno Medronho - Plant Protection, Genetics & Biotechnology

## FULL PROGRAMME

### Day 2 – June, 17

**Comparative Study of Volatile Profiles in Eco-friendly *Ficus carica* L. Liqueurs Produced from Leaf- and Fruit-Byproducts of White and Dark Cultivars**

Raquel Rodríguez Solana – Plant Protection, Genetics & Biotechnology

**GC×GC-ToFMS stands for?**

Daniela Fonseca – Food Science & Technology

**Questions & Answers (5min)**

**Emulsions featuring the “mother of vinegar” for food and crops**

Hugo Duarte – Plant Protection, Genetics & Biotechnology

**1-Methylcyclopropene and lemongrass essential oil nanocoatings effect on the preservation of cold stored ‘Rocha’ pear**

Custódia Gago – Food Science & Technology

**Microbial characterization of white pig dry-cured sausage**

Sara Conceição – Food Science & Technology

**Comparative proteomic analysis of *Trioza erytreae* nymphs developed on *Citrus ×limon* and *Citrus ×sinensis* host plants**

Tomás Magalhães – Soil, Water, Plant & Farming Technology

**Nematicidal activity of phytochemicals against the root-lesion nematode *Pratylenchus penetrans***

Pedro Barbosa – Plant Protection, Genetics & Biotechnology

**Questions & Answers (5min)**

**Mode of action of two plant-derived compounds on the root-lesion nematode *Pratylenchus penetrans***

Cláudia Vicente – Plant Protection, Genetics & Biotechnology

**The effect of the olive fruit fly infestation on the quality parameters of virgin olive oil and its relation to the commercial classification**

Miguel Ferro – Food Science & Technology

## FULL PROGRAMME

### Day 2 - June, 17

#### **ALTFoodSense**

Elsa Lamy - Food Science & Technology

#### **Truffle aroma - who produces it?**

Celeste S. e Silva - Ecology & Biogeography

#### **Agroecology assessment tools as a framework for agri-food systems' sustainability**

José Muñoz-Rojas - Landscape Dynamics & Management

#### **UAV-based monitoring of soil erosion in Mediterranean agricultural orchards under low erosion rates**

Sergio Prats - Soil, Water, Plant & Farming Technology

**Questions & Answers (5min)**

12:45-14:20

**Lunch**

14:25-14:30

**Group Photo**



14:30-15:30

**Scientific Exhibitions**



## FULL PROGRAMME

### Day 2 - June, 17

14:30-15:30

#### Scientific Exhibitions

**Rebooting the Montado: Restoring Ecosystems with Genetic Precision**

Liliana Marum - Plant Protection, Genetics & Biotechnology

**The contribution of molecular and biotechnological plant sciences to sustainable mediterranean agriculture**

Catarina Estêvão - Plant Protection, Genetics & Biotechnology

**AlBread - Aromatic plants from Alentejo, probiotics and acorn flour for the development of functional bread**

Margarida Oliveira - Plant Protection, Genetics & Biotechnology

**Antifungal potential of essential oils and their stabilization with bacterial cellulose in a functional bread**

Isabela Vera dos Anjos - Plant Protection, Genetics & Biotechnology

**From biomass to beauty: Lignin-based conditioning agents for sustainable cosmetics**

Catarina Fernandes - Plant Protection, Genetics & Biotechnology

**CynaraHub - a circular bioeconomy approach to enhance the economic valorization of *Cynara cardunculus*, promoting territory resilience**

Fátima Duarte - Food Science & Technology

**Connected to Science: Innovating in Science Communication for Inclusive Development and Resilient Agroecosystems**

Rita Martins - Food Science & Technology

**Biochar application: impact on the germination index of lettuce (*Lactuca sativa* L.) in agricultural soil**

Lúisa Coelho - Plant Protection, Genetics & Biotechnology

**Solutions for the valorization of surpluses from the olive oil sector**

António F. Bento Dias - Soil, Water, Plant & Farming Technology

**Impact of Harvest and Post-Harvest Practices on the Abundance of *Ceratitis capitata* (Wiedemann) (Diptera: Tephritidae)**

Silvio Junior - Plant Protection, Genetics & Biotechnology

## FULL PROGRAMME

### Day 2 – June, 17

15:45–16:45

5min pitches aligned with  
MED Goals:

Chair: Susana Filipe

- 3) Assure environmental integrity, biodiversity conservation and landscape multifunctionality
- 4) To promote organisational capability, governance mechanisms and inclusive development

**Intraguild predation and interference competition amongst raptors in Europe**

Rui Lourenço – Ecology & Biogeography

**Small mammal diversity in Mediterranean agroecosystems: insights from barn owl pellets in traditional farming landscapes**

Ricardo Pita – Ecology & Biogeography

**Spatiotemporal dynamics of pastures in Portugal between 1995 and 2018**

Rui D. P. Machado – Landscape Dynamics & Management

**Montados and Miombo forests impacts on adaptation of the soil surface to temperature variation, case of Alentejo central in Portugal and Mavago district in Mozambique**

Miguel P. Ferreira – Landscape Dynamics & Management

**Mapping global conservation priorities across natural, production and urban lands**

Diogo Alagador – Ecology & Biogeography

**Questions & Answers (5min)**

## FULL PROGRAMME

### Day 2 - June, 17

#### **LDT - From landscape metrics back to patterns**

Rui D. P. Machado - Landscape Dynamics & Management

#### **Bacterial Diversity and Biotechnological Potential of Mediterranean Fruit Tree Ecosystems and Vinegar-Derived Komagataeibacter Strains**

Diogo N. Proença - Plant Protection, Genetics & Biotechnology

#### **BioBlitz Herdade da Mitra: One day, one mission - Bringing people together for biodiversity**

Ana Sampaio - Ecology & Biogeography

#### **Social Science for Strengthening Governance Structures**

Maria Helena Guimarães - Landscape Dynamics & Management

**Questions & Answers (5min)**

16:45-17:00

#### **Closing Session**

**Maria João Costa**, University of Évora Vice-Rector for Research, Innovation and Internationalisation

**Fátima Baptista**, MED Director

**Fátima Duarte**, MED-CEBAL Coordinator

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# **PREFACE**

## PREFACE

Under the theme “Science for resilient agroecosystems and sustainable future”, this 3rd MED Meeting invited reflection on the central role of science in building more resilient agroecological systems and a truly sustainable future.

Over the course of two days, researchers shared knowledge, experiences, and perspectives on the MED research centre’s journey and on the paths ahead. The programme with more than 40 scientific presentations, included a session dedicated to projects funded by the Recovery and Resilience Plan (*Programa de Recuperação e Resiliência* – PRR) and Mobilising Agendas, led by MED researchers, as well as a second day structured around dynamic 5-minute pitch presentations aligned with the centre’s strategic objectives and exhibitions, with practical demonstrations of MED’s research.

This book of abstracts brings together contributions from diverse research teams who, with dedication and creativity, embody MED’s mission. The debates, scientific demonstrations, and informal moments that enriched the meeting, reflect the collaborative spirit that defines our R&D unit and our shared commitment to science, the territory, and society.

## **MED: Looking Back, Moving Forward**

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Since its creation in 2020, the MED – Mediterranean Institute for Agriculture, Environment and Development – has consolidated its identity as a multidisciplinary research centre connecting nature, food and people. This presentation provides an integrated overview of MED’s evolution, major achievements, internal restructuring, and strategic vision for the next funding cycle.

Between 2020 and 2024, MED grew to 410 members and delivered substantial scientific output, with 1,150 publications, active participation in 186 national and international projects, and a strong presence in science communication, knowledge transfer and policy impact, supported by its role within the CHANGE Associated Laboratory. Structural reorganisations — including the creation of new Thematic Lines, Research Groups and the MEDULLA data management system — strengthened internal governance and scientific coherence. Key challenges remain, notably human-resource retention, administrative constraints, and the need to increase success in competitive funding. Looking ahead, MED aims to deepen problem-solving-oriented research, enhance internationalisation, integrate Artificial Intelligence into science management, and reinforce its role in Mediterranean agroecosystems, ecological restoration, soil health, water efficiency and sustainable food systems. By combining interdisciplinary research with stakeholder engagement, informing public policies through scientific evidence, and promoting open-science practices, MED positions itself as a reference institution for resilient, sustainable and climate-adapted agroecosystems.

**Keywords:** Mediterranean agroecosystems; science management; sustainability; interdisciplinary research; strategic development

# PRR SESSION

**PEGADA 4.0 – Sustainability in agriculture supported by intelligent processes and technologies – assessing the biodiversity footprint**

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The use of sensors and digital tools for biodiversity monitoring can bring advantages in producing reliable information on broader temporal and spatial scales than methodologies that depend on extensive expert involvement. These new methodologies have a high potential to generate large volumes of data. To make these methodologies efficient, it is essential that the analysis of this volume of images and sounds can be based on machine-learning and artificial intelligence methodologies, saving many hours of work from experts, who will only have to ensure the validation of information that deviates from expected parameters. Within the scope of the Pegada 4.0 project, the team is developing and testing methodologies to obtain information on biodiversity on farms using digital tools and subsequently integrate them into a centralized system that analyses the information and makes it available to agricultural managers. Two digital collection approaches have been analysed: i) image collection with portable cameras for plants and invertebrates; ii) sound collection with fixed recorders and with cell phones for birds. Large volumes of image data (+ 7000) and sound data (1080 minutes) were generated. The identification of biological groups was performed using machine learning and artificial intelligence methodology. Bird identification capacity was compared between the algorithm (BirdNet) and the detection by an expert observer in the field and by listening to recordings. The identification of plants and invertebrates was performed using algorithms (including the iNaturalist application), and the identification capacity at different taxonomic levels based on images was evaluated.

**Keywords:** Agriculture footprint; artificial intelligence; automatic identification; biodiversity monitoring; passive acoustic monitoring

**MED's Research Group:** Ecology & Biogeography; Soil, water, plant & farming technology

### **SUMO: Sustainability of the Montado**

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This work aims to present the tasks and some results of the project SUMO: Sustainability of the “Montado”. SUMO project main focus is animal production and its compatibility with the maintenance and promotion of plant, animal and mycological biodiversity, in order to promote sustainable and resilient agricultural production. The SUMO project involves 15 partners (Research Institutions, Experimentation Centre, Public institute, Breeders’ Associations of different native species and breeds, SMEs and Competence Centers). The project team is multidisciplinary with training of various degrees and in various areas, such as Animal Science, Veterinary Medicine, Biology, Economics, Informatics and Agronomy. Among others, the main objectives of the project are: (i) improved animal health and welfare in local breeds; (ii) increased animal productivity in the context of extensive production; (iii) optimization of grazing management, making it compatible with the promotion of biodiversity (agroecological objectives); (iv) in situ and ex situ conservation of animal, plant and mycological germplasm; (v) the creation of new products of the cork oak forest; (vi) economic valorization of the current products and the management techniques and practices proposed throughout the project and (vii) contribution to the development of public policies that promote the valorization of the “Montado”.

**Keywords:** Montado, animal production, biodiversity, economy.

**MED’s Research Group:** Animal Biosciences; Soil, Water, Plant & Farming Technology; Ecology & Biogeography

#### **Acknowledgements:**

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**REVITALGARVE - Revitalization of rural areas in the Algarve: resilience and innovation in the creation of territorial food systems**

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The project comprises three lines of action (LA): 7.2 Knowledge; 7.5-Smart Rural Territories; and 7.6 -Economic Diversification. LA7.2 activities include R&D+I to value the Algarve food products, namely extensive livestock, sustainable fishing, traditional rainfed orchard, and technologies for sustainable production methods. LA7.5 activities are Territorial Food System; Brand; Technical Assistance; Collective Catering; and Governance; LA7.6 activities are Local Farmers' Markets, Valorisation of Endogenous Resources; and Communication Plan. In the LA 7.2, four food products are being developed/studied: new dry-cured sausages and meat balls made from lamb meat from Churra Algarvia sheep, could be an alternative solution, as a way of product diversification/canteens use (meat balls), and a potential way of increasing these sheep population; a vacuum-packed mackerel fillet product was developed, designed for easy preparation and versatile culinary use; and dried figs (cultivar Côtea) in order to valorize this commodity and the traditional rainfed orchard, using a solar dryer prototype, that allows the process to be performed under controlled conditions (temperature and hygiene). For the technologies for sustainable production methods, adaptive grazing management is being monitored in rainfed situations. A brand has been registered for the Algarve food products and network of local producers is under development.

**Keywords:** Sustainable food systems; network of local producers; short supply chain; agri-food innovation; brand

**MED's Research Group:** Food Science & Technology

## **Decarbonization studies at the Port of Sines**

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Decarbonizing human activity, it's vital to achieve Sustainable Development Goals and preserving the planet. From agriculture to industry, every sector seeks to reduce energy consumption, improve energy efficiency and achieve the required transition to alternative low carbon fuels and near zero-emission technologies. Maritime transport is responsible for almost 90% of the international trade, 3.6% of the global CO<sub>2</sub> emissions and 13.5% of GHG emissions in Europe. The Port of Sines is the most important maritime infrastructure in Portugal, responsible for 94% of the Natural Gas Energy entering the country and for more than 50% of the containerized cargo. The NEXUS Agenda (<https://nexuslab.pt/>) it's the innovation project led by APS that aims to promote the Digital and Green Transition at the Port of Sines to improve efficiency and effectiveness of the port's logistics chain. The evaluation of the actual energy consumption (EC) and carbon footprint (CF) of the Port of Sines jurisdiction area set the baseline for its decarbonization roadmap. This study was conducted within two approaches: by evaluating the EC and CF from 2018 to 2022 using the GHG Protocol and by analysing the potential of carbon stock by the surrounding landscape. The Scope 3 (emissions from the terminals) accounts for more than 99 percent of the energy consumption and carbon footprint of the Port of Sines. Approximately 80% of these emissions are found in maritime berthing and anchoring manoeuvres. The improvement of the surrounding landscape can potentially stock part of the direct emissions of the Port Authority (scope 1 and 2).

**Keywords:** decarbonization; maritime industry; Port of Sines, Agenda NEXUS

**MED's Research Group:** Landscape Dynamics & Management

# **PITCH SESSION**

**Pitches aligned with MED Goals:**

**1) Improve resources use efficiency**

**5) Foster the resilience, mitigation, and adaptation of agroecosystems and biodiversity conservation to environmental and climate changes**

## **Evaluation of a manure spreader for localized application of olive leaves in vineyards**

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In the olive oil extraction process, a considerable quantity of olive pomace is produced (around four times greater than the amount of olive oil). In addition to olive pomace, mills also accumulate shoots and leaves from the olive cleaning process. Although these by-products can be used as raw material in compost piles, this process is not widespread among farmers. The time required to obtain the compost may be one of the factors for a lack of interest. An alternative solution for the valorization of this material could be its application as mulch in orchards or vineyards. To minimize the size of the leaf storage parks, mills shred the leaves and the shoots to reduce their volume. In the INOVIRCOLIVE project, we are testing the application of shredded olive leaves in the rows of a vineyard as mulch. The distribution of leaves was carried out with a manure spreader for localized application. The objective of the pitch is to show the work carried out and the more relevant results obtained.

**Keywords:** mechanization; olive by-products; application; mulch

**MED's Research Group:** Soil, Water, Plant & Farming Technology

## **GEDICorrect: a Python framework for GEDI geolocation correction using multiple criteria and parallel processing methods**

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Accurately monitoring terrestrial ecosystems is essential for addressing global environmental challenges such as deforestation, biodiversity loss, and climate change. NASA's Global Ecosystem Dynamics Investigation (GEDI) mission has transformed ecosystem monitoring by providing near-global, high-resolution data on vegetation structure and terrain elevation through spaceborne LiDAR. However, these data often require geolocation correction due to various sources of error, including instrument inaccuracies and spacecraft platform instability. One of the primary challenges in using GEDI data is its horizontal geolocation error, which averages approximately 10 meters in the calibrated final products (V2). These errors, especially in heterogeneous landscapes (e.g. montados), can significantly affect the accuracy of canopy height and terrain elevation estimates. To address this limitation, we introduce GEDICorrect, an open-source Python framework for precise beam- and footprint-level geolocation correction. GEDICorrect integrates multiple correction strategies, similarity metrics, and scoring criteria, including waveform matching, terrain matching, and relative height (RH) profile matching, to refine geolocation accuracy at the orbit, beam, or footprint levels. By leveraging advanced similarity measures, GEDICorrect enhances geolocation precision and improves the reliability of canopy structure assessments. This capability supports a broad range of applications, from advancing our understanding of carbon sequestration to enabling more effective environmental planning and biodiversity conservation.

**Keywords:** GEDI; LiDAR; 3D-vegetation; Remote Sensing; Parallel Computing

**MED's Research Group:** Landscape Dynamics & Management

## Understanding the dynamic patterns of quorum SENSing signals in ROOT colonization and biofilm formation

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Plants and microbes form a tightly integrated unit, the holobiont, where microbial community dynamics are pivotal to plant health. While much is known about microbial structures in plant roots and leaves, the cooperative interactions among microbes, especially those driven by communication mechanisms like quorum sensing (QS), remain unclear. QS enables bacteria to coordinate behaviors through signaling molecules, influencing key plant-associated processes such as biofilm formation, nitrogen fixation, and growth promotion. The SensiRoot project investigates how dynamic QS signaling governs bacterial community assembly in the root microbiome, using the *Trifolium subterraneum*-*Rhizobium leguminosarum* sv. *trifolii* symbiotic model. This research will construct a QS database (QSDB) from a synthetic bacterial community (SynCom), explore QS gene dynamics during root colonization, and identify key QS molecules involved in biofilm formation. Moreover, it will assess the impact of nitrogen fixation efficiency and root exudates on microbiota assembly. SensiRoot aims to uncover the chemical-ecological principles underlying root colonization and microbial succession, offering new tools for precise microbiota manipulation. The findings will enhance our understanding of plant-microbe communication in near-natural conditions and inform the development of next-generation bioinoculants. This project has the potential to drive sustainable innovations in agriculture, promoting eco-friendly and economically viable practices through the intelligent management of plant-associated microbial communities.

**Keywords:** Plant-bacteria interactions; rhizomicrobiome; signaling molecules; root metabolites; biofilm

**MED's Research Group:** Plant Protection, Genetics & Biotechnology

## Metabolomics as a phenotyping tool for *Vitis vinifera* cultivar characterization

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Grapevine (*Vitis vinifera* L.) stands among the most economically significant crops worldwide. This species demonstrates a remarkable capacity to thrive under diverse abiotic stress conditions, with alterations in metabolite composition serving as one of the key regulatory responses. Metabolomics, as a powerful omics technology in agricultural research, offers valuable insights into stress adaptation mechanisms and factors influencing crop quality. This study aimed to differentiate three grapevine cultivars by applying metabolomics tools and to characterize their metabolite profiles throughout the ripening period. To this end, leaf samples from field-grown plants of each cultivar were collected at different periods during ripening, under high summer temperature conditions. Metabolites were analyzed following an untargeted metabolomics approach using FT-ICR-MS. More than 3,000 compounds were identified on grapevine leaves. Principal Component Analysis demonstrated that the metabolomic profiles of the *V. vinifera* cultivars were sufficient to discriminate among them. Moreover, some important compounds of the grape ripening period, such as quercetin and rutin, are differentially present in the grapevine cultivars. Compound variation over time was also observed, in accordance with the ripening period of each cultivar. Metabolomics represents a valuable phenotyping tool to differentiate cultivars and gain insights into the mechanisms underlying grapevine tolerance to high temperatures.

**Keywords:** *Vitis vinifera* L.; metabolomics; phenotyping tool

**MED's Research Group:** Plant Protection, Genetics & Biotechnology; Food Science & Technology; Soil, Water, Plant & Farming Technology

## Transcriptome analysis reveals novel molecular networks involved in cynaropicrin biosynthesis in *Cynara cardunculus* L.

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*Cynara cardunculus* L., commonly known as cardoon, is a Mediterranean plant from the Asteraceae family and a natural source of sesquiterpene lactones (STLs), particularly cynaropicrin (Cyn), the main STL found in its leaves. In Portugal, *C. cardunculus* displays significant natural variation at morphological, genetic, and biochemical levels. To investigate the molecular basis of STL production, we analyzed transcriptomes from different *C. cardunculus* genotypes with distinct Cyn biochemical profiles. Samples collected in May were categorized into four groups based on Cyn content: high-production peak (HP), low-production peak (LP), consistently high (CH), and consistently low (CL). Total RNA from leaves was used for cDNA library construction and DNBseq paired-end sequencing. After quality filtering, reads were aligned to the *C. cardunculus* genome (v2.0) with STAR, and DEGs ( $|\log_2FC| \geq 2$ ;  $FDR \leq 0.05$ ) were identified using DESeq2. Comparisons between HP vs. LP and HP+CH vs. LP+CL revealed 36 and 212 DEGs, respectively. Most of the DEGs showed increased expression in high-Cyn samples, associated with stress responses, photosynthesis, and respiration, highlighting the influence of environmental factors on Cyn biosynthesis. Key STL-related genes showed differential expression, including down regulation of germacrene-A synthase (GAS) and up-regulation of germacrene-A hydroxylase (GAO), suggesting enhanced hydroxylation of germacrene-A intermediates.

**Keywords:** *Cynara cardunculus*, cynaropicrin, Gene annotation, RNA-Seq analysis, environmental factors.

**MED's Research Group:** Plant Protection, Genetics & Biotechnology; Food Science & Technology; Animal Biosciences

## Exploring the potential of the Carob tree for sustainable agriculture in Alentejo

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The Alentejo region, located in the South of Portugal, is increasingly affected by water scarcity and soil salinization due to inefficient water use and intensive agricultural practices. Addressing these challenges requires alternative crops that are both resilient and economically viable. The carob tree (*Ceratonia siliqua* L.), a Mediterranean species tolerant to abiotic (drought, salinity, high temperatures) and biotic (pests and diseases) stress factors, emerges as a highly promising alternative. Although traditionally limited by freezing sensitivity, the genetic diversity preserved in the Portuguese germplasm collection at the Tavira Agricultural Experimentation Centre (CEAT) and the presence of productive trees in Alentejo suggest the existence of freezing-tolerant genotypes suitable for orchard plantation. This presentation introduces the project “ALCAROB - Applicability of Carob tree on sustainability of Alentejo region”, which integrates agricultural innovation and biotechnological approaches to promote sustainability, resilience, and rural development in the Alentejo region. The project ALCAROB, funded through “la Caixa” Foundation’s Promove Program, in partnership with the Foundation for Science and Technology (FCT) (Projetos I&D Mobilizadores 2024), aims to identify genotypes tolerant to freezing, establish in vitro clonal propagation protocols, and detect molecular markers associated with freezing tolerance. It also aims to characterize the metabolomic profiles of Portuguese varieties, rich in antimicrobial compounds, and explore the “Green Cell Factory” concept for the sustainable production of valuable metabolites.

**Keywords:** Carob tree, freezing-tolerance, in vitro plant propagation, metabolomics, Green Cell Factory

**MED’s Research Group:** Plant protection, Genetics & Biotechnology

## Combining mulch and biochar to increase the carbon sink capacity in Mediterranean vineyards and olive orchards

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Soil degradation in European Mediterranean agriculture is driven by intensive agricultural practices. Erosion-driven losses and herbicide overuse deplete soil organic carbon (SOC), threatening fertility and resilience. This study, conducted as a part of the SOLVIT and SOLVO projects, evaluated nature-based solutions—organic mulch and biochar—to enhance carbon sequestration in Alentejo, Portugal, a region facing rapid agricultural intensification. Four integrated-management sites (two vineyards and two olive orchards) were tested with three treatments: control, straw/olive leaves mulch layer (2 t ha<sup>-1</sup>), and mulch + biochar layer (2 t ha<sup>-1</sup> + 10 t ha<sup>-1</sup>). Effects were also assessed in three microenvironments (Tree, Rut, and Veg). SOC stocks (0–10 cm depth) were measured via loss-on-ignition, carbon forms via molecular analysis, and carbon fluxes using a LI COR LI-7810 CO<sub>2</sub>/CH<sub>4</sub> Trace Gas Analyzer. Results showed that both the mulch and mulch + biochar treatments were equally effective in reducing erosion losses (20 to 40 % reductions compared to the control). The mulch + biochar treatment was most effective at increasing soil carbon stocks across all sites. In the vineyards, no differences were found in carbon fluxes between treatments. Regarding microenvironments, the Tree exhibited the lowest carbon stock and sequestered the least carbon.

**Keywords:** climate change; desertification; soil restoration; agricultural waste; sustainability

**MED's Research Group:** Soil, Water, Plant & Farming Technology

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## **Role of permanent crops in soil carbon sequestration: a comparative study between avocado orchard and fallow land**

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The global population growth has increased demand for food, energy, transportation, industry, infrastructure, and housing. This escalating demand intensifies pressure on natural resources, generating various wastes, including greenhouse gases, primarily carbon dioxide (CO<sub>2</sub>), a key driver of global warming. A vital mitigation strategy is carbon storage to reduce atmospheric CO<sub>2</sub>. Terrestrial ecosystems serve as important carbon sinks by storing carbon in plant biomass and soils. Permanent crops, as agroecosystems, provide essential food security and have significant potential for carbon sequestration, especially under intensified agriculture. Their perennial nature and higher biomass accumulation, combined with sustainable management, enhance soil organic matter and carbon storage. To evaluate the carbon sequestration role of permanent crops, a managed avocado orchard was compared with adjacent unmanaged fallowland. In the orchard's top 20 cm of soil, labile organic carbon averaged 31.8 t ha<sup>-1</sup> in interrows and 42.6 t ha<sup>-1</sup> on ridges, while the fallow land averaged only 22.8 t ha<sup>-1</sup>. These results demonstrate that permanent crops not only support food production but also increase soil carbon storage compared to fallow land, emphasizing the importance of productive, well-managed soils in climate change mitigation.

**Keywords:** Agroecosystems, Fruit growing, Food security, Ecosystem services, Soil organic carbon

**MED's Research group:** Soil, Water, Plant & Farming Technology

## ***In vitro* culture as a Sustainable Strategy for Secondary Metabolite Production**

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Plants are an extraordinary source of high-value secondary metabolites with diverse applications across the pharmaceutical, cosmetic, and food industries. *In vitro* plant cell and tissue culture techniques offer a sustainable and environmentally friendly platform to produce these compounds. Conducted under controlled conditions, these systems enable the large-scale production of homogenous plant material, independent of geographical location or seasonal variability, and without endangering natural populations. This study focuses on the *in vitro* propagation and production of secondary metabolites from Mediterranean Lamiaceae species, including *Lavandula viridis* L'Hér and *Thymus lotocephalus* López & Morales. Particular emphasis is placed on elicitation strategies to enhance secondary metabolite biosynthesis. In the context of climate change, this research provides valuable insights into the effects of abiotic stress on plant performance and highlights the role of secondary metabolism in plant adaptation to adverse conditions. Moreover, the use of green extraction methods for bioactive compounds aligns with sustainable development goals and supports the valorization of underutilized Mediterranean plant species for industrial applications.

**Keywords:** Lamiaceae; Abiotic stress; Secondary metabolism; Biological properties; Sustainability

**MED's Research Group:** Plant Protection, Genetics & Biotechnology

**Airborne pollen and fungal spores monitoring data: application on health, agronomy, environment and climate change fields**

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Over the last two decades, the Palynology and Aerobiology Lab of MED and SPAIC have been dedicated to aerobiological research related to airborne bioaerosols monitoring (airborne pollen grains and fungal spores) and their relationship with health and allergy in particular. Aerobiology helps us understand the distribution and abundance of plants and fungi using airborne pollen grains and fungal spores monitoring data. Aerobiological studies help to explain the impact of those particles and microorganisms on human health, the environment and many other related fields. Today, our studies carried out using atmospheric pollen data from plants of agro-economic and social interest, such as olive trees, holm oaks and cork oaks trees, grasses (cereals and pastures) and other weeds have shown the occurrence of changes in plant phenology due to environmental and land use changes. Aeromycology is still underexplored despite the predominance of fungi in the bioaerosol fraction of the atmosphere. Little research has been done, particularly on *Alternaria*, an important pathogenic fungus for humans, animals and plants.

**Keywords:** Aerobiology, airborne pollen grains, bioaerosols monitoring, fungal spores, Climate change

**MED's Research Groups:** Animal Bioscience

**Pitches aligned with MED Goal:**

**2) Improve sustainability of food systems**

## **Mediterranean diet and brazilian red própolis: bioactive synergy in oral health promotion**

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The Mediterranean diet is widely recognized for its antioxidant and anti-inflammatory properties, largely attributed to the high intake of flavonoids from fruits, vegetables, olive oil, and wine. Similarly, Brazilian red propolis, mainly derived from *Dalbergia ecastophyllum*, is rich in isoflavones such as formononetin and biochanin A—bioactive compounds with effects comparable to those found in Mediterranean foods. This literature review aimed to explore the convergence of physiological effects of these flavonoids, emphasizing their role in oral health promotion. Articles published between 2015 and 2025 were reviewed, including phytochemical, clinical, and *in vitro* studies. The findings indicate that flavonoids found in both red propolis and the Mediterranean diet share antioxidant, anti-inflammatory, and antimicrobial pathways relevant to maintaining oral tissue integrity, preventing periodontitis, and potentially protecting against oxidative processes associated with corrosion of oral metallic devices. This theoretical synthesis proposes innovative directions for integrating traditional foods and natural bioactive products as allies in preventive oral health and nutraceutical development.

**Keywords:** Propolis, Mediterranean Diet, flavonoids, antioxidants, nutraceuticals.

**MED's Research Group:** Animal biosciences

**Epigenetic modulation in plants: exploring DNA methylation and miRNA dynamics across different environmental contexts**

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Epigenetic changes refer to modifications in gene expression that occur independently of changes in the underlying DNA sequence. They play a critical role in plant development and phenotypic plasticity by enabling adaptive responses to environmental stresses. Epigenetic mechanisms include DNA methylation, histone modifications, and the regulation by small RNAs. In addition to genetic variation, epigenetic modifications offer potential tools for plant breeding by serving as predictive markers of plant performance. To investigate epigenetic diversity as a contributor to phenotypic variation, we are conducting studies on plant DNA methylation and microRNA (miRNA) responses under various environmental stresses. One study examined DNA methylation patterns in wheat plants colonized by arbuscular mycorrhizal fungi and exposed to manganese toxicity. We observed differential expression of genes involved in DNA methylation, as well as altered methylation levels in a gene associated with manganese transport. In another study, miRNA profiles were analyzed during the induction phase of adventitious rooting (AR) in the olive tree cultivar 'Galega vulgar'. We identified changes in miRNA expression in response to AR and confirmed a miRNA target gene implicated in this process. These and future investigations aim to characterize and harness epigenetic variation to support genetic improvement efforts in key crop species.

**Keywords:** plant phenotypic plasticity, epigenetic changes, DNA methylation, miRNAs

**MED's Research Group:** Plant Protection Genetics & Biotechnology

## **AlBread: Bioactive Potential of Alentejo and Algarve Essential Oils in Functional Bread Formulation**

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Essential oils (EOs), extracted from various parts of aromatic plants, have been used for centuries for their therapeutic properties. These natural compounds remain central in folk medicine across many cultures due to their wide-ranging medicinal benefits, including antioxidant, anti-inflammatory, analgesic, anticancer, hepatoprotective, and neuroprotective effects. As part of the Albread project—supported by the Promove 2023 competition and titled “Aromatic plants from Alentejo, probiotics, and acorn flour in the development of functional bread”—this study investigates the antioxidant and antifungal potential of EOs sourced from companies in the Alentejo and Algarve regions of Portugal. A total of 21 EOs were evaluated for their antioxidant activity using three complementary assays: DPPH (2,2-diphenyl-1-picrylhydrazyl) radical scavenging, ABTS (2-azino-bis (3-ethylbenzothiazoline-6-sulfonic acid)) radical scavenging, and the  $\beta$ -carotene/linoleic acid bleaching method. The results revealed distinct antioxidant profiles among the oils, with good qualitative agreement across the methods. The EOs were also tested for antifungal activity. Their chemical composition was analyzed by gas chromatography-mass spectrometry (GC-MS) to identify and quantify key constituents. This analysis helped establish preliminary links between the EOs’ composition and their observed antioxidant and antifungal properties.

**Keywords:** Essential oils; Antioxidant and antifungal activities; Gas chromatography–mass spectrometry (GC-MS); functional bread; aromatic plants

**MED’s Research Groups:** Plant Protection, Genetics & Biotechnology; Food Science & Technology

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## Comparative Study of Volatile Profiles in Eco-friendly *Ficus carica* L. Liqueurs Produced from Leaf- and Fruit-Byproducts of White and Dark Cultivars

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*Ficus carica* L. is an underutilized plant traditionally employed in Mediterranean countries for the preparation of various food products and beverages. This study evaluated the impact of different plant by-products—specifically leaves and non-commercial fruits—on the production of sustainable, monovarietal liqueurs, focusing on their volatile profiles analyzed by GC-MS. A total of 109 volatile compounds were identified in liqueurs made from either fig fruits or leaves of Portuguese *Ficus carica* L. cultivars, including the white varieties Côtea, Burjassote Branco, and Castelhana Branca, and the dark varieties Eucharia Preta and Lampa Preta. In white fig cultivars, liqueurs produced with leaves exhibited a greater number of volatile compounds than those made with fruits, whereas in dark varieties, the number of volatiles was comparable between both plant parts. Both liqueur types showed similar levels of esters, alcohols, and terpenes. However, aldehydes, acids, and C13-norisoprenoids were more abundant in fruit-based liqueurs, while ethers, phenylpropanoids, sesquiterpenes, and miscellaneous compounds were more prevalent in those made with leaves. Regardless of the cultivar, the PLS-DA analysis clearly distinguished liqueurs according to plant part utilized. Leaf-based and fruit-based liqueurs exhibited distinct volatile compound patterns, reflecting characteristic chemical signatures associated with each plant tissue.

**Keywords:** fig byproducts, sustainable production, alcoholic beverages, volatile composition, multivariate analysis.

**MED's Research Group:** Plant Protection, Genetics & Biotechnology

## **GC x GC ToFMS stands for?**

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Comprehensive two-dimensional gas chromatography (GC × GC) has emerged as a powerful analytical technique that significantly enhances the separation capacity and detection capabilities of conventional one-dimensional gas chromatography (GC). By coupling two columns with different stationary phases—typically of orthogonal polarity—GC × GC allows for a multidimensional separation of complex mixtures, resulting in improved resolution, increased peak capacity, and better analyte identification. This approach is particularly beneficial in the analysis of volatile organic compounds in complex matrices such as wine, olive oil and environmental matrices. The aim of this pitch is to give an overview of this analytical technique and its potentiality in MED research.

**Keywords:** Comprehensive two-dimensional gas chromatography

**MED's Research Group:** Food Science & Technology

## **Emulsions featuring the “mother of vinegar” for food and crops**

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The “mother of vinegar” is a bacterial cellulose membrane formed in the liquid-air interface during a static acetic acid fermentation. Though usually considered a residue, this membrane is not only a great source of acetic acid bacteria, but also a source of pure cellulose. Bacterial cellulose (BC) is known to excel plant cellulose in several features as its higher purity, superior mechanical properties, water absorption and ultimately, sustainability. Given its amphiphilicity, cellulose and its derivatives are known to act as effective oil-in-water emulsion stabilizers suitable for a wide range of applications. In this work, we show how a mildly processed BC cellulose obtained from vinegar production can be used alone, and in combination with other biopolymers, as an emulsifier and how it affects the stability of olive oil in water and plant essential oil-in water emulsions. In addition, BC was also proved to be a suitable candidate to developing a spreadable olive oil by replacing a fraction of methylcellulose (E461) and reducing the total amount of polymer needed to acquire desirable stability and rheological properties. Emulsion systems comprising BC and essential oils are being further developed to integrate food and agrochemical formulations.

**Keywords:** Biopolymers, Essential oils, Encapsulation

**MED’s Research Groups:** Plant Protection, Genetics & Biotechnology, Food Science & Technology

## **1-Methylcyclopropene and lemongrass essential oil nanocoatings effect on the preservation of cold stored 'Rocha' pear**

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To extend the postharvest life of 'Rocha' pear, this study compared the effectiveness of alginate-based nanoemulsion coatings enriched with lemongrass essential oil (LG) to the commercial treatment 1-methylcyclopropene (1-MCP). This approach aligns with efforts to improve the sustainability of food systems by exploring natural, biodegradable alternatives to synthetic preservatives. Pears were treated with 1-MCP (312 nL L<sup>-1</sup>) or coated with nanoemulsions containing sodium alginate 2% (w/w) combined with LG at either 1.25% or 2.5% (w/w). Fruits were stored at 0 °C and 90–95% RH for eight months, with quality assessments at harvest and every two months, including a 7-day shelf-life period at 22 °C. Parameters such as firmness, color, ethylene production, physiological disorders, microbial growth, antioxidant activity, and sensory attributes were evaluated. Both coatings and 1-MCP slowed color changes and maintained firmness, without affecting soluble solids or acidity. While all treatments reduced superficial scald, LG 2.5% led to more decay and internal browning after eight months. 1-MCP best preserved firmness and minimized softening and weight loss throughout storage. LG 1.25% was similarly effective up to six months but showed limitations afterward. Overall, 1-MCP remains the most effective for long-term storage, while LG 1.25% coatings may offer a natural alternative for shorter storage periods.

**Keywords:** *Pyrus communis*, Nanoemulsions, Ripening, Scald, Internal browning

**MED's Research Group:** Food Science & Technology

### **Reference:**

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## Microbial characterization of pork dry-cured sausage

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Dry-cured sausages are widely consumed in Mediterranean countries. Therefore, it's important to assure their safety. The aim of this work is to characterize the microbiota of dry-cured sausage ("Paio") manufactured from two different raw materials (Alentejo pork and commercial pork meat). Since Alentejano pork's is a less commercial product, it is necessary to compare it to a more common one (results presented) to understand the quality of the final product. Three independent batches were analysed. Two replicate samples were collected at different steps throughout the manufacturing and curing process (meat batter, half-cured sausage, and end-product). Physicochemical analyses, namely pH and aW, and microbiological analyses (*Salmonella* spp. detection, and *Listeria monocytogenes*, enterobacteria, lactic acid bacteria (LAB), staphylococci, mold and yeast counts) were performed. The presence of *Salmonella* spp. and *L. monocytogenes* was not detected in any of the samples analyzed throughout the manufacturing process. During the curing process there was no growth of enterobacteria (hygiene indicator microbiota), however, there was an increase of LAB and staphylococci. Regarding the physicochemical analyses, the end-product had a pH of 5.9, and a aw value of 0.89. Thus, the results obtained for the cured sausage indicate that the manufacturing process results in a microbiologically safe product, as well as a shelf-stable product, since with aw values <0.9 spoilage bacteria are inhibited.

**Keywords:** dry-cured sausages, *Salmonella* spp., *Listeria monocytogenes*, microbiota characterization

**MED's Research Groups:** Food Science & Technology and Animal Biosciences

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CHANGE LA/P/0121 (<https://doi.org/10.54499/LA/P/0121/2020>).

**Comparative proteomic analysis of *Trioza erytreae* nymphs developed on *Citrus ×limon* and *Citrus ×sinensis* host plants**

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*Trioza erytreae* is a vector of the highly damaging citrus disease Huanglongbing (HLB). The citrus hosts have a significant influence on the development of the psyllid, with lemon plants (*Citrus ×limon*) being the preferred host. The present study analysed *T. erytreae* oviposition, and nymphal development on lemon and sweet orange (SwO) (*C. ×sinensis*) hosts. A comparative proteomic analysis was performed on the fourth and fifth instar nymphs developing on each citrus host. Evaluating citrus host impact on nymphal development and biology. The proteomes were examined by nanoscale liquid chromatography coupled to tandem mass spectrometry (nanoLC-MS/MS). *Trioza erytreae* exhibited significant variations in oviposition and infestation patterns depending on the host, with a high number of nymphs developing on lemon plants. Proteome analysis revealed nymphs that developed on lemon exhibited a heightened energy metabolism, and an increase in initiation translation factors. Nymphs that developed on SwO had a high abundance of proteins associated with “muscle” and “neuronal muscle development”. Feeding on SwO induced an enrichment of “semi-sterile” and “abnormal development” phenotype groups. In conclusion, the nutrients obtained when *T. erytreae* fed on lemon were conducive to successful nymph development, whereas feeding on SwO seemed to be suboptimal.

**Keywords:** African citrus psyllid; Huanglongbing; insect development; insect plant interaction; sap-feeding insects.

**MED’s research groups:** Soil, Water, Plant & Farming Technology; Plant Protection, Genetics & Biotechnology

**Nematicidal activity of phytochemicals against the root-lesion nematode  
*Pratylenchus penetrans***

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The root-lesion nematode, *Pratylenchus penetrans*, is among the most harmful plant parasitic nematodes for crop productivity worldwide, parasitizing a significant number of plant hosts. Common pest management strategies rely on the use of synthetic chemical nematicides, which impose serious concerns regarding their impacts on human health and the environment. In the present study, the nematicidal activity of 40 phytochemicals was assayed against *P. penetrans* using standard direct and indirect contact methodologies. The nematode was remarkably insensitive to the tested phytochemicals at the highest concentration tested, 2 mg/mL, seldom reaching full mortality after a 24 h exposure period. However, high activities were obtained for benzaldehyde, carvacrol, 3-octanol, and thymol, in comparison to the other phytochemicals or the synthetic nematicide oxamyl; about 1 h was required for carvacrol, 3-octanol, and thymol to kill half population. Mortality percentages obtained from the indirect contact bioassays for the most active compounds were lower than the ones from direct contact, not exceeding 65%. These compounds are good candidates for the development of biopesticides for a more sustainable root-lesion nematode management strategy.

**Keywords:** Phytochemicals; pest management; *Pratylenchus penetrans*; nematicides

**MED's Research Group:** Plant Protection, Genetics & Biotechnology

**Mode of action of two plant-derived compounds on the root-lesion nematode  
*Pratylenchus penetrans***

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The root-lesion nematode (RLN), *Pratylenchus penetrans*, is one of the most severe plant parasitic nematodes, responsible for productivity losses in a significant number of plant hosts. Chemical control of this RLN, such as the use of nematicides, is limited due to the associated risks to both environmental and human health. Plant-derived compounds with nematicidal potential are sustainable alternatives for the control of *P. penetrans*. The aim of this study is to analyze the molecular response of *P. penetrans* to the strong nematicidal compounds 3-octanol and benzaldehyde, using a de novo transcriptome assembly approach. The mode of action was studied at a sub-lethal exposure for 30 min. Despite their distinct chemical compositions, both compounds elicited a similar molecular response in *P. penetrans*. These compounds induced the activation of detoxification mechanisms in *P. penetrans*, with significant upregulation of metabolic pathways related to xenobiotic metabolism by cytochrome P450, steroid hormone biosynthesis, retinol metabolism, and drug metabolism. In parallel, they affected ascorbate and aldarate metabolism, starch and sucrose metabolism, as well as several signaling pathways associated with the cellular immune response. Understanding the defense mechanisms of *P. penetrans* against natural nematicides can lead to development of tailor-made control solutions.

**Keywords:** nematicide, transcriptome, sustainable control, green approaches

**MED's Research Group:** Plant Protection, Genetics & Biotechnology

## The effect of the olive fruit fly infestation on the quality parameters of virgin olive oil and its relation to the commercial classification

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The olive fruit fly, *Bactrocera oleae*, is one of the most significant pests influencing virgin olive oil (VOO) production in Portugal. This insect inflicts irreversible damage to the olive fruit during its oviposition process, affecting the quality of the produced VOO. In this work, we aimed to assess the damage produced by this insect in VOO; for this, fruits from the cultivar 'Cordovil de Serpa' were collected along an increasing gradient of pest infestation: 0%, 1%, 2%, 4%, 8%, 16%, 32%, 64%, and 100%, and VOO was produced with a laboratory-scale extraction method. VOO were evaluated in terms of their quality parameters (acidity, K232, K270, and peroxide index), as well as the phenolic profile, fatty acid profile, volatiles profile, and sensory analysis. The analyses in this study indicate that as the infestation rate of *B. oleae* increases, the quality parameters of virgin olive oil (VOO) decline. Additionally, the reduction in phenolic compounds was supported by sensory analysis, which revealed a decrease in pungency and bitterness starting at a 32% infestation rate. This observation is consistent with results from the volatile compounds, which show a decline in those responsible for the "fresh" and "fruity" characteristics of the VOO. Given that both the sensory analysis and free acidity measurements classified the VOO as virgin rather than extra virgin at infestation rates higher than 64%, we can conclude that VOO produced with an infestation rate exceeding 64% will likely see a reduction in its retail price, as it no longer meets the criteria for extra virgin classification.

**Keywords:** Olive oil, *Bactrocera oleae*, 'Cordovil de Serpa', phenolic compounds, free acidity.

**MED's Research Groups:** Food Science & Technology; Landscape Dynamics & Management; Ecology & Biogeography

## **ALTFoodSense – Technological Approach for Food Sensory and Nutritional Evaluation**

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The sensory quality of food is crucial to the success of the food industry. However, the methods currently in use have some limitations that make it difficult to obtain accurate and reproducible results that can predict consumer acceptance and nutritional effects. Taste panels report how food is perceived by human senses, but they have limited capacity, and are prone to variation over time, apart from being expensive to train. Likewise, many of the ingredients used may have greater or lesser bioactivity, which is difficult to predict based solely on knowledge of the chemical composition of the product. This situation becomes even more relevant for the industry, which, in the current context of pressure to present innovative, healthy and sustainable products, has been increasing the use of less traditional ingredients. One of the limitations of current methods for sensory evaluation of food products is the difficulty in providing analytical (objective) information that simultaneously takes into account biological/physiological processes that occur inside the mouth. The objective of the ALTFoodSense project is to develop artificial saliva capable of evaluating how the food product behaves in the mouth, since different salivary constituents, in direct interaction with the food, determine its sensory characteristics, as well as the availability/accessibility of chemical compounds in the food with potential bioactivity. This approach aims to provide a reproducible and biologically relevant tool to complement or even partially replace traditional sensory panels, enabling the food industry to design products with enhanced predictive accuracy for both sensory appeal and health impact.

**Keywords:** Food Oral Processing, Nutrient bioavailability; Sensory sciences; Saliva; Food acceptance

**MED Research Group:** Food Science & Technology; Animal Bioscience; Landscape Dynamics & Management

## Truffle aroma – who produces it?

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Truffles are hypogeous fruiting bodies of Ascomycota fungi that obligatorily form ectomycorrhizal associations with host plants. These fungi emit volatile organic compounds, which act as ecological signs for spore dispersal and are synthesized either by the fungi themselves or by associated microbial communities. The black truffle (*Tuber melanosporum*) is highly valued for its distinctive aroma; however, desert truffles (*Terfezia* spp.) occasionally exhibit comparable aromatic profiles. This observation suggests a potential microbial contribution to truffle aroma, particularly involving bacterial communities inhabiting within truffle tissues. Comparative analyses of these microbiomes and their associated volatile organic compounds are central to this investigation. Our results revealed that 3-methylbutanol was detected exclusively in aromatic *Terfezia fanfani* specimens. In these samples, 3-methylbutanal was present at concentrations approximately 170 times higher than in non-aromatic specimens. Similarly, levels of 1-octen-3-ol and (2E)-octenal were found at approximately threefold greater levels. Notably, *Fusarium* spp. was identified exclusively as an endophyte in aromatic truffles. The ongoing isolation and characterization of endophytic bacteria aim to elucidate their role in aroma biosynthesis. These findings offer promising implications for enhancing the aroma and market value of desert truffles via microbiome manipulation, with relevance to the sustainable development of arid and economically disadvantaged regions.

**Keywords:** Desert truffles; Truffle microbiome; Volatile organic compounds; Endophytic fungi; *Tuber melanosporum*

**MED's Research Groups:** Ecology & Biogeography; Plant Protection, Genetics & Biotechnology; Food Science & Technology

## **Agroecology assessment tools as a framework for agri-food systems' sustainability**

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The rapid expansion of agroecology as a paradigm capable of addressing the challenges faced by food systems has led to the need for defining mechanisms for identifying, assessing, and validating initiatives as being truly agroecological. This need is even more apparent as agroecology provides both a holistic and transformative approach to food systems. Thus, since the definition of the 10 elements of agroecology (interrelated with the 13 principles), a set of tools has been developed to measure the adequacy and performance of agroecological initiatives. These tools hold paramount importance in the agroecological transition due to their capacity to assess adequacy and performance from a holistic perspective, which allows for the inclusion of often neglected, hidden costs or externalities, and guarantees True Cost Accounting. Additionally, these tools can help prevent co-optation processes by the corporate sector and serve as a framework guiding the development of Participatory Guarantee Systems (PGS). We suggest adopting agroecology assessment tools in formulating policies and programs, since using holistic and systemic criteria could support the definition and encouragement of genuinely sustainable initiatives and avoid partially focused approaches unable to address the holistic and systemic configuration of the food systems.

**Keywords:** Agroecology, Agroecology assessment tools; Local food systems; Sustainable food networks

**MED's Research Group:** Landscape Dynamics & Management

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## **UAV-based monitoring of soil erosion in Mediterranean agricultural orchards under low erosion rates**

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As soil erosion is one of the main causes of land degradation in the Mediterranean, high-resolution spatial information on soil erosion is important for soil conservation. UAV imagery has become an important instrument for erosion monitoring, but little is known about its application in Mediterranean agricultural systems. In this study, drone flights were conducted in vineyards and olive groves where soil conservation measures were applied. Digital Terrain Models (DTM) and orthomosaics were constructed with a photogrammetry workflow, from which topographic variables were derived. Erosion was assessed both by field erosion plots and through Digital Elevation Models of Difference (DoD). Differences between treatments and relations between topographic variables and erosion were investigated with statistical analysis. As erosion rates during the study period were low, the DoDs did not detect any erosion. Significant differences in DTM-derived variables were found between study areas, but not between treatments. The results suggest that soil erosion in the study areas is mostly determined by topographic and management factors, and not by the applied treatments. This study shows that UAV imagery can contribute to erosion monitoring in Mediterranean agricultural systems, but determining net erosion from DoDs at low erosion rates remains a challenge.

**Keywords:** Soil Erosion, UAV remote sensing, Photogrammetry, soil conservation, change detection.

### **Acknowledgments:**

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**Pitches aligned with**

**MED Goals:**

**3) Assure environmental integrity, biodiversity conservation and landscape multifunctionality**

**4) To promote organisational capability, governance mechanisms and inclusive development**

## **Intraguild predation and interference competition amongst raptors in Europe**

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Interactions between organisms are essential for defining species distribution and coexistence, especially when it comes to vertebrate top predators. Such is the case with raptors, as these animals often engage in antagonistic interspecific interactions, like competition and predation, with other raptors. In this study, we reviewed the interactions of predation and competition amongst 51 raptors in Europe, and their impacts on raptor assemblages. We carried out a literature search for competitive and predatory interactions amongst all the raptor species, including dietary studies, using the Google Scholar database. We also conducted a survey on competitive and predatory interactions amongst raptors in Europe, sent to 55 experts. Finally, we collected data from eBird reporting competitive interactions among raptors in six European countries. We obtained 547 dietary studies reporting 615 samples by 49 raptor species, while the overall compilation of competitive interactions yielded 3824 records. The information regarding the diet of European raptors showed that most raptor species do kill and feed on other raptors, even though it only constitutes a minor proportion of their diet. In most cases, the predator was larger than the prey. Interspecific aggression or mobbing was the most reported interactions, being followed by unspecified interference competition interactions and kleptoparasitism.

**Keywords:** European raptors, Interference competition, Interspecific aggression, Intraguild predation, Mobbing.

**MED's Research Group:** Ecology & Biogeography

## **Small mammal diversity in Mediterranean agroecosystems: insights from barn owl pellets in traditional farming landscapes**

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Understanding how agricultural landscapes influence biodiversity is key to promoting resilient agroecosystems. In Mediterranean farmland, small mammals play crucial ecological roles, including seed dispersal, soil nutrient cycling, and pest control, but they can also damage crops and cause significant economic losses. The balance between these services and disservices may depend on the composition and diversity of small mammal communities, with higher diversity possibly limiting the dominance of potential pest species, while also supporting beneficial ecological functions. This study investigates small mammal diversity using *Tyto alba* pellets collected from 40 roosting sites across the Trás-os-Montes region (NE Portugal), where traditional land management persists alongside emerging trends of intensification, particularly in olive groves. Species composition was identified from regurgitated remains, and diversity patterns were analyzed in relation to landscape composition and structure, measured within 1.5 km buffers around each site. Preliminary results indicate that higher landscape heterogeneity is associated with increased small mammal diversity, providing support for the ecological value of traditional agroecosystems and the importance of conserving landscape complexity for biodiversity and ecosystem functioning. While data analyses are still ongoing, the emerging findings contribute to better understanding the links between land use, biodiversity, and the sustainability of Mediterranean farming systems.

**Keywords:** Agriculture intensification; Conservation management; Farmland biodiversity; Landscape Heterogeneity.

**MED's Research Group:** Ecology & Biogeography

## **Spatiotemporal dynamics of pastures in Portugal between 1995 and 2018**

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Meadows and extensively cultivated pastures were shaped by millennia of moderate grazing in areas unsuited for more intensive agricultural practices, due to climate, terrain and soil conditions. Besides meat and dairy production, pastures provide other relevant goods and services, such as carbon sequestration, water regulation and biodiversity conservation. Despite their relevant role, European pasturelands have been facing degradation and area reduction. This work addresses the dynamics of pastures in Portugal between 1995 and 2018, and focuses on the extensification/intensification dichotomy applied to agricultural land transformations. The pastures in mainland Portugal suffered a net loss of 11,390 hectares in the studied period; ~70% unchanged, and ~30% lost in some areas, partially compensated by gains elsewhere. Knowing beforehand that extensification is a proxy for land abandonment and intensification is often driven by supportive sectorial policies, the transitions were then classified as such. At the national level, 48% of the pastures lost suffered an extensification process, 42% were replaced by more intensive uses, and 10% were associated to other changes. A regional outlook, fundamental for policy design in heterogeneous territories, was achieved by additional NUTSII characterization and classification based on the recent pasture loss profile.

**Keywords:** LULC change, spatial patterns, pastures, Portugal

**MED's Research Group:** Landscape Dynamics & Management; Ecology & Biogeography

**Montados and Miombo forests impacts on adaptation of the soil surface to temperature variation, case of Alentejo central in Portugal and Mavago district in Mozambique**

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Climate change impacts have been increasingly noticeable in recent decades. Vegetation in general and forests in particular have a significant influence on the environment and especially on regional climate, by regulating Earth's reflectance and evapotranspiration. Therefore, different types of forests are expected to contribute differently to heat regulation, and substantial changes in a given forest, e.g. fast area reduction, are likely to be reflected in relevant indicators, at local or regional scales. This work aims to understand the influence of Montado, in Portugal and Miombo, in Mozambique, on soil temperature regulation. The analytical procedure relies on 1) landcover dynamics, vegetation indices and temperature (atmospheric and surface) variation to assess forests' ability to buffer temperature oscillations; and 2) scenario building by combining simulated forest dynamics and climate scenarios (representative concentration pathways – RCP). This is instrumental to produce relevant knowledge for regional planning and forestry management, considering the forests' capacity to regulate surface temperature, and thus contributing to the general system enhancement.

**Keywords:** Forest dynamics, temperature, land cover, Montado, Miombo.

**MED's Research Group:** Landscape dynamic & management

## **Mapping global conservation priorities across natural, production and urban lands**

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Efforts in biodiversity conservation have traditionally focused on the protection or restoration of natural and semi-natural ecosystems, often overlooking the role of trophic structure in guiding these priorities. In this presentation, we depart from the mainstream conservation paradigm. By applying spatial data analysis at a global scale, we identify the top 30% of natural and semi-natural, production, and urban lands in each country that exhibit the highest levels of community saturation for the adequate representation of key community trophic regimes. Through a multi-scaled framework— integrating global and country-level prioritization—we distinguish how different land use systems contribute to the representation of community trophic diversity across spatial scales. We map these priority areas and assess how they differ from the remaining areas in terms of community saturation, human population density and current protected area coverage. We trust that this study contributes to a more integrated understanding of biodiversity conservation along different land use systems and therefore aligns well with MED's objective to assure environmental integrity, conserve biodiversity, and promote landscape multifunctionality.

**Keywords:** Conservation planning; Land use; Mammal; Ranking; Trophic diversity

**MED's Research Group:** Ecology & Biogeography

## **LDT - From landscape metrics back to patterns**

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Landscapes are shaped and influenced by a dynamic balance of ecological processes and anthropogenic activity. Substantial changes may disrupt the natural balance of ecosystems, jeopardizing their capacity to provide essential services. Landscapes are often characterized and assessed through their most circumstantial aspect, land use/land cover (LULC), via metrics and indices. That way, particular traits of the landscape elements are captured and measured, allowing temporal tracking or comparisons between landscapes. Despite the advantages of such simplifications, sometimes combining metrics can mirror and describe actual patterns and dynamics effectively. The Landscape Dynamics Typology (LDT) is a method that combines possible variations of “area” and “number of patches” of a given LULC category to identify the spatial patterns resulting from landscape dynamics. These Types of Dynamics (ToD) can be calculated and displayed for different analytical units (AU) and may represent the end product or be used to feed the following analytical procedures. Attached to the LDT is a forecast scheme that allows us to understand in which phase of the dynamics each AU is (early fragmentation, strong habitat gain, etc.). LDT implementation is facilitated by three tools: LDTtool (ArcGIS toolbox), LDT4QGIS (QGIS scripts) and LDTR (R package).

**Keywords:** GIS, Landscape ecology, LULC dynamics, metrics, spatial patterns.

## **Bacterial Diversity and Biotechnological Potential of Mediterranean Fruit Tree Ecosystems and Vinegar-Derived *Komagataeibacter* Strains**

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Mediterranean fruit tree ecosystems represent underexplored reservoirs of bacterial diversity with biotechnological potential. *Komagataeibacter* species are recognized for their ability to synthesize bacterial cellulose (BC), a biodegradable high-value biomaterial. This study investigated the bacterial communities associated with carob tree (*Ceratonia siliqua*) and strawberry tree (*Arbutus unedo*) using a culturomics approach and characterized BC-producing strains isolated from artisanal vinegars. A total of 155 bacterial strains were isolated from rhizosphere-to-fruit niches. Phylogenetic analysis based on 16S rRNA gene sequences of 56 isolates revealed a predominance of *Sphingomonadaceae* (18%), *Rhizobiaceae* (11%), and *Microbacteriaceae* (9%), as well as three putative novel species. Moreover, 26 acetic acid bacteria, isolated belonging to the genera *Komagataeibacter* (n=18), *Acetobacter* (n=7), and *Bacillus* (n=1). In total, biochemical profiling of 21 strains was conducted using the RapID™ ONE System. Ten selected strains are currently under evaluation as plant growth-promoting bacteria (PGPB), and their genomes were sequenced. BC produced by three *Komagataeibacter* strains using glucose or fructose as sole carbon sources was analyzed by FTIR spectroscopy. Overall, this study underscores the potential of Mediterranean fruit trees as sources of novel PGPB and biodegradable materials. It further highlights the importance of preserving microbial biodiversity to support circular bioeconomy in sustainable Mediterranean agro-food systems.

**Keywords:** Bacterial biodiversity; Culturomics; Plant growth-promoting bacteria (PGPB); *Komagataeibacter*; Bacterial cellulose

**MED's Research Groups:** Plant Protection, Genetics & Biotechnology; Food Science & Technology

**BioBlitz Herdade da Mitra: One day, one mission - Bringing people together for biodiversity**

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A Bioblitz aims to record all species observed in a specific area over a specific time. Members of the Ecology and Biogeography Group of MED have been promoting an event that opens research to a broader audience, bringing together the general public and researchers. The “Bioblitz Herdade da Mitra” is more than a competition to record as many species as possible in 24h, it is an outdoor activity that engages citizens in hands-on science, fostering a deeper connection to nature through collaborative exploration and data collection. Through dedicated activities and taking advantage of the diversity of habitats present in the UÉvora experimental farm (Holm/Cork Oak montados, shrublands, pastures, diverse orchards, and a well-preserved riparian gallery), we survey most species groups of the area: nocturnal birds, bats, moths, mushrooms, lichen, vegetation, passerines, reptiles, butterflies, ground insects and terrestrial mammals. This event had its first edition in spring 2023 (1938 observations of 571 species), and a second edition in autumn 2024 (1453 observations of 444 species). Organized on a regular basis, this BioBlitz contributes to increasing public scientific literacy and promotes synergies among MED researchers. Beyond its societal value, this initiative helps document the ecological value of UÉvora’s experimental farm.

**Keywords:** Citizen Science, ecology, conservation, monitoring, outreach

**MED’s Research Group:** Ecology & Biogeography

## **Social Science for Strengthening Governance Structures**

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In an era where problem-oriented and goal-driven research dominates the agenda of many institutions, it is vital not to overlook one of science's core strengths: its ability to pose critical questions and foster reflection. This pitch highlights the crucial role of social sciences in advancing organisational capability, governance mechanisms, and inclusive development. We argue that meaningful progress in these areas requires a grounded understanding of existing governance contexts—how governance is currently practiced, by whom, and with what consequences. Yet, a review of the literature reveals a significant gap: few studies offer robust, empirically grounded characterisations of current governance structures. As a result, many initiatives are being replicated without a thorough diagnosis of the situations they aim to improve, nor are their impacts systematically assessed. We therefore call for a stronger integration of social science in governance research to build the analytical and diagnostic foundations necessary for more effective, evidence-based governance and development strategies.

**Keywords:** Governance, social science, research and innovation

**MED's Research Group:** Landscape Dynamics & Management

# **SCIENTIFIC EXHIBITIONS**

## Rebooting the Montado: Restoring Ecosystems with Genetic Precision

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The Montado ecosystem is compromised by climate change, soil desertification, and unsustainable practices. In order to ensure its survival, it is important to repopulate with genetically superior cork oaks. Hence, the SOS\_ProdehesaMontado project implements actions to reverse cork oak decline, promoting both restoration and long-term environmental and economic resilience of the ecosystem. New clonal propagation methods for disease-free cork oak plants and genomic tools are being implemented based on a unique germplasm resources with high genetic potential from the F1 population of known pedigree, a located at H. Abóbada (Serpa-PT). Somatic embryogenesis was selected as the method of propagation for elite cork oak genotypes due to the successful induction of embryogenic calluses in 80% of the tested genotypes. Genotype significantly affected induction rates, whereas the vegetative stage did not. Acclimation remains a bottleneck to cork oak vegetative propagation, prompting improvements to preceding steps. Molecular methods for early detection of fungal pathogens in cork oak, such as *B. mediterranea*, are also being used. Additionally, state-of-the-art genomic technologies, including genome sequencing, are being applied to identify molecular markers linked to cork quality. The overarching goal is to develop resilient, high-performance cork oak populations, ensuring a sustainable future for the Montado and its socioeconomic value.

**Keywords:** *Quercus suber*, somatic embryogenesis, genomic, disease-free cork oak, *Biscogniauxia mediterranea*.

**MED's Research Group:** Plant Protection, Genetics & Biotechnology; Animal Biosciences

## **The contribution of molecular and biotechnological plant sciences to sustainable mediterranean agriculture**

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The Mediterranean region faces growing environmental challenges, driven by intensive agriculture, poor natural resource management, and excessive chemical use. Combined with climate change, these pressures have led to low agricultural yields, soil erosion, desertification, and declining biodiversity. In response, there is a shift toward sustainable practices like organic and regenerative agriculture, which focus on restoring ecological balance and soil health. In this transition, science plays a key role, not only in guiding improved farming practices but also in developing crop varieties suited to low-impact systems. At MED-UÉVORA, researchers from the Plant Breeding and Biotechnology and Molecular Biology labs focus their work on Mediterranean species. These fields are central to the development of elite genotypes that are resource-efficient, that better cope with environmental stresses, and sustain productivity while protecting the environment. In this exhibition, the current research lines will be presented, which includes the integrative analysis of omics datasets of plant response to abiotic stresses, phenotyping and genotyping technologies, and the use of in vitro culture to assist plant propagation and breeding. Additionally, techniques that are available at MED-UÉVORA that could be applied in this context will be demonstrated.

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

**MED's Research Group:** Plant Protection, Genetics & Biotechnology

**AlBread – Aromatic plants from Alentejo, probiotics and acorn flour for the development of functional bread.**

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Bread is one of the most popular and ancient foods in the world, with a strong presence in the daily lives of populations due to easy access to this food. The consumers' conscientization of the need to maintain high health standards, has led to the development of the so-called "functional foods". In this sense, the role of essential oils and probiotic microorganisms is seen as essential, because of their good biological activities and beneficial impact on human health. On the other hand, the use of gluten-free flours has gained increasing attention, in the last years. The acorn flour is an excellent alternative to conventional flours, yet little explored. The integrated use of these endogenous resources from the Alentejo region, essential oils extracted from aromatic and medicinal plants and acorn, intends to contribute to the development of an innovative concept of functional bread with significant positive results in human health, economic valorisation of resources, environmental and social impact, due to the maintaining of Montado, from where is obtained the acorn and the aromatic and medicinal plants.

**Keywords:** Bread, acorn flour, essential oils, aromatic plants, foods

**MED's Research** Group: Plant Protection, Genetics & Biotechnology, Food Science & Technology

## **Antifungal potential of essential oils and their stabilization with bacterial cellulose in a functional bread**

dos Anjos I<sup>1</sup>, Duarte H<sup>2,3</sup>, Oliveira M<sup>2</sup>, Magalhães S<sup>2</sup>, de Souza E<sup>1</sup>, Corrêa L<sup>1</sup>, Jorge R<sup>1</sup>,  
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The development of a functional bread, made from acorn flour and typical aromatic plants from the Alentejo region, represents an innovative approach that combines the nutritional benefits of acorns with the therapeutic properties of local plants. This initiative, the project 'AlBread - Aromatic Plants from Alentejo, Probiotics and Acorn Flour in the Development of Functional Bread', supported by Promove 2023, aims to valorize local biodiversity and promote healthier, sustainable food choices. We are evaluating the antifungal potential of the plant's essential oils against *Penicillium* sp. Concurrently, various techniques for emulsifying these oils with acorn flour are being tested, including stabilization using bacterial cellulose derived from vinegar production. Bacterial cellulose, known for its high viscosity and film-forming ability, is explored to improve oil dispersion and stability, potentially extending shelf-life. By integrating local ingredients with new technologies and harnessing their bioactive properties, this project aims to make a significant contribution to the development of functional foods, to the food industry and to the preservation of the natural resources and traditional knowledge of the Alentejo.

**Keywords:** Acorn flour; essential oils; Antifungal activity; bacterial cellulose; functional bread.

**MED's Research Group:** Plant Protection, Genetics & Biotechnology; Food Science and Technology

## **From biomass to beauty: Lignin-based conditioning agents for sustainable cosmetics**

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The valorization of lignocellulosic biomass is a key strategy in advancing circular economy principles, reducing agro-industrial waste, and addressing the growing demand for sustainable ingredients in the cosmetic industry. This work explores the transformation of lignin, an abundant and underutilized byproduct of biomass processing, into high-value ingredients for sustainable hair care formulations. Lignin was chemically modified to enhance its solubility and surface charge, aiming to improve its performance as a conditioning agent. The modified lignins were evaluated for their solubility, film-forming properties, and compatibility in hair care formulations. Their ecotoxicity was assessed using aquatic organisms and compared to conventional commercial polymers, demonstrating significantly lower toxicity. Additionally, formulations incorporating lignin derivatives showed promising conditioning effects, supporting their functional application in cosmetics. This approach not only adds value to a major biomass residue but also contributes to the development of more sustainable, environmentally conscious cosmetic products. Bridging green chemistry, material science, and cosmetic innovation, this work presents a practical path toward integrating renewable resources into the personal care sector.

**Keywords:** Biomass-derived materials, Conditioning agents, Green chemistry, lignin valorization, Sustainable cosmetics

**MED's Research Group:** Plant Protection, Genetics & Biotechnology

## **CynaraHub – a circular bioeconomy approach to enhance the economic valorization of *Cynara cardunculus*, promoting territory resilience**

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With growing prominence, *Cynara cardunculus*, known as cardoon, has emerged as a valuable endogenous resource uniting R&D strategy, mainly due to its broad range of applications, but also because of the remarkable diversity among its genotypes, encompassing genetic, morphological, chemical, and technological traits. Over the years, researchers at MED have explored various approaches to fully valorize the plant, fostering new applications. This exhibition aims to present a multidisciplinary strategy involving genetic, molecular, chemical, biological, agronomic, and animal nutrition studies, to promote the valorization of: i) flowers, particularly within dairy industry, both through a biochemical approach to optimize their use in cheese production and through the development of a prototype for assessing milk coagulation time; ii) leaves, as a potential source of sesquiterpene lactones (SLs), exploring their use in new products such as bioherbicides; iii) seeds, as source of fatty acids and proteins for animal feed; iv) stalks and leaves as an alternative raw material for bioethanol production. The exhibition will also showcase ongoing studies on transcriptomic analysis for selection of cardoon superior genotypes, as well as the ongoing in vitro propagation studies. The existing experimental fields (Beja and Évora, Mitra) will also be presented as an example of biodiversity preservation.

**Keywords:** Cardoon; cheese manufacturing; bio-based products; animal feed; economic valorization

**MED's Research Group:** Plant Protection, Genetics & Biotechnology; Food Science & Technology; Ecology & Biogeography; Soil, water, Plant & Farming Technology; Animal Biosciences

## **Connected to Science: Innovating in Science Communication for Inclusive Development and Resilient Agroecosystems**

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In recent years, MED-CEBAL has strategically invested in science communication as a tool to bring research closer to society and promote scientific literacy, focusing on biotechnology, agriculture and agroecosystems. Since 2022, a renewed effort has been placed on strengthening the digital presence, rebranding MED-CEBAL's image, and launching diverse digital strategies exploring multimedia and writing tones to make scientific content more accessible, engaging, and relevant. This demonstration will showcase MED-CEBAL's evolving "digital toolbox", including short educational and informative videos, social media short videos, promotional videos, carousel posts, email marketing, and newsletters. It will also highlight the work of producing clear, engaging written content while maintaining scientific and technical accuracy. Through an interactive multimedia setup, visitors will explore how different formats are tailored to engage specific target audiences, facilitate knowledge transfer, and foster public involvement with science. The demonstration provides a practical look at how MED-CEBAL's communication strategy promotes inclusive development through stronger organisational visibility (MED Objective 4), while contributing to the resilience of agroecosystems by fostering knowledge, innovation, and informed decision-making (MED Objective 5).

**Keywords:** agroecosystems, digital strategy, inclusive development, multimedia tools, science communication

**MED's Research Group:** Food Science & Technology

## **Biochar application: impact on the germination index of lettuce (*Lactuca sativa* L.) in agricultural soil**

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Soil is the basis of terrestrial ecosystems and essential for environmental restoration. Intensive agriculture has accelerated soil degradation, erosion, and desertification. Strategies that improve soil quality, such as increasing organic matter content, are therefore crucial. Biochar, a carbon-rich product from the pyrolysis of organic biomass, has shown potential as a soil amendment due to its ability to improve physical and chemical properties and microbial diversity. Nonetheless, its effect may vary depending on feedstock and production method, with possible phytotoxicity. This study evaluated the phytotoxicity and repellence effects of two biochars from different raw materials. Each was incorporated into olive grove soil at concentrations of 0%, 1.5%, 3.0%, 5%, and 100%. Distilled water was added to saturation, and germination assays were performed with *Lactuca sativa* L. seeds in Petri dishes under controlled conditions (25 °C, dark, 72 h). The germination index, based on root length and germination rate, was recorded. Results showed that germination improved at 1.5% and 3% biochar concentrations but declined at 5%. Biochar application also increased soil repellence. These findings suggest that biochar can benefit agricultural soils, provided that its application rate is carefully optimized.

**Keywords:** Phytotoxicity, Soil amendment, Sustainable agriculture

**MED's Research Group:** Soil, Water, Plant & Farming Technology; Plant Protection, Genetics & Biotechnology

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## **Solutions for the valorization of surpluses from the olive oil sector**

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Since olive oil production is the primary objective of the olive-growing sector, its extraction generates considerable amounts of olive pomace (around 85% of the olive mass). This by-product/surplus is transported from the mills to specialized facilities where olive pomace oil is extracted, resulting in a new surplus: extracted dry pomace. In addition to pomace, mills also accumulate shoots and leaves from the olive cleaning process. The INOVIRCOLIVE project aims to promote solutions for the integrated valorisation of olive oil production surpluses (olive pomace, pruning residues and olive leaves, wastewater, and olive pits), as well as other by-products from the agri-food chain. This exhibition seeks to showcase the activities carried out in this project, namely the valorisation of surpluses used in composting, the compost obtained, and its application to the soil. The agricultural valorisation of these surpluses included evaluating the application of compost to olive grove soil, the development of olive trees, olive production and the quality of the olive oil produced, as well as its use as a substrate in plant nurseries. Organic valorisation includes the development of extraction processes using methodologies and solvents with low environmental impact to obtain phenolic concentrates, as well as their characterization.

**Keywords:** Olive pomace, olive leaves, compost, phenolic compounds

**MED's Research Group:** Food Science & Technology, Plant Protection, Genetics & Biotechnology, Soil, Water, Plant & Farming Technology

**Impact of Harvest and Post-Harvest Practices on the Abundance of *Ceratitis capitata* (Wiedemann) (Diptera: Tephritidae)**

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*Ceratitis capitata* is one of the main insect pests in horticulture worldwide. Thus, this study aimed to evaluate the abundance of *C. capitata* in citrus-growing areas, before and after fruit harvest. Ten McPhail traps with BioLure™ were installed in commercial citrus orchards, simultaneously, during the pre- and post-harvest periods. For the statistical analysis of the infestation level, a non-parametric bootstrap analysis with 10,000 pseudoreplications was used, employing the R software. The results indicated a higher abundance of *C. capitata* in traps placed in orchards after harvest (17.3) compared to those in pre-harvest orchards (2.5), coinciding with the increased availability of fallen host fruits on the ground after harvest and the reduction of management practices in the studied areas. These factors provide important insights for integrated pest management, as poorly managed areas may favour the population growth of *C. capitata*, resulting in population outbreaks and migration of individuals to neighbouring orchards. It is concluded, therefore, that pest monitoring and proper management of citrus crops are essential for greater production efficiency, with post-harvest management being fundamental for the reduction of *C. capitata*.

**Keywords:** Citrus; Population monitoring; Integrated Pest Management.

**MED's Research Group:** Soil, Water, Plant & Farming Technology

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