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Session A. Plant Biodiversity of Terrestrial Ecosystems

Nature-based Solutions approaches for ecosystem restoration

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Keywords: Restoration, NbS, Ecosystem Services, Benefits Assessment, Multistakeholder approach.

Nature-based Solutions (NbS) have been launched by the World Bank in 2008 as tools to help renaturing degraded ecosystems, with the aim to improve Climate Change resilience, while providing environmental, social and economic benefits. Since 2015, the International Union for Nature Conservation (IUCN) and the European Union (EU), separately adopted and developed the NbS concept, being mainly focused on landscape and seascape ecosystem restoration and on urban environment regeneration, respectively.
The most prominent contribution given at global level by the EU since the launch of the NbS strategy has been the need to create a common assessment framework to evaluate, and compare, the benefits originated by the implementation of NbS (Raymond et al., 2017). Several projects on NbS have been funded since 2017, in which partners from across Europe have been asked to share knowledge and experiences within a task force, with the final aim to develop a common list of indicators and protocols to help the stakeholders in evaluating NbS effectiveness in connection with different target societal challenges (EU, 2021).
Impact assessment has thus become a crucial step in the NbS implementation, also implying the collaboration of the different actors while representing a strategic tool to grow awareness in the society and the funding institutions. It is evident that the Scientific Community is assuming a crucial role in this context.
In 2022, under the guidance of the United Nations (UN), a common, shared definition has been agreed among the several institutions involved worldwide, and NbS are now defined as "actions to protect, conserve, restore, sustainably use and manage natural or modified terrestrial, freshwater, coastal and marine ecosystems which address social, economic and environmental challenges effectively and adaptively, while simultaneously providing human well-being, ecosystem services, resilience and biodiversity benefits" (UNEA, 2022).
At the EU level, the expansion from an urban perspective to a global one, in connection with the UN Sustainable Development Goals (SDGs), moved the focus beyond the Climate Change mitigation and adaptation (with the Carbon Neutrality as first goal, as set by the Green Deal). For instance, NbS are also relevant in terms of Decent Work provision, thus including the concepts of inclusiveness, social and fair income, security in the workplace and social protection for families (ILO, 2022). Also, the crucial role that can be played by NbS in biodiversity restoration and conservation in degraded and restored ecosystems clearly emerges, as also stated in the agenda of the EU recently funding partnership on biodiversity, i.e. Biodiversa+ (Eggermont et al, 2021).
The strength of the NbS approach as the only possible one in future sustainable scenarios clearly emerged in July 2023, when the European Parliament approved the Nature Restoration Law, which includes clear commitments and targets for the member countries in respect with the biodiversity restoration and in the future adoption and implementation of national adaptation strategies promoting nature-based solutions and ecosystem-based adaptation strategies (Nature Restoration Law, 2023).
It is thus a priority to further improve the assessment methodologies and the adoption of valuable and robust indicators which will help in planning the future restoration programs but also to verify the effectiveness of those with the final goal to provide the best benefits to people and nature.
Within this context, Italy is actually at the very front of the NbS landscape in Europe, and likely worldwide, thanks to two main actions: (1) the funding of the National Biodiversity Future Centre (NBFC), with two activities fully focused on the development of NbS and ecosystem restoration strategies suited for biodiversity restoration and conservation in the national territory, in both urban and extra-urban contexts, to further strength and boost the definition of national guidelines; (2) the constitution of the NbS Italy Hub, which has the main role of aggregating all the national public and private institutions active in the NbS field, to improve the NbS inclusion into national and local policies and funding programs.

Future strategies for plant germplasm conservation: the case for a single national coordination centre

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Keywords: plant genetic resources, food security**,** bottlenecks and challenges, Italian National Coordination Centre for the Conservation of Agro-biodiversity (INCCC).

- Plant genetic resources are a cornerstone of food security, utilized as the building blocks of crop improvement by farmers and modern plant breeders alike. A Research Study of the International Treaty on Plant Genetic Resources for Food and Agriculture (The International Treaty) demonstrates that national food supplies and production systems are highly interdependent worldwide in regard to plant genetic resources. Countries strongly depend on crops whose genetic diversity originates largely outside their borders, both in their food supplies and in their production systems.

- Humankind is therefore dependent on the continual availability of a wide pool of plant genetic resources for food and agriculture (PGRFA) to sustain our food and economic security, yet despite the vast pool of resources that exist, we face significant hurdles in mobilizing them for effective conservation and sustainable use. Both thematic areas, (Articles 5 and 6 of the International Treaty) are always the relevant part of agenda of the Governing Body of the International Treaty.

- In 2021 the Secretariat commissioned a Background study on the bottlenecks and challenges to the implementation of Articles 5 and 6 and although there is great diversity among and within the seven FAO regions, the results of the background study show that four types of bottlenecks and challenges are relevant across the regions to a greater or lesser extent:
  1. Legal, policy, and institutional challenges;
  2. Technical and scientific issues;
  3. Seed distribution and marketing of landraces and farmers' crop varieties; and
  4. Resource constraints.

- The lecture will underline the outcomes of the analysis to which participants from FAO European Region 91 respondents from 29 countries. It will also be presented the Joint Programme on Biodiversity in Agriculture for Sustainable Use of PGRFA (2024-2029) which will be discussed at the Tenth Session of the Governing Body in November 2023.

- Bearing in mind the recent outcomes of the bottleneck study and noticing the urgency to respond to the need to facilitate access to seeds for food and agriculture, an Italian National Coordination Centre for the Conservation of Agro-biodiversity (INCCC) will be also suggested. This Centre, under the leadership of the Ministero dell'agricoltura, della sovranità alimentare e delle foreste, will coordinate the activities for conservation and sustainable use of PGRFA, access and benefit sharing and might be the effective response to the emerging challenges. A coordinated and univocal voice with regard to the Italian strategic approaches in the international Biodiversity Forums might finally be possible.

Biodiversity: a fundamental resource for vegetable varieties

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Keywords: plant breeding, selection, multiomics, genetic diversity.

Biodiversity is defined as variability among living organisms which underpin diversity within species, between species and of ecosystems. Besides its ecological importance, biodiversity includes genetic variability among and within populations that could be used for breeding purposes in vegetables, or other crops.
Interspecific crosses, spontaneous mutations in closely related species, etc. have been deeply used to introduce desirable traits into breeding programs to constitute varieties with more tolerance to pest and diseases, as well as salt tolerance, or other negative environmental conditions to increase yield, qualitative traits and adaptability to biotic and abiotic stress.
Indeed, plant breeding is considered the science of recombining genetics obtained from existing varieties, landraces, gene banks or wild relatives into new varieties to satisfy market requirements in case of commercial varieties. Therefore, genetic diversity is the required condition to select superior individuals in "conventional" plant breeding, as well as in "multiomics" plant breeding.
Starting from the rediscovery of Mendel's laws of trait inheritance in 1900 and Darwin's concept of natural selection, plant breeders relied on technologies and methods to achieve ever changing targets. For example, gamma-irradiation, protoplast fusion, embryo rescue, some tissue culture techniques permitted to exploit genetic variation, overcome crossing barriers, and speed up the stabilization of parental-breeding lines. From the early '90s, marker-assisted selection fastened selection and, more recently, novel omics tools and genome editing (cutting-edge techniques) are used in breeding to face coming challenges to increase the qualitative value of crop cultivation, solve malnutrition/starvation issue in 10 billion people over the next 30 years.
F1 hybrid seed production allowed the exploitation of heterosis and the combination of useful genes (e.g. resistance to biotic and abiotic factors) in a uniform outperforming variety. According to the requirements of the food supply chain, the development of a few high-yielding, extremely uniform commercial varieties, led to global annual productivity gains but also to a replacement and subsequent elimination of the locally adapted landraces. In some cases, the narrow genetic base of modern cultivars in a global scale, increased the incidence of new races of pests and diseases. Furthermore, the continuous application of some conventional breeding schemes in some species could lead to the narrowing of the original gene pool used to develop the parental lines. Therefore, also in this case, the introduction of new genetic variation into elite germplasm can reduce the undesirable effects of a narrow genetic base. As consequence, breeders (re-)started to explore landraces and crop wild relatives with useful traits, for the introgression of the respective genes and/or quantitative trait loci (QTL) into more resilient parent lines. Some practical examples of exploitation of biodiversity to increase resistance/qualitative traits into breeding programs are reported for some vegetable crops.
In synthesis, between biodiversity and plant breeding there is a mutualistic approach: breeding programs maintain biodiversity by protecting endangered species from extinction which, in turns, are used as genetic source to introduce variability for desired traits.
Other than the breeding method used to exploit biodiversity, the commercialization of a new variety needs for a long process of testing and production before its release. In particular for vegetable varieties, the life cycle includes several variety trials that are conducted also in critical conditions (e.g. high pathogen pressure) to identify the current performance of the new variety.
In this lecture, some case of study reporting the breeding approaches to exploit biodiversity and the process to constitute and release a vegetable variety are also discussed.

Strengthening the MIRRI Italian Research Infrastructure for Sustainable Bioscience and Bioindustry: THE PNRR SUS-MIRRI.IT project

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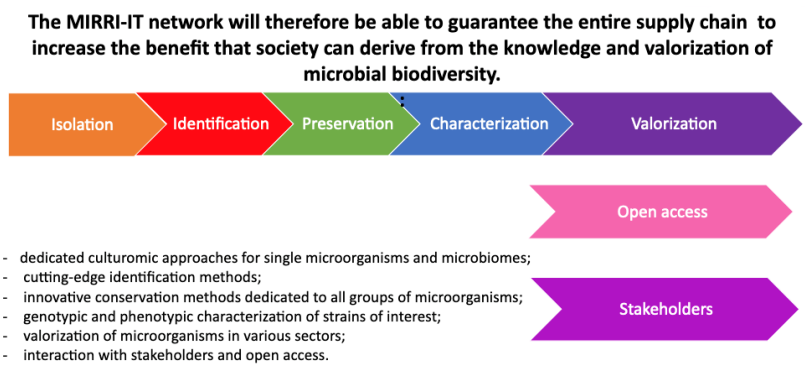
Keywords: Italian microbial biodiversity, microbiomes, MALDI-TOF, WGS.

The JRU MIRRI-IT (https://www.mirri-it.it/) is the Italian network of microbial culture collections operating in various sectors (clinical, food, environmental, agricultural, cultural heritage, etc.). The network includes 25 Institutions holding microbial Biological Resource Centers (mBRCs) and Culture collections (CCs) of viruses, microalgae, bacteria and fungi distributed throughout the national territory. The project SUS-MIRRI.IT, funded by PNRR in 2022, aims at improving and reinforcing the Italian microbial collections network supporting it to focus on the new opportunities that microbiology poses to civil society to face challenges such as improving human well-being and food quality, facing climate change and environmental pollution. The most important activities focus on:

- development of common Standard Operation Procedures (SOPs) for sampling, characterization, authentication, management and conservation of microbial strains and microbiomes from several sectors;
- development of a national network of laboratories to implement the use of MALDI-TOF as a gold standard for rapid identification of microorganisms in fields of application other than the medical one;
- set up of a national plan for whole genome sequencing (WGS) of microorganisms;
- creation of a national catalogue of microbial resources according to FAIR principles;
- creation of new pipelines for description of microorganisms and microbiomes;.
- establishment of boards to raise awareness of national Policy on the conservation, protection, and enhancement of microbial resources biodiversity.

A brief overview on the preliminary results obtained by the JRU, and an excursus on the different foreseen activities and potentiality of the network will be presented. The synergic activities of the JRU and of the SUS-MIRRI.IT project will guarantee the following results:

- achievement of an adequate quality management system by the culture collections belonging to the Italian network;
- availability of "certified" microbial resources, deeply characterized with state-of-the-art technologies, stored in mBRCs/CCs;
- availability of metadata, "certified" services according to international quality standards and latest generation facilities for interested parties;
- creation of a single access platform for requesting microbial resources, metadata, services, training and other related activities;
- possibility of access to the MIRRI-ERIC European consortium by mBRCs/CCs after passing any certification audit;
- availability of highly qualified human capital, possessing excellent skills and expertise in the microbiological sector;
- attraction of capital and investment by the bio-industry at national and regional level;
- attraction of young researchers from foreign research groups with doctoral scholarships in collaboration with private industries and public research centres;
- increasing the scientific and technological competitiveness of national development sectors related to public health, nutrition and the environment;
- availability of new services and training activities for a differentiated audience, responding to public and private needs at a territorial level.



Biodiversity in the Common Agricultural Policy and its implementation in Italy

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Keywords: Green Deal, biodiversity strategy, CAP, land lying fallow, ecoschemes.

Agriculture is strongly influenced by the European new green orientation: European Green Deal, A Farm to Fork Strategy for a fair, healthy and environmentally friendly food system and EU Biodiversity Strategy for 2030. The EU Biodiversity Strategy is based on the premise: farmers play an essential role in preserving biodiversity. At the same time, certain farming practices are one of the major causes of **biodiversity decline**.
Biodiversity is not only an environmental issue but also and especially an economic issue.
The depletion of biodiversity represents a threat to food systems, endangering our food security.
Farmers are the guardians of our land, therefore, they are essential to preserving biodiversity: **farmers are among the first to experience the consequences of its loss and among the first to benefit from its restoration.**
The European Biodiversity Strategy aims to work together with farmers to support and encourage the transition to fully sustainable practices. For this purpose, the CAP 2023-2027 and its implementation in Italy aims at the remuneration of cumulative environmental benefits, through a green architecture, consisting of three levels: cross-compliance, eco-schemes, agro-climatic-environmental payments (Fig. 1).

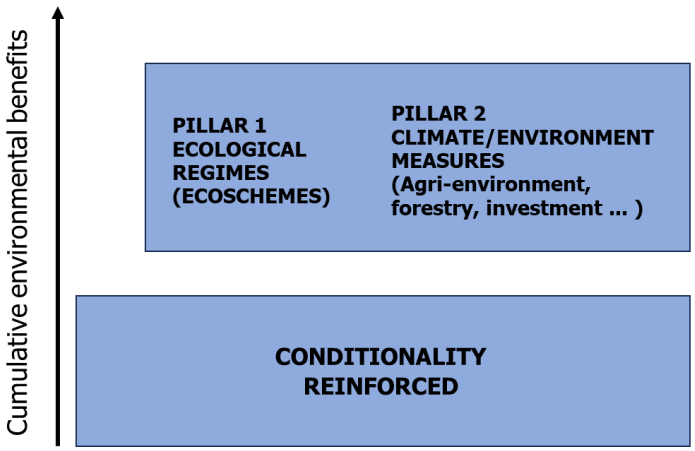

Fig. 1 Architecture of CAP

All three levels foresee, also in Italy, support and commitments to the benefit of plant and animal biodiversity.
Cross-compliance is the first level, which subordinates the payment of CAP support to compliance with 20 environmental rules, including good agricultural and environmental conditions, GAEC 8, which requires a minimum percentage of at least 4% of arable land, at the farm level, to be devoted to non-productive areas and elements for biodiversity.
Ecoschemes (second level), in particular Ecoscheme n. 5, called "Payment for Specific Measures for Pollinators", is specifically addressed to biodiversity, involving the maintenance of dedicated coverage with plants of interest to pollinators (nectar-bearing and pollen-bearing).
Agro-climatic-environmental (ACA) payments (third level) have a direct or indirect incentive effect on biodiversity, with 31 interventions for agro-climatic-environmental commitment payments.
The green architecture of the CAP, in particular the ecoschemes, has been a point of contention in the EU and in Italy between environmental associations which demanded greater environmental ambition and strongly accused the CAP's choices of mainly supporting an intensive agricultural model, and farmers, concerned about the increase in adaptation costs and the reduction in the benefits of public support.
The most forward-looking position is to embrace the expectations of citizens, build good green architecture, avoid excessive complications for farmers, enhance the environmental values already existing in European agriculture and create new green business opportunities. In this way, the CAP will have a future, it has the potential to increase public resources, and it is a commercial lever for agricultural and food products, rather than a constraint.

Biodiversity in Mediterranean fermented foods and beverages: from tradition to innovation

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Keywords: yeasts, bacteria, filamentous fungi, food biotechnologies, microbiology.

Fermentation has been a food preservation strategy for thousands of years, capable of modulating the quality of the finished products, with an important impact on food security. The diversity of biological resources and traditional knowledge has led, over the centuries, to a plethora of fermented foods and beverages that decisively contribute to shaping the traditional productions of different geographical contexts. Fermentation and fermented products are receiving increasing interest for economic, social, and environmental reasons. Fermentation represents a food transformation process with low energy input, with a high potential for developing new products. Fermented products, resulting from a synergy of microbial, animal and plant biodiversity, have an important influence on human health and well-being. In addition, from a scientific point of view, fermented products represent a stimulating sector for transdisciplinary studies and concretise interesting models for in-depth studies in food and microbiological sciences, also because they are considered manageable microbial ecosystems. From a food/gastronomic point of view, the Mediterranean basin has important common elements, but also relevant national peculiarities according to the specificity of the resources and economic, cultural, social and religious factors. The diversity of traditional fermented products in the Mediterranean area reflects these general trends, so it is possible to identify shared characteristics and specific facets referring to fermented foods and beverages in the 'Mediterranean diets'. In this variability, it is interesting to underline the role of the biodiversity of macro- and micro-organisms and the relevance in terms of environmental, economic and social sustainability. In particular, it is to highlight this biodiversity's role in affecting unique sensory, nutritional, and functional traits, as well as aspects related to food security and food safety. The critical overview follows the classic categories related to raw materials (e.g. cereals, vegetables, milk, meat), microbial resources (e.g. lactic acid bacteria, *Saccharomyces*, non-*Saccharomyces* yeasts), and fermentative processes (e.g. lactic fermentation, alcoholic fermentation, acetic fermentation), observing this gastronomic heritage through the lens of scientific literature. How the diversity of fermented products is protected and valued in the framework of the defence of geographical indications and other trademark/product specifications is one of the hot topics in the relationship between tradition and innovation. The search for a balance between managing complexity, global changes and market needs represents the great challenge that the sector faces. The potential of microbiomes, autochthonous microbial resources and the so-called 'microbial crossover' among different food patterns represent drivers of innovation well connected with different 'glocal' trends, capable of further valorising biodiversity in food systems. This makes it possible to deal with emerging tendencies related to issues such as the development of alternatives to foods of animal origin, the improvement of the food/territory link, the design of foods as sources of dietary microbes, and the use of fermentative processes aimed at improving personalised nutrition. The present work has been developed in the framework of the projects i) PIMENTO (COST Action CA20128) and ii) 'SUS-MIRRI.IT', 'ONFOODS', and 'AGRITECH' [Italian National Recovery and Resilience Plan (NRRP) projects financed by the European Commission's Next Generation EU programme].

A.1 Impact of climate change on the duration of the phenological cycle of wine grapes in hot-dry areas

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Keywords: bioclimatic indices, Shared Socioeconomic Pathways, Apulia, viticulture.

The ongoing climate change has a negative impact on the quantity and quality of wine grapes. Air temperature directly affects the duration of each phenological phase, the overall cycle of the growing season, causing earlier ripening and decreasing yield and organoleptic composition of the grapes and wines. In this work, two temperature-based bioclimatic indices widely used in viticulture were considered: Huglin Index (HI) and Growing Season Temperature (GST). The aim was to classify the thermal requirements of 21 wine grapes grown in hot arid areas (Rutigliano - BA) during a trial period of 5 years (2011 - 2015) within the three-year RGV-FAO project 2011-2013 and 2014-2016, and to evaluate their evolution in relation to two different future scenarios: SSP2-4.5 and SSP5-8.5 until 2100. The Days of the Year (DOYs) calculated by phenology/variety in the 2041-2060 and 2061-2080 allowed estimation of early flowering, veraison and ripening that will lead to a contraction of the vine vegetative cycle of 8.7 DOY for SSP2-4.5 and 22.6 DOY for SSP5-8.5 in the time window 2061-2080. These results suggest that winegrowers should consider short- and long-term mitigation and adaptation solutions to climate change, in order to preserve regional tradition and wine quality and lead Apulian viticulture into a future scenario.

A.2 Biodiversity of the *Lamiaceae* Family in Algeria

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Keywords: Algeria, Biodiversity, Botanical, *Lamiaceae, Taxa.*

The Mediterranean basin is one of the 34 Hotspots of Biodiversity in the world. Most of Algeria's ones, have not yet received adequate exploration. The Algerian flora counts 3139 taxa, including 1300 low-frequency species and 653 endemic species. With 236 genera and nearly 7,000 species, *Lamiaceae* is the sixth-largest angiosperm family. The latter includes species that are both culturally and economically significant, as flavor enhancers, and medicinal herbs. This family exhibits therapeutic properties that can be effective for both human health and agricultural purposes. In the Algerian flora, *Lamiaceae* family is represented by 28 genera and 146 taxa. The main botanical characteristics are described through recognised databases. The most common and representative ones are *Lavandula*, *Mentha*, *Rosmarinus*, *Thymus*, *Salvia* and *Stachys*. These latest chorological data underline the importance of preserving Algeria's biodiversity.

A.3 "The pollen journey": the role of sucrose in maintaining viability and pollen germinability during dispersal in Italian wild type hazelnut accessions

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Keywords: *Corylus avellana*, cytoplasmic disaccharides, sugars content, desiccation.

Carbohydrates in pollen grains can function as both structural components and metabolic reserves. Here we propose a possible correlation between pollen sucrose content, viability and germinability and meteorological condition in four different accessions of wild type hazelnuts collected along the Italian peninsula. Each accession showed a unique trend of viability during the flowering period and, however, all of them were characterized by high levels, between 80 and 96%. The levels of anomalous pollen were negligible, likely not correlated to the sterility events induced by reciprocal translocation, a common feature among *Corylus avellana* cultivars. The content of sucrose, with respect to glucose and fructose, resulted very high in all the accessions analyzed and its concentrations during the entire dispersal phase reflected the trend of both viability and pollen germinability. When subjected to controlled dehydration, all accessions reduced their viability to almost zero. All these data suggest a direct involvement of sucrose in protecting plasma membranes from dehydration thus supporting pollen viability and germinability during dispersal period.

A.4 Temperature in Vine Growing Future Scenarios across the Apulia Region in Southern Italy

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Keywords: climate change, regional forecast, temperature.

The progressive climate change is expected to impact the quantity and quality of grapes. Air temperature, among meteorological parameters, plays a key role in directly influencing the yield and organoleptic characteristics of wines. Taking into account one of the most representative climatic indices basically based on temperature, the Huglin Index (HI) has been considered in order to classify and separate winegrowing regions of Apulia in Southern Italy. The last thirty years (1961–1990 and 1991–2022) have been considered as historical periods to forecast future evolution either in the global warming contest or under two different Shared Socioeconomic Pathways, SSP2–4.5 and SSP5–8.5 four global climate models. The 2021–2040 next period if compared to the last historical period of 1991–2022 will fortunately be unchanged. The differences between the two SSPs appeared more evident during the end of this century. According to the HI index, by 2081–2100, SSP2–4.5, the more probabilistic future scenario showed as areas still suitable for qualitative viticulture only the Murgia plateau, the Gargano promontory, and the Pre–Apennine. By contrast, SSP5–8.5, although a "highly unlikely" future scenario, showed a dramatic shift of more than 90% of the Apulia region to "too hot" classes to ensure the survival of viticulture. These results suggest that winegrowers should consider short– and long–term solutions and adaptations in order to preserve the regional tradition and wine quality and to plan the Apulian viticulture for future scenarios.

A.5 A new proposal for estimating the number of vascular plants: Four case studies

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Keywords: species richness estimation, data integration, incidence data, purposive lists, SPADE software.

In this work we present a new way to perform species richness estimation from probabilistic sampling of species. The motivation is that most sample-based estimators of species richness, such as the widely applied estimators automatized in the SPADE software, completely neglect the tendency of species to aggregation or repulsion, assuming the independence of species selection.
Through a simulation study performed on two real communities of trees, we show that SPADE estimators are affected by a massive underestimation of species richness. Therefore, we propose a data integration strategy in which the lists of rare species usually compiled by purposive surveys are exploited and sample-based richness estimation is performed on the residual community of species not included in the purposive lists. In particular, we adopted the well-known Chao & Lee estimator for estimating the residual richness. The strategy has been empirically checked by the same simulation study adopted for checking SPADE estimators achieving appealing results. The application to four case studies (nature reserves and parks in Central Italy) showed a better performance of our proposal with respect to the SPADE software, whose estimates were invariably smaller than the actual number of species recorded in both the samples and the purposive lists, a situation highly embarrassing in reporting phases.

A.6 Analyzing the diversity of forest ecosystems and trees outside forests: Two case studies

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Keywords: biodiversity, diversity estimation, two phase sampling, forest ecosystem, trees outside forest.

Forests are one of the most important storages of biological diversity, playing a key role in biodiversity conservation and mitigation of climate change effects. Recently, also trees outside forests have been included in forest management strategies, given their important ecological and social-economic roles in rural and urban contexts.
In this work, we present a sampling strategy performed in two phases for analyzing the diversity of forest ecosystems and trees outside forests. In the first phase, a sample of points is randomly selected in such a way that the sample points are evenly spread over the study region, with no portion of the region over- or under-represented. Since the first-phase sample can be excessively large and, consequently, with high sampling costs and times, a sample is randomly selected in a second phase from the points selected in the first phase. This allows for the reduction of the sampling effort, with less points requiring on-field investigations.
As case studies, the strategy was applied in Casentino valley and Molise region, both in Central Italy. Satisfactory results in terms of precision of diversity index estimates were obtained in both applications. Moreover, the application to Molise region showed non-negligible carbon stock in trees outside forests above ground biomass.

A.7 Transcriptomic and metabolomic analysis reveals the regulation mechanism of color diversity in *Passiflora genus*

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Keywords: *Passiflora***,** Anthocyanins, Dihydroflavonol-4-Reductase, flavonol synthase.

Passiflora is the largest genus belonging to *Passifloraceae* family, which is featured for colorful flowers and represents a group of economic importance because of their productive potential and nutritional, pharmaceutical, and industrial properties. Therefore, it is interesting to study the diversity of the cultivated species. Cultivated species have great nutritional, medicinal and ornamental value since they are source of many metabolites, such as alkaloids, flavonoids, and carotenoids with beneficial properties for human health. In this study to explore the underlying genetic basis of flower color formation, a metabolomic and transcriptomic analysis was performed on four different cultivated species belonging to *Passiflora* genus. Results showed different anthocyanins profiles in the four samples. Moreover, we found different expression levels of genes for anthocyanins and flavonol biosynthesis, such as dihydroflavonol reductase and flavonol synthase.
Collectively our study provides some valuable information for exploring the flower color intensity variation in *Passiflora*.

A.8 Characterization of the specific phenolic profile of different monovarietal grape pomaces from Salento

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Keywords: *Vitis vinifera*, polyphenols, wine, flavonoids, health benefits.

Vine cultivation and wine production are among the most identifying agricultural activities of the Mediterranean area since ancient times; moreover, the cultural and traditional value of the wine-making process make South Italy and all the Mediterranean basin a biodiversity heritage for this crop. Grape pomace, the main by-product of the oenological industry, still contains several highly bioactive compounds such as polyphenols. It is here proposed the characterization of three red (Negroamaro, Primitivo and Susumaniello) and two white (Fiano and Chardonnay) monovarietal grape pomaces. The pomaces were subjected to methanol extraction assisted with ultrasounds; the yield in phenols were evaluated by spectrophotometric methods. Susumaniello pomace provided the highest total phenolic content and total flavonoids content while the highest yield of non-anthocyanin flavonoids was obtained from Negroamaro pomace. In terms of relative composition, Primitivo pomace showed the highest percentage of total anthocyanins and flavan-3-ols in relation to the total phenolic content. Instead, from white pomaces was obtained a yield of total phenols on average half to those obtained from red pomaces and Fiano pomace resulted a richest source of flavonoid than Chardonnay pomace. In general, the analyses revealed that the composition of the different classes of phenolic compounds is characteristic for each monovarietal grape pomace. Being source of polyphenols pomaces can be converted from waste material to high-added value compound sources, giving hopefully an additional income and further prestige to the winemaking sector.

A.9 Unveiling the Genetic Diversity and Landscape Genomics of Maize Landraces: Insights into Adaptation and Conservation

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Keywords: landraces, landscape-genomics, maize, resilience, population analysis.

Climate change poses a formidable challenge to maize cultivation. Maize landraces, which have adapted to various agroecological conditions, can harbour valuable indigenous germplasm for future breeding programmes to further improve modern varieties. In this research 28 Italian maize landraces were analysed searching for genetic markers associated with environmental factors. Landraces from Lombardia, Emilia Romagna, Trentino-Alto Adige, Veneto, Toscana, Valle d'Aosta and Friuli Venezia Giulia were phenotyped and the genetic analysis was performed using the GBS technique. Subsequent population studies were carried out. Some populations displayed distinct and well-defined genetic profiles, representing unique populations that have not interbred with others. Conversely, there were admixed varietal groups, representing the result of historical cultivation practices, wherein farmers cultivated diverse maize varieties without territorial discontinuity, facilitating cross-pollination between distinct materials. Finally, a comprehensive analysis was conducted to investigate local adaptation in relation to the environment, using climatic variables of the landraces sampling sites, spanning a 30-year period (1970-2000). Preliminary findings from this ongoing investigation identified two specific Single Nucleotide Polymorphisms (SNPs) strongly correlated with the environmental factor of wind, and three with the latitude of the sampling site, indicating promising prospects for genetic improvement.

A.10 Genetic diversity of the "Cavasso and Val Cosa" onion landrace from Friuli

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Keywords: *Allium cepa* L., landrace, agro-biodiversity, SSR, Friuli.

According to FAOSTAT, onion (*Allium cepa* L.) is the third most important vegetable crop. With its origins traced back to Central Asia, the Mediterranean region has emerged as a secondary centre, fostering a remarkable level of diversity throughout Italy. Here we present a survey about evaluation and characterization of the "Cavasso and Val Cosa" onion, a landrace with more than 80 years history of small-scale cultivation in the western portion of Friuli. Before WW II to approximately the 1976 earthquake, onion seeds passed across generations of farmers, and women took care of the production, with onions assembled in attracting braids ("Riesti" in Friulian language) and directly marketed in several villages of Friuli. Since 2004, our genebank (ITA 368) at the University of Udine, maintained the onion seeds and evaluated the performance of the landrace. As expected, adaption of the local landrace was high, compared to OPV varieties (Tonda Musona / Bianca di Giugno, Tropeana Lunga and Rossa Lunga di Firenze. Qualitative tests (storability, total sugars, pungency, total polyphenols, quercitine) are available. In parallel, a genetic diversity assessment was performed in order to ascertain whether the landrace onions from the two locations (Cavasso vs Castelnovo del Friuli) had a common genetic base or were distinct, as postulated by local experts. Green tissues from 150 individual plants collected from nine local farms in the area of Cavasso and Val Cosa and the four registered onion varieties were screened at 14 microsatellite loci. The overall panel of individuals showed HW equilibrium at several loci and small amount of variance explained by principal components, indicating limited differentiation and common ancestry of the materials analyzed. However, the local onion landrace resulted to be significantly distinct from the other OPV varieties ($0.19 < FST < 0.23$). Six farms from the area of Cavasso presented materials genetically compatible with the Cavasso landrace whose seeds were originally collected; one showed more heterogeneity among varieties; the last two, corresponding to the area of Val Cosa, exhibited separated genetic profiles, supporting the traditional knowledge of two distinct populations for the local onions, despite the geographical proximity.

A.11 Enhancement of "Carosello Scopatizzo" (*Cucumis melo* L.) through the adoption of a cultivation system with high water and nutrient use efficiency

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Keywords: Cucurbitaceae, unripe melon, hydroponic, nutrient film technique, landraces.

For more than twenty years, the horticulture research group at the University of Bari has been engaged in various activities, including the study and application of soilless cultivation systems characterized, among other aspects, by high plant densities and efficient water resource utilization. Generally, these systems are adopted for the cultivation of hybrid cultivars characterized by high uniformity and productivity. In fact, in reference to these cultivation systems, there is often talk of industrialized agriculture. Both "industrialized agriculture" and "precision agriculture" are not "enemy" terms to the conservation of agro-biodiversity, but rather cultivation systems that can also enhance local varieties like the 'Carosello Sopatizzo' (*Cucumis melo* L.). In the experimental activity carried out in a greenhouse at the experimental farm "La Noria," ISPA-CNR in Mola di Bari, the 'Carosello Scopatizzo' was cultivated with the Nutrient Film Technique (NFT) in a closed-loop system, during the spring-summer period, with a nutrient solution consisting of three levels of NaCl concentration (0, 2.5 mM, and 5 mM) starting from rainwater and it was examined how the concentration of this salt influences cultivation, productivity, and fruit quality. It emerged that increasing the concentration of NaCl in the circulating nutrient solution in the NFT system led to an increase in electrical conductivity up to 8 $dS \cdot cm^{-1}$, without a significant decrease in yields or fruit size. Furthermore, the NFT cultivation technique allowed for a rapid onset of production, with the first harvest taking place 26 days after transplanting. In the three experimental treatments, at 60 days after transplanting, each "Carosello Scopatizzo" plant produced an average of 16 fruits with an average weight of 200 g, resulting in a production of 3.2 kg per plant. Furthermore, plants produced an average of 3.2 g of biomass per liter of absorbed nutrient solution, which means that for every kilogram of harvested product, the consumption of nutrient solution was approximately 35-40 L, compared to over 100 L/kg of harvested product in open-air cultivation. NFT proved to be a suitable technique for the enhancement of "Carosello Scopatizzo," even though it requires technical knowledge not widely spread among farmers. Among the objectives of this activity are also the nutritional characterization of "Carosello Scopatizzo," the production of small entirely edible fruits, the analysis of macro and micronutrient removal to optimize fertilizer use, and the development of non-destructive assessments (NIR technology) for qualitative fruit selection.

A.12 Leaf production and quality of wild edible plants grown with wastewater from hydroponic and aquaculture system

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Keywords: halophyte plants, salinity soilless culture, wastewater irrigation, wild plants.

There is a growing interest for the cultivation of wild edible plants due to their quality attributes and salt tolerance, which makes them suitable for cultivation with agricultural wastewater.

In two separate experiments, three wild species, hawkweed oxtongue (*Picris hieracioides* L.), buck's-horn plantain (*Plantago coronopus* L.) and sea beet (*Beta vulgaris* subsp. *maritima* (L.) Arcang.), were grown hydroponically (floating raft system) in greenhouse with moderately saline drainage water from semi-closed substrate culture of tomato. Sea beet was also grown with highly saline wastewater from saltwater recirculating aquaculture system (with Gilthead Sea bream as fish species). Treatment with hydroponic effluents reduced the yield and increased leaf Na content of hawkweed oxtongue and buck's-horn plantain. Antioxidant capacity and total phenol content also increased in buck's-horn plantain grown with hydroponic effluents. Sea beet growth was reduced by the aquaculture effluent while no or minor effects were found on leaf production and quality in plants irrigated with the hydroponic effluent. In sea beet leaves showed a high content of oxalate, which increased with the salinity of the nutrient solution.

In conclusion, hawkweed oxtongue, buck's-horn plantain and sea beet could be grown using hydroponic effluents with moderate salinity. In contrast, the crop yield and leaf quality of BM is markedly reduced by highly saline aquaculture effluents, which could be used after some dilution with standard nutrient solution.

A.13 Cumulative Arsenic Impact on Durum Wheat: An Analysis of Italian Biodiversity

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Keywords: durum wheat, agronomic biodiversity, arsenic, heavy metals.

Arsenic (As), a widespread trace metalloid, permeates almost all environmental sectors. The inorganic form of As, a known carcinogen, finds its way into the food chain, presenting a risk to human health. It gains entry into plants in multiple forms, namely As(III), As(V), DMA (dimethylarsenic acid), and MMA (monomethylarsinic acid), using various transport pathways. The structural resemblance of As(V) with phosphate and As(III) with silicic acid enables their penetration into root cells. Wheat, serving as a primary food source for 85% of the global population, contributes significantly to dietary energy and protein intake. It is also crucial for livestock feed, seed production, and industrial applications.

Durum wheat presents considerable genetic variations concerning grain As concentration, yet low-As characteristics are seldom prioritized in commercial cultivar selection. This research's principal focus was to analyze the impact of non-toxic As concentrations in hydroponic solutions on biomass output and grain As concentration across ten commercial wheat cultivars. The study aimed to identify genotypes well-adapted for As-laden soil and those with high As contents in their grains.

A comprehensive multivariate analysis was conducted to pinpoint cultivars with similar As concentrations in roots, shoots, and grains, and to calculate the As translocation factor. Additionally, the study assessed As's influence on iron, lead, zinc, and copper. The research concluded that commercial cultivars like Creso, Cappelli, and Russello exhibit lower As translocation levels. Furthermore, the study found that arsenic interferes with the assimilation of phosphorus and zinc.

A.14 Genetic mapping of flavonoids content in durum wheat

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Keywords: durum wheat, anthocyanins, SNPs, QTL mapping.

Cultivated cereal species include genotypes with pigmented grain (red, purple, blue, black), which contain high levels of flavonoid compounds, known for their high antioxidant activity and beneficial effects on human health. So far, improving the content of grain flavonoid pigments represent a major challenge especially in durum wheat, as the genetic control of grain color still needs to be thoroughly elucidated. In this study, we used a RIL population derived from the cross of the Ethiopian PG2 purple durum wheat accession with Grecale, a modern amber Italian durum variety. The RIL population was genotyped with the wheat SNP 25K chip array and phenotyped for total anthocyanin content (TAC), grain color, and the L*, a*, and b* color index of whole meal flour, based on four field trials. We identified two QTL for TAC (*QTAC.mgb-2A* and *QTAC.mgb-7B*) and two QTL for purple grain colour (*QGc.mgb-2A*, *QGc.mgb-7B*), respectively mapping in the same regions of chromosomes 2A and 7B. Furthermore, two QTL for red grain color (*QGc.mgb-3A* and *QGc.mgb-3B*) were detected on chromosome arms 3AL and 3BL. The projection of the four QTL genomic regions on the durum wheat Svevo reference genome disclosed the occurrence of the candidate genes *Pp-A3*, *Pp-B1*, *R-A1* and *R-B1* involved in the flavonoid biosynthetic pathways and encoding the transcription factors bHLH (*Myc-1*) and MYB (*Mpc1*, *Myb10*), previously reported in common wheat. The identified markers linked to TAC and grain color in durum wheat could support marker-assisted selection (MAS) in breeding programs aimed at improving the nutritional and health-promoting quality of raw materials and derived products towards sustainable food and nutritional security.

A.15 Morphological, agronomic and nutritional characterization of nine landraces of Apulian unripe melon (*Cucumis melo* L.)

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Keywords: carosello, barattiere, local variety, biodiversity, valorisation.

Landraces of *Cucumis melo* L. known as 'Carosello leccese Tomentoso', 'Carosello Scopatizzo', 'Carosello di Ginosa Cucumbr', 'Carosello mezzo lungo di Polignano', 'Carosello striato tondo di Massafra', 'Barattiere', 'Spuredda bianca', 'Spuredda nera', and 'Spuredda fasciata' are typical of Puglia region (Southern Italy), where their fruits are traditionally consumed at the erbaceous stage, likewise cucumber. Due to the high intraspecific variability, the variety identities are easily confused and a morphological characterization is missing. Furthermore, these fruits are appreciated for their refreshing and digestible properties, but the nutritional profile is poorly known. To investigate and describe these local varieties, a field experiment was carried out on vertically trained plants, grown with and without pruning, according to the local agronomic management. Plant and fruit morphological and physiological characters were detailed according to national and international melon descriptors. Common productive parameters were found. Conversely, by qualitative and biochemical analyses, the potential nutritional and commercial value of these unripe fruits was confirmed for these landraces, with differences mainly related to fruit appearance, organoleptic perception, and nutritional profile. This comprehensive description will contribute to preserve the abovementioned landraces and to enhance their production and consumption.

A.16 Evaluation of germinative power and volatile compounds in specimens of *Crithmum maritimum* L. taken from different sites in Salento

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Keywords: *Crithmum maritimum* L., domestication, Salento (Apulia Region), volatile organic compounds

In the framework of the project 'Biodiversity of Apulian Non-Fruiting Horticultural Species - BiodiverSO Veg' (CUP: B97H22003760009), characterisation actions and cultivation protocols were started for some of the edible species considered interesting both from a gastronomic and nutraceutical point of view. This is the case of Sea Fennel (*Crithmum maritimum* L.), a plant adapted to thermal, water and salt stresses that follow one another even in short intervals of time, and therefore suitable for the restoration of marginal soils or those no longer suitable for conventional agronomic cultivation. In order to identify the most suitable ecotypes for cultivation, germplasm (seed) collection campaigns were carried out in various Salento locations: San Cataldo, Otranto, Tricase, Santa Maria di Leuca, Gallipoli and Torre Lapillo. For each sample, the morphological characterisation of the seeds (colour, size and weight) and the evaluation of their germinative power were carried out. In addition, to better characterise the intraspecific diversity of *C. maritimum* salentino, the volatile compounds (VOC) of the various accessions were also analysed. The data collected indicate that the species has excellent germinability and that VOCs characterise the product in both nutraceutical and gastronomic terms.

A.17 Six *Chlorella* sp. microalgal strains applications for wastewater treatment from soilless crops at laboratory and pilot scale in greenhouse

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Keywords: phytoremediation, *Chlorella* sp., exhausted hydroponic effluents, wastewater, runoff.

To guarantee year-round horticultural production, more developed countries including Italy rely on greenhouses to mitigate environmental conditions. Despite substantial progress in greenhouse operation, greenhouse effluents are still overloaded with nutrients and are known to be a source of eutrophication that decreases the quality of natural waters worldwide. At DiSAAA of Uni-PI the possibility of recirculating exhausted hydroponic effluents (HE) of tomato soilless crops to cultivate microalgal biomass was treated. Microalgae were investigated as both candidate organisms to the treatment of HE and feeding source for detritivore filters-feeder organisms. A stepwise methodology was applied to scale-up procedures from laboratory to a pilot scale photobioreactor (PBR) which were operated inside a greenhouse. The screening results identified that 5 (of 6) strains used were capable of proliferating in the genuine HE without any adjustment or dilution. A native microalga belonging to the *Chlorella* genus, named SEC_LI_Chl1 was selected for a greenhouse experimentation. A batch cultivation was undertaken under four different test conditions: by 2 L bottles in spring and by 100 L bags PBR in autumn, winter, and summer. The dry biomass obtained using HE ranged from about 300 to 900 $mg \cdot L^{-1}$ in 2-7 weeks for bags PBR and 2500 $mg \cdot L^{-1}$ in 4 weeks for bottles, respectively. The removal efficiencies between 33 and 99% for $N\text{-}NO_3$ and 37–96% for $P\text{-}PO_4$ were achieved. This work indicates the feasibility of microalgal phytoremediation of greenhouse effluents in Mediterranean countries.

A.18 Characterization of the ancient Calabrian olive variety Fidusa

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Keywords: olive biodiversity, olive germplasm, olive genetic resources, ancient olives, genotyping.

Currently, there are more than 1,200 worldwide olive varieties (*Olea europaea* L.), but just 5% of them represent almost all the olive harvested area, increasing the risk of genetic erosion. Nowadays, the olive sector faces challenging risks, such as dangerous diseases (e.g. *Xylella fastidiosa*) and climate change effects affecting olive and olive oil production. Then, it is very important to select and characterize tolerant and/or resistant genotypes to pests as well as resilient genotypes to climate change effects, such as chilling requirements, drought, frost and high temperature tolerance. In this work we will report on the exploration of ancient genetic resources present in the province of Crotone. The morpho-bio-agronomic and molecular characterization of the Fidusa variety, present in the Roberto Ceraudo farm in Strongoli Marina (KR), initiated by the CREA Research Center for olive, fruit and citrus crops, Rende section, is part of the research on the ancient olive germplasm of the GEN4OLIVE EU project. The Fidusa variety is an ancient minor autochthonous Calabrian cultivar, present only in the province of Crotone through a few hundred individuals, all centuries-old. The Fidusa variety stands out for its resistance to drought and is still cultivated and appreciated today for the very interesting sensory profile of its single cultivar olive oil, characterized by an intense green olive fruitiness with a predominant sensation of oregano which is also evident in the taste, and is accompanied by other sensations of aromatic herbs. Finally, DNA analysis performed with 12 SSR shows that the Fidusa variety is a unique genotype.

B.1 Study of the fungal microorganisms of *Abies nebrodensis* twigs and needles in its natural habitat

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Keywords: mycobiome, plant pathology, fungal ecology, Sicilian Fir, endangered species.

Fungi play a crucial role in terrestrial ecosystems as symbionts, commensal colonizers, saprobes or acting as plant pathogens with many species persistently or temporarily inhabiting the phyllosphere of the vegetation. In this study we investigated the mycobiome of the twigs and leaves of *Abies nebrodensis*, an endemic species located in the northern part of Sicily (Italy) in the Madonie Natural Park, represented only by 30 adult trees and reported as critically endangered by IUCN. In a first survey, the endophytic fungi present on blighted needles of the adult trees were molecularly identified through DNA barcoding; results indicated that most of the fungal microorganisms associated with the symptoms of needle desiccation and reddening are secondary pathogens or saprophytes, with a large prevalence of the genera *Cytospora* and *Rhizosphaera*. To deeper investigate the role of the entire fungal community, forty samples from 10 selected trees were analyzed by high throughput sequencing (HTS): the Illumina-generated ITS2 sequences identified a total of 568 genera and 793 species. A more in-depth ecological analysis has been performed, exploring the entire fungal community related to the organ examined (twigs or needles), the micro-habitat of trees (rocky soil or beech forest), and the health state the twigs (symptomatic vs asymptomatic).

B.2 Novel bacteria as a threat to Salento's holm oaks

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Keywords: Holm oaks, pathogens, ecosystems, Acute Oak Decline, conservation.

In recent years, desiccations in holm oak (*Quercus ilex* L.) woodlands in Salento were frequently observed in rural areas. This phenomenon is characterized by peculiar symptoms of crown as thinning of the canopy, epicormic shoot on branches, while trunks showed insect exit holes and, under the bark, larva galleries exclusively associated with the presence, at the level of the outer bark, of longitudinal cracks from which an amber-coloured liquid leaks. Three bacteria were found in the exudates, namely *Brenneria goodwinii*, *Gibbsiella quercinecans*, and *Rahnella victoriana*, which are known pathogens of oak trees but yet undetermined to the authors' knowledge in the Mediterranean area. The symptomatic description and the bacteria found correspond to the phenomenon first described in the UK known as 'Acute Oak Decline' and leads to the death of the affected oaks within a few years. Deepening our knowledge of this phenomenon and investigating the geographical distribution of these pathogens is essential in order to protect the Salento forests and develop management strategies.

B.3 Microbial resources, innovation and fermented foods: echoes from PIMENTO COST Action and different Italian NRRP project activities

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Keywords: fermentation; foods; beverages; innovation; tradition.

Fermented foods and beverages represent an important part of the gastronomic heritage, about one-third of human diet, but also a dynamic and constantly evolving sector, offering solutions to improve the well-being and nutrition of different population targets. Fermentation also makes it possible by promoting sustainable innovation and enhancing the quality of food and beverages. This family of microbial-based bioprocesses combine traditional knowledge, food microbiology and food sciences, also concretising interesting models of study for ecology, biodiversity and biological sciences. PIMENTO COST Action CA20128 is a pan-European transdisciplinary community that works to *i)* study the diversity of European fermented products, *ii)* create an original synthesis in the definition of the benefits and risks associated with these product categories, and *iii)* analyse the dynamics of innovation in the field. Here, we report the recent advances of the PIMENTO project, underlying how the selected activities from a constellation of Italian National Recovery and Resilience Plan (NRRP) projects financed by the European Commission's Next Generation EU programme contribute to shape new trajectories in research activities in the field, particularly about: a) food microbiomes preservation (SUS-MIRRI.IT); b) fermented products in marginal areas (AGRITECH); c) fermentation for sustainable food systems (ONFOODS); d) sensors to promote and speed up innovation in the sector (iNEST).

B.4 Untangling plant associated microbiomes in *Vaccinium* ssp.

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Keywords: agriculture, biodiversity, sustainable crop production, holobiont, metagenomic.

Specific microbial communities are associated to host plants. Microorganisms colonize every part of the plant, from roots (rhizosphere) to leaf surfaces (phyllosphere). They play a crucial role in providing plants with nutrition, promoting stress tolerance/resistance, and modulating defense responses against pathogens. However, conventional agricultural practices may impact these associations due to the use of chemicals, which may alter the plant's microbiome and result in a loss of biodiversity. Despite the rising interest in plant microbiome, the role of microbial communities associated with perennial fruit plants remains overlooked. In this study the taxonomic composition of the microbial communities that colonize different plant compartments (leaves, fruit and fruits endophytes microorganism) was assessed on 10 blueberry (*Vaccinium* spp.) cultivars. Our analysis aims to understand how the composition of microorganisms varies in terms of both the specific plant compartments they are associated with and their quantity. Results indicate that plant organ and genotype had a significant role in determining the taxonomical and functional composition of microbial. However, a significant portion of these communities remains unknown, underscoring the need for further studies to fill this knowledge gap. Furthermore, we are interested in evaluating how host genetics can reshape these microbial communities. These preliminary results shed light on the interaction of cultivated blueberry genotypes with a variety of microbes and highlight their importance to increase the sustainability of fruit crop production.

B.5 Plant species for the crop renewal of Salento affected by *Xylella fastidiosa*

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Keywords: *Xylella*, pistachio, almond, leaf scorch.

Xylella fastidiosa is a quarantine pathogenic bacterium detected for the first time in Europe in 2013 in Apulia (Italy). This bacterium causes numerous diseases, and one of the most threatened plants is the olive tree as demonstrated by the mass death of plants in thousands of hectares caused by the strain "De Donno". To restore part of the agricultural sector affected by the epidemic, besides varietal renewal of the olive tree using resistant cultivars, the crop renewal represents a key strategy for the restoration of the agroecosystem and enrichment of biodiversity. Pistachio and Almond might be a good choice since these two species adapt very well to the soil and climatic conditions of Salento and there is increasing interest from growers.

For this purpose, several naturally infected almond and pistachio cultivars hosted in different orchards located in the area of Puglia where the bacterium is considered endemic (i.e. no longer eradicable and widely spread) were evaluated for symptoms, infection incidence and bacterial concentration. Several groups of chestnut trees were also monitored.

The results obtained showed that the almond tree rarely develops symptoms of leaf scorch and maintains a low bacterial concentration. For pistachio it was observed that the incidence of infection is very different between the cultivars analyzed but plants are asymptomatic. When infected, the chestnut maintains a low bacterial concentration and never shows symptoms attributable to *X. fastidiosa*. Long-term observations are requested to confirm the good aptitude of these species.

B.6 Biological soil crusts succession and dynamic: the potential interactions between bacterial, fungal and metazoan communities in Arctic Svalbard

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Keywords: biological soil crusts; inter and intra-kingdoms interactions; High Arctic.

Biological soil crusts (biocrusts) are privileged ecosystems particularly impacted by ongoing climate change. They are widespread soil communities found in arid and semiarid ecosystems worldwide, including polar regions. In Arctic Svalbard, a succession of different crust types was identified: physical, cyanobacteria-dominated, cyanobacteria/moss-dominated, moss-dominated, and bryophyte carpet. The study of biological community dynamics along crust successions may allow the identification of their dominant taxa. An integrated morphological, chemical, and molecular study using three gene targets (16S rRNA, ITS region, and *COX1* gene) was applied to evaluate inter-kingdom interactions at different stages of succession. Overall, the co-occurrence analysis showed that Gemmatimonadota, Cyanobacteria/Nematoda and Tardigrada are the keystone groups in physical, cyanobacterial, and moss-dominated biocrust, respectively, explaining different stages of colonization and measuring the trajectories of functional diversity and ecosystem functioning. In addition, nitrogen and phosphorus were suggested as limiting factors driving the ecological succession.

B.7 Managing biodiversity loss and restoring cultural ecosystem services: a choice experiment in the Salento area

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Keywords: *Xylella fastidiosa*; cultural ecosystem services; landscape restoration; choice experiment.
In the Salento area located in the South of the Apulia Region, the *Xylella Fastidiosa* outbreak spread has reduced the delivery of ecosystem services by 30%, with an expected reduction of 28% in biodiversity components. In fact, the invasion of the bacterium reduced native species diversity, mainly Mediterranean species, including oleander, rosemary, broom, curry plant, and the olive groves. A choice experiment (CE) was conducted in order to estimate the existence value of the biodiversity components through the annual willingness to pay (WTP) expressed by a representative sample of residents of the provinces of Taranto, Brindisi, and Lecce. During the CE the participants were presented with different landscape restoration scenarios which varied based on different Mediterranean crop species, as well as their related cultural ecosystem services (e.g., cultural heritage, recreation and ecotourism, aesthetic values, education and inspiration, sense of place). The results show that participants coming from the areas most affected by the spread of the bacterium (i.e., the Province of Lecce) expressed a higher average WTP than the others in each scenario. Moreover, residents aged between 36-50 exhibited a greater WTP for restoring landscape through the planting of olive groves, while residents aged 18-35 showed a propensity towards seeking tree crop alternatives. These findings could support decision-making in the management of biodiversity loss across the Salento area, but also suggest strategic recommendations to restore cultural ecosystem services, enhancing new opportunities of value creation.

B.8 Fungal biodiversity in the Mediterranean Sea, state of the art and future perspectives

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Keywords: Mediterranean Sea, marine fungi, novel taxa, ecological role.
The Mediterranean Sea is a well-recognised hotspot of biodiversity: not only it is home to flora and fauna, but it is also a treasure trove of precious microorganisms. As in any other environment, biotic and abiotic substrates can be colonised by pathogenic, symbiotic or saprotrophic fungi that constitute a huge part of microbial biodiversity representing a major component in aquatic food webs and supporting many ecosystem services. In recent years, the Mycotheca Universitatis Taurinensis (MUT) developed and realized several research projects with the aim of uncovering the marine fungal biodiversity, investigating the ecological role of marine fungi, discovering and preserving novel taxa suitable for biotechnological exploitation. Within these studies, a high number of fungal strains from different marine substrates were isolated, identified and preserved. Some of these fungi are representative of taxa that had never been described before, while many others have been detected in the Mediterranean Sea for the first time. In the future, it is desirable to adopt more intense, regular and accurate sampling campaigns, based on more efficient culturomic and metagenomic techniques. Indeed, due to intense human activity, uncontrolled urbanization, pollution and climate change, the Mediterranean Sea is facing a deterioration of habitats with a consequent decrease in the number of species. Hence the importance of studying these microorganisms that can contribute to the conservation of the entire ecosystem.

C.1 Chemical element distribution analysis in a wild population of *Dittrichia viscosa* L. in the area of Taranto (Italy)

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Keywords: *Dittrichia viscosa*. element analysis, phytoremediation, soil pollution, homeostasis.

Intensive anthropic activity, like mining and heavy industry, influence the air and soil quality. The ecosystem around is able to react but in some cases water and soil become very polluted, harmful for human health and not suitable for agriculture. The phytoremediation technique is very helpful to rescue contaminated land. A lot of plants are known to be able to uptake and translocate contaminants present in the soil. Some of these plants, the hyperaccumulators, are able to accumulate high amount of contaminants but not all produce high amount of biomass, which is an important parameter for phytoremediation application. *Dittrichia viscosa* (L) *Greuter* is a widespread plant in the Mediterranean area and grow on diverse environments, including marginal and contaminated soil. It isn't a hyperaccumulator plant but it produces high quantity of biomass. We have sampled *D. viscosa* plants in different area in the Taranto province near and far from the ex-ILVA/Acciaierie di Italia and we analyzed the elemental content in the shoot dividing it in apical, sub-apical and terminal parts. The elements analyzed are differentially accumulated in the three shoot parts. This study can give us information to correlate the stage in which it is better to harvest the plant when used in phytoremediation; for example, for a contaminant accumulated more in the apex could be preferable harvesting the juvenile parts of the plants several time per year. Because the apical part is predominant in the shoot composition. It is also important to notice that the natural biodiversity in the populations of *D. viscosa*, allow to select plants with different performances on different pollutants uptake supporting further improvements of phytoremediation approaches.

C.2 Biobanking for genetic resources conservation: *Abies nebrodensis* a case of study

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Keywords: cryo-bank, seed-bank, endangered conifers, Madonie fir.

The Madonie Fir (*Abies nebrodensis*) is an endemic conifer of Sicily, Italy. The relic population consists of only 30 adult trees, located in the "Parco delle Madonie" (Sicily), spread in an area between 1400 and 1650 meters a.s.l. It is considered as Critically Endangered by the International Union for Conservation of Nature (IUCN), due to the dramatic genetic erosion and the poor natural regeneration. In order to develop concrete actions to preserve the Madonie Fir from extinction, an EU LIFE project was initiated (LIFE4FIR, Life18 Nat/It/000164 - 2019) with several partners (CNR - IPSP and IBE Institutes; Universities of Palermo and Seville; Ente Parco delle Madonie and Sicily Region). Among the different actions of LIFE4FIR project, the action C5 involves the constitution of a seed-bank and a cryo-bank for long-term conservation of *A. nebrodensis* germplasm. Seed-bank is the classic approach for maintaining the germplasm of species characterized by gamic propagation. In *A. nebrodensis*, as many conifers, the large presence of empty seeds, together with normal seeds, is a major problem. Hence, an X-ray investigation protocol was developed to separate the full seeds from the empty seeds; this will allow implementing the seed-bank with only full and germinable seeds. Cryopreservation refers to the preservation of plant organs and tissues at the ultra-low temperature of liquid nitrogen (-196°C). Effective protocols for the cryopreservation of pollen, excised embryos and embryogenic callus lines of *A. nebrodensis* have been already developed for the establishment of cryo-bank. The LIFE4FIR project (2019-2023), funded by the EU in the 'Nature and Biodiversity'.

C.3 Building thermal performance enhancement using nature-based solutions: green façade behavior in summer and winter

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Keywords: sustainability, green infrastructure, urban heat island, heat transfer, energy saving.

Rising environmental concerns, the lack of available space for green areas in cities and the ever-increasing pressure to minimize energy consumption have emphasized the relevance of incorporating nature-based solutions into the design of new buildings and retrofits. Vertical green systems, such as living walls and green façades, which are an interesting way to integrate vegetation into the building envelope, use unexploited vertical surfaces. The implementation of green façades can be a sustainable approach to improve the urban environment quality and microclimate, reduce energy consumption, and increase biodiversity especially in urban areas where natural green spaces are limited. An experimental test was conducted under Mediterranean climatic conditions to investigate the summer and winter energy performance of an evergreen double-skin green façade compared to a bare wall. The improvement in the building's thermal performance obtained thanks to the green façade was found. The major energy-saving benefit was gained in summer by the cooling of the wall surface and the surrounding air and a considerable energy input reduction because of plant evapotranspiration and solar shading. A slight winter benefit was also obtained, with the warming of the wall surface and close air and a reduced air velocity in the wall close proximity. These results contribute to increasing knowledge about the energy performance of green façades and may encourage their further deployment.

C.4 Validating Temperature Data from Copernicus Marine Service using Satellite-Telemetered Mediterranean Sea Turtles

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Keywords: *Caretta caretta*, ocean modeling, satellite tracking, remote sensing.

The marine environment is warming rapidly as a result of the climate change and it is expected to have profound consequences on biodiversity and functioning of ecosystems. The temperature increase might lead to loss of coastal and marine habitats, stressed ecosystems and decreased their productivity, with an impact on people who rely on these ecosystems for food security. Thus, it is crucial to improve technologies, introducing new approach which can combines different tools to better understand the ocean temperature dynamics. This study presents a validation analysis for the temperature data obtained from the oceanographic model of Copernicus Marine Service for the Mediterranean Sea. A validation analysis can add more data and information to the computing of environmental variables and can drastically increase the spatial and physical accuracy of the models. Therefore, accurate modeling and prediction of temperature are crucial to forecast the impacts of climate change on marine biodiversity. For this scope, data collected from seven loggerhead sea turtle rescued from accidental catches along the coastal areas of the Puglia region (Italy) and recovered by the Management Consortium of Torre Guaceto (Carovigno, BR, Italy). These specimens have been equipped with Argos satellite tags KiwiSat KS202, which are capable of recording temperature, depth, date, Coordinated Universal Time (UTC), latitude and longitude. The temperature data collected are used to build an innovative validation model approach. Thus, real-time temperature data were recorded from July 2021 and February 2022, in various locations across the Adriatic and Ionian Seas and then compared with ocean modeling temperature measurements. The advanced statistical analysis has highlighted the strong correlation and low error between model and tag sensors temperature data. Moreover, the results reveal that the satellite-telemetered sea turtles can fill gaps in ocean observing systems, improving the spatial coverage and resolution of observations and support environmental data model validation. Finally, the present work also demonstrates the potential of using animal-borne sensors as a novel and cost-effective tool for oceanographic research and marine conservation.

C.5 Biodiversity Friend® certification standards for biodiversity and landscape conservation

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Keywords: biodiversity, certification, bioindicators, agrosystem, sustainability.

Biodiversity Friend® (BF) is a voluntary certification developed in 2010 by World Biodiversity Association (WBA), with the aim of assessing biodiversity and landscape conservation in agrosystems. The impacts of agricultural practices on biodiversity are evaluated through 10 actions, representing the "Decalogue of Sustainability in Agriculture": 1) sustainable agricultural model, 2) conservation of soil fertility, 3) rational water management, 4) conservation of hedges, woods, meadows and pollinators, 5) conservation of agrobiodiversity, 6) energy savings and renewable sources, 7) landscape conservation, 8) social sustainability, 9) economic sustainability, 10) soil, water and air quality, evaluated using soil, water and air Biodiversity Indices (SBI-bf, FBI-bf e LBI-bf). In 2020 WBA developed a new standard within BF, named Biodiversity Friend® Beekeeping. This certification is a voluntary scheme dedicated to European and Mediterranean beekeeping, with the aim of sustaining the beekeeper's commitment in *Apis mellifera* conservation and sustainable apiculture. A certification module of the BF standard, called "Meadows-Pastures", was presented by WBA in 2021. The new module is intended to enhance the products derived from pasture areas, in particular dairy products. Finally, in 2023 WBA created three other environmental sustainability standards: Biodiversity Friend® Forest, Biodiversity Friend® Green and Biodiversity Friend® Territory. The first is dedicated to the certification of forests and coppices, and the second is dedicated to parks and green areas; both certifications assess the conservation of biodiversity and ecosystem services. The third standard is aimed at supporting public administrations in increasing the environmental performance and guaranteeing citizens biodiversity and landscape conservation.

C.6 Exploiting wild relatives of *Solanum lycopersicum* for salt tolerance traits as a tool to enhance agrobiodiversity

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Keywords: *S. lycopersicum*, *S. pimpinellifolium*, salinity, tolerance, agrobiodiversity.

Abiotic stresses are considered the first cause of crop loss worldwide, foremost of which is salt stress. In response to these problems, genetic improvement has selected a small number of tomato cultivars, greatly reducing their biodiversity. Tomatoes are considered to be moderately sensitive to salt stress, but excessive salt accumulation causes reduced yield and product quality.

This study was undertaken to explore the existing genetic variability in wild tomato varieties (*Solanum pimpinellifolium*) and identify genetic resources that can adequately respond to climate change in the Mediterranean area by enriching the gene pool of modern cultivars. An *in vitro* screening method was developed using wild tomato seedling accessions growth on plates with sucrose-free agarized medium containing increasing concentrations of salt, taking marine salinity as a reference.

This pipeline leads to (i) evaluate biometric and biochemical parameters and (ii) expand knowledge on biometric traits relevant to adaptation to adverse environmental condition (salinity); (iii) define innovative phenotyping methodologies to select wild genotypes; (iiii) analyze simultaneously numerous accessions in the confined growth chamber space. The results have shown that the *S. pimpinellifolium* accessions investigated till now are indeed more resistant to salinity than traditional cultivars, with up to 60 percent seawater tolerance.

C.7 Modeling the oil spill pollution as an ecotoxicological stressor in the Mediterranean

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Keywords: Coastal and marine systems, anthropogenic pressure, oil pollution, ecosystem response, MEDSLIK-II oil spill model.

Under the NECCTON Project, new operational tools and products are implementing to strengthen the Copernicus Marine Service capability of modeling marine pollution and assessment of integrated pressures. Despite the long-term decline in the total number of oil spills, they are still damaging aquatic life, coastal infrastructures, and the local economy. Therefore, oil pollution entering the marine environment has been an issue of concern for many decades. A Lagrangian oil spill model MEDSLIK-II is used as a powerful and robust tool that predicts oil spill transport and transformation at sea. In deterministic mode, the model was successfully validated on several real cases (e.g., the Agia Zoni-II oil spill, 2017, the Ulysse-Virginia oil spill 2018, the Baniyas oil spill 2021). Stochastic oil spill simulations provide the delivery of multi-year hazard maps that can be used in the long term for marine biodiversity conservation and food resources management. Identification of the hot spots in the Mediterranean allows guiding remote environmental monitoring and ecotoxicological sampling. Being integrated with the model-based distributions of the biogeochemical state variables computed in the Project, the hazard maps help to foresee the risks of imbalance and loss of the ecosystem's resilience caused by oil spills.

C.8 Assessing Risks to Water Resources in the Salento Peninsula

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Keywords: coastal aquifer, groundwater, saltwater intrusion, pollution, Salento

The Salento aquifer is a coastal underground water reservoir located in the Salento peninsula. Anthropogenic activities and climate change cause saltwater intrusions and the karstic nature of coastal aquifer in Salento region allows for rapid and deep saline intrusion, making the region highly vulnerable. Numerous studies have confirmed that overexploitation of groundwater resources in the region has led to a gradual reduction in available groundwater volume, causing saltwater intrusion, as evidenced by various scientific literature and planning tools. For example, Margiotta and Negri (2005) characterized the aquifer through monitoring various parameters such as piezometric level, salinity, pH, dissolved oxygen, and the volume of freshwater. Surveys conducted in Salento, Italy, between 1987 and 2003 revealed a decline of 0.50 m (maximum 1.50 m) in the piezometric level, indicating a decrease in deep groundwater, with most wells showing a deeper piezometric level compared to 1987, ranging from 0.3 to 1.45 meters lower. In several wells the Total Dissolved Solids (TDS) were 0.2-0.5 g/l higher compared to 1987. Various approaches, including geochemical methods, remote sensing, and numerical models, are being used to understand and manage coastal aquifers. The last numerical models of Salento aquifer were made over a decade ago by Giudici et al, 2012 and De Filippis et al, 2013. Considering that aquifer behavior changes over time, it is crucial to develop a new model for the Salento aquifer by integrating new monitoring data. We are currently in the process of simulating a new numerical model using the updated data.

C.9 The PRIMA LEGU-MED project: "Legumes in biodiversity-based farming systems in Mediterranean basin"

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Keywords: agroecosystem's services, biodiversity-based agriculture, chickpea, climate change, lentils,

Legumes are the backbone of the Mediterranean agro-ecosystems from ancient times. However, their unique and wide biodiversity has not been sufficiently valorized by Mediterranean countries. Legumes are ideal crops for sustainable land use as stated by the Common Agricultural Policy (CAP) of the European Union (EU). They are essential crops in Mediterranean agro-ecosystems because they provide important benefits such as: 1) maintaining of soil water availability, 2) reduction of the use of anthropogenic inputs through enhancing soil fertility, 3) improvement of ecological connectivity with flora and fauna, 4) protection of close-by wildland ecosystems, 5) providing important agro-ecosystem services, 6) supply of a a good source of vegetal proteins for human and animal consumption. The main objective of this project is to put forward an international and well-integrated plan to valorise the legume agrobiodiversity of Mediterranean in biodiversity-based farming systems and consequently enhance agro-ecosystem functions and services in the Mediterranean basin. The proposal is using lentils and chickpeas as models for all grain legumes. LEGU-MED aims at valorizing, restoring and managing Mediterranean legume biodiversity focusing on under-investigated and neglected genotypes. We are an international consortium composed by 5 universities, 5 research institutes and 1 private company from 8 countries: Italy, Germany, Spain, Algeria, Tunisia, Turkey, Lebanon and Croatia. The project is structured in four work packages (WPs) and 2-3 activities within each WP, aiming at obtaining the following three major objectives (Obj): 1) Deeply characterize biodiversity of key legume species in Mediterranean basin; 2) Enhance use and management of agro-biodiversity to improve the provision of legume-based ecosystem services and farming system sustainability in the Mediterranean basin; 3) Evaluate trade-offs of proposed measures, with cost/benefit analysis performed by stakeholders. In this oral communication the ongoing results of the third and last year of the project will be shown for each of the 10 activities. Results will dealt with: 1) the agronomic and phenotypic screening of selected chickpea and lentil germplasm in drought conditions; 2) in field agronomic evaluation of agricultural systems based on the use of chickpea and lentil in rotation with other crops; 3) the functional genomic analysis of drought tolerance mechanisms and stress memory in chickpea; 4) isolation of efficient nitrogen-fixing rhizobia for chickpea and lentil; 5) the development of new models based on biodiversity for future legumes-based farming systems in the Mediterranean basin.

C.10 Assessment of biodiversity indicators in beech forests with diverse management systems in the Italian Apennines

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Keywords: forest heterogeneity, saproxylic beetles, birds, deadwood, tree-related microhabitats.

In this study we evaluated the effects that currently in-use sylvicultural practices have on the tree features affecting biodiversity indicators in high beech forests in the Tuscan Apennines. The field work was carried out in five study areas: three areas with different age managed with the uniform shelterwood system, one area managed with the single tree selection system, and one unmanaged area. In each area, we selected a plot of 2500 m^2 where data was gathered about forest characteristics and biodiversity indicators. Specifically, for each area we analyzed the stand structural attributes, and microhabitats occurrence, distribution and diversification of saproxylic and non- saproxylic beetles and birds. Our results show that sylvicultural practices have led to a simplification of the forest complexity in managed sites compared to the old-growth site. The amount of deadwood and the diversity of microhabitats were substantially lower in the managed sites than in the old-growth forest. However, the beetles´ species richness and diversity in the managed sites was comparable with that in the old-growth forest. Our findings provide evidence of the importance of both managed and unmanaged forests for the conservation of biodiversity, supporting the necessity to develop management practices able to combine forest production and biodiversity conservation in montane beech forests. The study was carried out within the LIFE SySTEMiC project (LIFE18ENV/IT/000124).

C.11 An integrated approach for coastal habitat mapping based on autonomous survey and remote operated technologies

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Keywords: New autonomous technologies, USV, ROV, habitat mapping.

Climate change and human activities threaten the health of the world's oceans. These issues led to increased global attention to the conservation and restoration of marine ecosystems in recent decades (Ridge and Johnston, 2020) since they can cause loss of biodiversity, alteration of communities' structure, and loss of their functionality. Among marine ecosystems around the world, those on the coasts of the Mediterranean Sea, which are historically important sites for the development of multiple human activities, are particularly threatened. Seagrasses are important and productive coastal systems that provide nursery areas, carbon sequestration, protection from erosion, bioremediation, and oxygen production. Accurate information about the spatial distribution of coastal habitats such as seagrass meadows is essential towards effectively managing anthropogenic pressures and ensuring the conservation of environmental resources. In this perspective, the use of innovative methodologies and technologies able to facilitate the monitoring activities of the coastal marine environment is particularly helpful. New cost-effective devices and autonomous survey technologies contribute to the optimization of the cost-benefit ratio of field surveys, to the limitation of the impacts of the survey activities themselves on the habitats, and to favour the acquisition of more real-time data. Here we report the results of the seafloor and habitats mapping along the coast of Civitavecchia (Northern Latium, Italy) using an integrated approach which involves the use of Unmanned Surface Vehicle (USV) and Remote Operated Vehicle (ROV) technologies, supported by in situ diving surveys, GIS elaborations, and existing information, aiming to demonstrate its effectiveness for local scale investigations and to reach a greater information detail useful for ecosystem management and conservation actions. The habitat knowledge at small-scale in the selected area is particularly important due to the presence of industrial activities such as the Port of Civitavecchia, a tourist and commercial hub which is subject to structural expansion works, potentially impacting coastal ecosystems. This work was performed as part of the RENOVATE project, financed by the Port System Authority of the Northern-Central Tyrrhenian Sea.

C.12 *Camelina sativa*: an ancient crop worthy of re-evaluation

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Keywords: fatty acid profile, defatted meal composition, antinutritionals, genotype diversity.

Camelina sativa (L.) Crantz is an annual plant belonging to the *Brassicaceae* family. It is native to Europe and central Asia and archaeological remains dated back the beginning of cultivation to 4000 B.C. The interest in this species is related to good agronomic performances in marginal areas and low fertilization and irrigation requirements. The seeds are a valuable source of oil (35-40%), characterized by a high percentage of both polyunsaturated fatty acids (PUFA > 50 %), and proteins (24-30%). The analysis of seed composition of 17 varieties, with different geographic origin, grown in northern Italy allowed to obtain information about the variation existing within this subset of material. The main biochemical seed traits (oil, proteins and some secondary compounds) were quantified. The Principal Component Analysis (PCA) of collected data allowed to arrange the 17 varieties in three subgroups corresponding to different potentialities toward oil production, animal feed or other utilizations. The addition of defatted meal in livestock rations was evaluated by studying the relationships among protein content and two antinutritional compounds (trypsin inhibitors and condensate tannins) able to affect the protein digestibility. The defatted meal of 4 varieties grown for four consecutive years (2016 – 2019) were analysed. Overall, the nutritional quality of camelina meal appeared mainly influenced by the genotype. A weak relationship ($p < 0.06$) between *in vitro* digestibility and trypsin inhibitors was recorded. All these results confirm that camelina is a promising alternative crop with great potential applications in several fields.

C.13 The positive impacts of sustainable and diversified agricultural systems: a case study in the Salento area (Apulia, Italy)

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Keywords: Carbon-neutral rural district, Sustainable land management, land-based mitigation options, crop/forest suitability, biodiversity.

After the spread of *Xylella fastidiosa* in 2013 the rural landscape of Salento, characterized by an extensive monoculture of olive groves, radically changed: today most of this land hosts dead trees exposed to the risk of fire. This loss of ancient trees had an impact also on the carbon balance reducing the carbon fixation of the entire territory. In this work we evaluated the potential of the rural areas of Salento to be restored, aiming at increasing their biodiversity and variety in crops while becoming also the first carbon neutral rural district in Europe. To this aim firstly, we determined, at a large-scale rural landscape, the GHG emissions of the agricultural sector through a Life Cycle Assessment. The second step consisted in selecting and testing a set of sustainable land-based mitigation options aimed at reducing and offsetting the agricultural GHG emissions while improving the crop and forest biodiversity. The third step consisted in analysing the main bio-climatic variables to determine the land suitability of about 110 different Mediterranean crop and forest species. All these components are being integrated in a Decision Support web-Tool designed for farmers and policymakers. Results showed the potential of the rural district to differentiate its landscape while reaching carbon neutrality and even generating negative emissions.

C.14 Transforming Taxonomy in the field to tackle biodiversity loss: the TETTRIs initiative

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Keywords: Taxonomy, Biodiversity loss, Biodiversity Hotspot, Cascade funding.

The Horizon Europe Project Transforming European Taxonomy through Training, Research and Innovation (TETTRIs) is a joint effort of 17 partners, co-led by CETAF as technical coordinator, and RBINS for finances and administration, tackling the shortage of taxonomic experts and resources through the transfer of knowledge to increase taxonomic capacity and an innovative instrument to tackle specific validation in the field by professionals and amateurs. This new instrument consists on a call for Third Party Projects (3PP) to fund research and innovation projects particularly in European biodiversity hotspots and protected areas, with a total budget of nearly 1.8 million euros. The call invites proposals that contribute to validating the nine TETTRIs outcomes and expanding mechanisms for engaging in taxonomy-related participation in specific areas of high diversity and subject to special protection across 7 specific topics: (1) Species-level indexing of pollinator collections; (2) Improving access to local taxa lists and taxon-related scientific data through pragmatic name- mapping workflows; (3) The co-development of Artificial Intelligence (AI)-based image recognition for European terrestrial molluscs; (4) The co-development of AI-based sound recognition of European grasshoppers; (5) Innovative molecular techniques for taxonomy: integrating genomic tools for the development of cost-efficient genetic markers for species identification and delimitation; (6) The development of training programs for taxonomic research; and (7) Innovative cross-disciplinary projects focused on involvement of citizen scientists in monitoring biodiversity hotspots.

C.15 In Apulia (Italy) a regional conservation center as tool for territorial development, preservation of local germplasm, development of new food product and varietal innovation of the Mediterranean woody crops.

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Keywords: *ex situ* conservation, local germplasm, clonal selection, breeding, tourism.

The Regional Center for the *ex situ* conservation of autochthonous fruits, grapevine, olive and citrus trees, managed by CRSFA Basile Caramia, covers about 20 hectares, making it one of the largest germplasm collections in Italy. It is the result of clonal selection, recovery and characterization of germplasm carried out by various scientific bodies over more than fifty years. The program for the recovery of Apulian germplasm, initiated by the University of Bari in the 1960s with grapevines, was subsequently extended to other woody crops, involving five other Italian regions and some Mediterranean countries. The Center currently preserves about 6,500 genotypes of over 1,800 varieties of grapevine, olive, citrus (10 species) and fruit crops (26 species) and it's managed according to the "Guidelines for the conservation and characterization of plant biodiversity of agricultural interest" of the National Plan on Biodiversity approved with Ministerial Decree 28672 of 12/14/2009. Since 2012, three integrated projects, funded by the Puglia Rural Development Program and dedicated to fruit trees, grapevine and olive, have enabled the Center to acquired new equipment, laboratories and facilities for the characterization, multiplication, conservation of regional germplasm and to recover ancient buildings (lamie, trulli and a snow house) that are well integrated with the collections and have given rise to the "diffused Museum of Biodiversity", within the wonderful frame of Valle d'Itria. It has become a tourist attraction that welcomes visitors and training activities for schools, valorizes and registers ancient varieties, and experiments with new products such as wines from recovered ancient native vines. Beside the activities of official varietal/clonal registration and the new unique food products development, the collection hosted some private and public breeding activities aimed to obtain genotypes for the new priorities of EU green deal and climate change mitigation action.

D.1 Application fields and perspectives of a newly designed Illumina® 61K SNP chip for dromedaries

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Keywords: *Camelus dromedarius*, whole-genome sequences, Single Nucleotide Polymorphisms, SNP chip.
Within the frame of the 11th Illumina® Agricultural Greater Good Initiative, 192 dromedary samples from 19 countries were whole-genome sequenced (30X). In addition, 22 publicly available dromedary whole genomes were included in the dataset. Raw data were analyzed by DRAGEN Germline App using CamDro3 as reference genome. Overall, 179 samples and 641,741 Single Nucleotide Polymorphisms (SNPs) passed the quality control. A list of 61K biallelic loci, fitting in a medium-density array format, was selected, including (i) 59K SNPs on autosomes and (ii) 1230 SNPs on chromosome X, both sets having minor allele frequencies ≥ 0.1; (iii) 77 SNPs on the mitochondrial genome; (iv) 832 SNPs representative of 47 genes with known functional importance. The technical validation of the SNP chip, based on SNP genotyping, is currently ongoing. Once released, the use of this tool will contribute boosting genetic diversity and genome-wide association studies, as well as gene/genome-assisted selective breeding in this species. In parallel, a world-wide dromedary genetic diversity study is ongoing by using the available whole-genome sequencing data. A future collaboration with the ongoing EU-founded CAMEL-SHIELD project partners will allow, for the first time, the adoption of the newly developed SNP genotyping tool over a large number of dromedaries in Algeria, France and Morocco, paving the way for DNA-oriented breeding practices.

D.2 The endangered Austrian Turopolje pigs: genetic relations and inbreeding level compared to Austrian and Balkan pig breeds using genome-wide SNP data

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Keywords: Turopolje pig, diversity, inbreeding, local breeds, population structure.
The Turopolje pig breed is an endangered breed, originating from Croatia, but now also farmed in Austria and Germany. The Austrian Turopolje (AT) pig population originated exclusively from six Croatian individuals (two sows and four boars) imported during the Yugoslav conflict and nowadays is preserved through a conservation project (ÖPUL), overseen by the Austrian National Association for Gene Conservation (ÖNGENE). In this study we analysed a set of 12 herds (AT, 4 Austrian commercial breeds, and 7 Balkan local breeds, including Croatian Turopolje), aiming to identify the genetic relations through the PCA and admixture analysis. The outcomes showed a good differentiation of the AT herd, and the presence of few crossbred individuals within this population. F_{ST} indexes were computed to infer the genetic distances, and a network analysis was performed, highlighting that the AT pig population is genetically unique, being closer to the Banija Spotted breed of Croatia, than to the Croatian Turopolje breed. Moreover, we investigated the inbreeding level of each breed, proving that the AT herd is unexpectedly less inbred (F_{ROHav} = 0.17±0.05), than other breeds such as Croatian Turopolje (F_{ROHav} = 0.35±0.08) or Hungarian Mangalitsa (F_{ROHav} = 0.41±0.14). The results of this study could help to obtain an Austrian pure-bred population, through the avoidance of the selection of admixed individuals during the mating process, and raise awareness about the inbreeding levels of these local breeds, driving the breeding management towards proper strategies.

D.3 Molecular characterization of the white-clawed crayfish *Austropotamobius pallipes* in Northern and Central Italy to assess biodiversity and aid conservation plans

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Keywords: White-clawed crayfish, molecular characterization, conservation genetics.

Austropotamobius pallipes species complex includes *Austropotamobius italicus/fulcisianus*, an autochthonous species inhabiting the Italian peninsula. During the last century Italian *Austropotamobius* populations have undergone a severe reduction of the global population size caused by habitat loss and outbreaks of diseases introduced by allochthonous crayfish. To improve the taxon's conservation status in the Italian north-western Apennines, the Life CLAW project (www.lifeclaw.eu/) is carrying out *ex situ* breeding and restocking activities guided by genomic data on the variation of the nuclear and mitochondrial DNA. To gain knowledge on the genetic variability of the species within the project area, 1272 samples have been collected from 62 populations. Both mtDNA and nuclear DNA data showed a clear differentiation between *A. pallipes* in the west and *A. italicus/fulcisianus* in the central-eastern Apennines, together with the occurrence of a geographical structuring of diversity within each lineage. Thanks to our involvement in the National Biodiversity Future Center NBFC of the National Recovery and Resilience Plan (NRRP), we are collecting new sets of samples through a network of collaborations with public and private institutions to gain further insight into the species' conservation status and extend the molecular characterization to *Austropotamobius* populations from Northern, Eastern and Central Italy.

D.4 Environmental abiotic stresses on medicinal and aromatic plants

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Keywords: abiotic stress, medicinal and aromatic plants, biomass and essential oil yield.

Medicinal and aromatic plants are known to be used by 60% to 80 % of global population for their effects as estimated by World Health Organization. These plants are mainly grown for various plant parts (root, stem, leaves, flowers, fruits and seeds), which are used in pharmaceutical, flavouring, perfumery, fragrance, cosmetic and food industries. The growth, development, dry biomass and essential oil yield of medicinal and aromatic plants are affected globally due to increase abiotic stresses by changes in climatic conditions. Abiotic stress factors include water stress or flooding, high or low temperature, excessive or low light incidence, salinity, heavy metals and excessive or deficiency of nutrients, which hamper the physiological and biochemical efficiency of the plants. This review summarizes experimental studies about effects of abiotic stresses on morphology and yield of plants and on the quantity and main compounds of essential oils on some medicinal and aromatic plants. This study was carried out on a review of international scientific publications, using different database. From each publication, data and results were extrapolated about plants that belong to families like *Lamiaceae, Asteraceae, Apiaceae, Hypericaceae* and others. In conclusion, this study shows that abiotic stresses increase the secondary metabolites production and the percentage and quality of oils in the medicinal and aromatic plants.

D.5 The rapid decline of the invasive species *Ailanthus altissima* under the challenge of *Verticillium dahliae*: a physiochemical study

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Keywords: mycoherbicide, biocontrol, wilt disease, photosynthesis, osmolytes.

The decay of *Ailanthus altissima* due to *Verticillium* spp. (Fungi, Ascomycota) represents a relevant opportunity for the biocontrol of this invasive tree, which is not properly counteracted by traditional physical and chemical approaches. *Verticillium* wilt symptoms remember those of drought as they are caused by vessel occlusions, even if phytotoxins produced by the fungus are also involved in the pathogenic mechanism. Here, outcomes from an open air pot experiment aimed to investigate the physiochemical responses of *Ailanthus* trees stem inoculated with *V. dahliae* (VdGL16 strain) are reported. Inoculated plants showed foliar injuries starting from 2 weeks post inoculation (wpi) and a final severe defoliation. Already at 4 wpi, the infection induced a reduction in leaf water content (-14% compared with uninoculated plants), stomatal opening and net photosynthesis (-46 and -38%, respectively). Moreover, the disease altered the translocation of mineral elements and carbohydrates, that reached minimum values at 8 and 6 wpi, respectively (-84 and -14%). An accumulation of abscisic acid, proline and phenylalanine was also observed at 8 wpi (3-, 10- and 6-fold, respectively), suggesting a potential response mechanism. Despite this weak attempt to counteract the fungal colonization, plants were prematurely compromised and death inevitably occurred, confirming the great potential of using *Verticillium* to control *Ailanthus* invasion.

D.6 Orchids and the city: the occurrence of wild orchids in urban systems

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Keywords: *Orchidaceae*, biodiversity, climate change, urban environment.

Orchids (*Orchidaceae*) are amazing plants growing in many different ecosystems but defined habitats, establishing specific relationships with symbiotic fungi and pollinators, showing precise requirements in terms of abiotic factors. Despite this, in recent years, a lot of orchid species are found in urban areas and their number appears to be increasing. In order to understand and monitor the occurrence of wild orchids in the cities, a new study has been carried out, with the involvement of floristic experts and researchers. Here, we report results on investigations conducted in Modena and Reggio Emilia, two cities in the central part of Emilia-Romagna Region, in Po Plain. *Cephalanthera damasonium* and *C. longifolia*, *Ophrys apifera*, *O. bertolonii*, *Anacamptis morio* and *A. pyramidalis*, *Orchis purpurea*, *Spiranthes spiralis* have been found not only in peri urban green areas but also in urban parks, private and public gardens, green beds near streets, and cemeteries. *Himantoglossum adriaticum* plants appeared four years ago in a public park at Reggio Emilia, with a trend of increasing number of individuals. In some cases, orchid populations seem to have been established for years, with dozens of flowering plants, and sometimes production of seeds. This evidence suggests that climate change can sometimes have positive effects on biodiversity; in fact, populations stability and seed production are "bioindicators" of pollinators and fungi biodiversity. These results are also related to nature restoration in the cities and good management of urban environment.

E.1 Micropropagation techniques for the conservation of biodiversity. The case of two rare species *Phyteuma cordatum* Balb and *Empetrum hermaphroditum* Hagerup

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Keywords: germination, *in vitro*, rare plants, regeneration, seed.

Climate change and human actions are compromising the conservation status of natural habitats, spontaneous plant, and animal species. To cope with these changes, the European Union has set up the Natura 2000 Network, a network of sites of community interest (SIC) and special protection areas (SPA) created in the regulatory framework of the "Habitats Directive (92/43/EEC) and the Birds Directive" (79/409/EEC), for the protection and conservation of habitats, animal and plant species biodiversity. Among the methods used to conserve the biodiversity, micropropagation is a multiplication technique that allows to obtain a clone of the plant or a set of individuals with the same genetic heritage, using *in vitro* culture methods of plant tissues. The aim of this study was to identify *in vitro* regeneration protocols for *ex situ* conservation of two rare plant species of the Ligurian and Maritime Alps (*Phyteuma cordatum* Balb and *Empetrum hermaphroditum* Hagerup.) present within Natura 2000 Network. Leaf and explants were collected from wild adult plants. MS was used as culture medium in presence of 2.4D plant growth regulator at different concentrations (0.5, 1.0 and 2.0 mg/L). Explant sections showed no responsiveness for callus formation at plant growth regulator concentrations used. Moreover, to obtain sterile *Phyteuma cordatum* and *Empetrum hermaphroditum* seedlings, we use an agar medium with the addition of gibberellins (GA) at concentrations of 250 and 1000 mg/L to promote *in vitro* seed germination. Only few seeds germinated and the freshly seedlings were then transferred in MS+AG medium, with a photoperiod of 14h light/10h dark and T 20 °C, for starting acclimatization.

E.2 *Lagenaria siceraria* landraces and biostimulatory action of a seaweed extract drive young shoot production, mineral profile and functional quality

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Keywords: plant-based biostimulants, foliar application, bottle gourd landraces, greenhouse cultivation, crop production.

Although *L. siceraria* is not native to Sicily, the landraces of bottle gourd cultivated in this region show a high diversity. Typically, regional ecotypes have poor production performance, so large amounts of fertilizers are used for their cultivation, which has a negative impact on the environment. Therefore, considerable efforts are being made to find new environmentally friendly cultivation techniques to increase the yield and quality of vegetables. In this context, biostimulant products are an effective and environmentally friendly technology to improve plant performance. In the present study, the effects of foliar application of seaweed extract (SwE) (0 or 3 mL L^{-1}) on five *L. siceraria* landraces (G1, G2, G3, G4 and G5) grown in greenhouse were investigated. Our results showed that plant height and number of leaves were significantly increased by SwE application. Seaweed extract treatment also increased marketable fruit yield, mean fruit mass, young shoot production and quantity of young shoots compared to control plants. There were also significant increases in young shoot nitrogen use efficiency, P, K, Ca, Mg, ascorbic acid and polyphenol concentrations. Biostimulant treatments did not significantly affect total fruit yield and soluble solids content. In addition, plants treated with SwE produced a lower number of marketable fruits than non-treated plants. The research indicated that application of SwE at 3 mL L^{-1} can effectively increase plant performance, young shoot yield and quality of *L. siceraria* landraces.

E.3 Genotyping-by-Sequencing Defines Genetic Structure within the "Acquaviva" Red Onion Landrace

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Keywords: onion, landrace, SNPs, genetic structure, traceability.

Genetic structure and distinctive features of landraces, such as adaptability to local agro-ecosystems and specific qualitative profiles, can be substantially altered by the massive introduction of allochthonous germplasm. The "Acquaviva red onion" (ARO) landrace is traditionally cultivated and propagated in a small area of the Apulia region. However, the recent rise of its market value and cultivation area is possibly causing genetic contamination with foreign propagating material. In this work, genotyping-by-sequencing (GBS) was used to characterize genetic variation of seven onion populations commercialized as ARO, as well as one population of the landrace "Montoro" (M), which is phenotypically similar, but originates from another cultivation area and displays different qualitative features. A panel of 5011 SNP markers was used to perform genetic structure analyses, which supported the hypothesis of genetic contamination of germplasm commercialized as ARO with a gene pool including the M landrace. Four ARO populations formed a core genetic group, homogeneous and clearly distinct from the other ARO and M populations. Conversely, the remaining three ARO populations did not display significant differences with the M population. A set of private alleles for the ARO core genetic group was identified, indicating the possibility to trace the ARO landrace by means of a SNP-based molecular barcode. Overall, the results of this study provide a framework for further breeding activities and the traceability of the ARO landrace.

E.4 The cultivation of chestnuts (*Castanea sativa* Mill.) in Umbria. A resource for the development of local communities, a collective heritage of Biodiversity and a source of resilience towards current social and environmental challenges

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Keywords: chestnut, biodiversity, local germplasm, safeguard.

Although Umbria is known for the excellent agro-food products of Oil and Vine, it can boast other elements that enrich its production panorama and among these, the cultivation of Marrone (*Castanea sativa* Mill.) plays an only apparently secondary role. Chestnut is currently experiencing a delicate and "transitional" moment due to internal and external factors. Challenges related to global warming and phytosanitary issues today represent a source of uncertainty and great concern for producers. Added to these are other problems such as insufficient generational turnover, the absence of plantations, management costs.
Since 2020, 3A-PTA has carried out, with the collaboration of the CNR-IRET and with the active participation of local chestnut growers, a study aimed at defining the number and diffusion of the different regional varieties. This with the goal to register them in the Regional Register (L.R. 12/2015). About 130 samples were surveyed on about twenty sampling sites scattered throughout the Region. For each of these the morpho-phenological characteristics were detected and the genetic profile obtained. At least 6 distinct varieties have been identified and 3 of these (Gentile della Vallocchia, Marrone Valle Spoletana and Castagna grande di Pompagnano) have already been signed up in the Register. The hope is to give new impetus to the local communities involved in the management of chestnut groves, also in view of a possible launch of the application for the Community trademark (DOP) for the Marrone Umbro.

E.5 Oleario. Where Italy leaves its mark

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Keywords: sustainability, landscape, biodiversity, culture, adaptation.

The project "Oleario. Where Italy leaves its mark" is a good practice of scientific communication and dissemination through which we intend to tell the Italian richness of extra-virgin olive oil, a fundamental element of the Mediterranean diet, the main product of our food and wine tradition, exploring the link with the production territories but also enhancing and enhancing their importance in terms of olive biodiversity and consequently our landscape and our culture. Oleario tells through a journey into the world of oil, the history, the importance in economic and quality terms, the plurality of oils present on the national territory, a treasure of olive biodiversity connected to Italian territories and landscapes. But through the landscape it tells the history of the places, the traditions. It is a project that contains scientific knowledge on the olive heritage in agronomic, health and nutritional terms but also in terms of landscape and in terms of biodiversity; a container that through knowledge, knowledge and love for nature has made simple scientific concepts to be disclosed to a wide audience, to support learning processes on biodiversity, on the importance for the well-being and prosperity of the various communities, so that everyone can learn more about what we have and preserve it with care.

E.6 Traditional foods as a means of preserve the genetic diversity of Grapevine (*Vitis* spp.) in Tunisia

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Keywords: grapevine, genetic diversity, traditional foods, Tunisia, North Africa.

The cultivation of grapevine in Tunisia and North Africa is ancient and of great economic interest, as shown by the increasing production of dried and wine grapes. The species shows great diversity, especially in areas such as Ben Arous, Nabeul, Sidi Bouzid, and the Kerkennah Islands, and is cultivated in more than 100 cultivars. The North African and Tunisian populations have a rich culinary tradition inspired by different civilizations such as the Berbers, the Romans, the Andalusians, the Arabs, the French, the Spanish etc., and include foods based on fresh and dried fruits or other products. Traditional foods are experiencing a decline over the years as traditions have been lost, habits have changed from traditional to introduced crops; or laboriousness of preparation, as traditional food processing techniques can be time-consuming. Reviving these traditional foods through a proper recognition and appreciation seems to be a good way to preserve not only the cultural heritage inherent in food, but also the richness of grape biodiversity. The aim of this work is to review the use of grapes in traditional foods in Tunisia, taking into account the specificities of Tunisian grape germplasm and the role it can play in conserving invaluable natural and cultural resources and to ensure a sustainable agriculture.

E.7 Grafting eggplant onto underutilized *Solanum* species and *A. brasilense* affect plant performance

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Keywords: *Solanum melongena*, *S. torvum*, *S. aethiopicum*, *S. macrocarpon*, microbial biostimulant, PGPB.

The aim of the present study was to evaluate the synergistic effect of grafting eggplant on different allied potential rootstocks (*Solanum torvum*, *S. aethiopicum* and *S. macrocarpon*) and the application of a plant growth promoting bacterium (PGPB) (*Azospirillum brasilense* DSM 2298) on eggplant performance. The results showed that plants grafted on *S. torvum* or *S. aethiopicum* had a significant increase in plant height compared to non-grafted plants. Our results also showed that *S. torvum* and *S. aethiopicum* grafted plants improved their marketable yield compared to non-grafted plants. In addition, PGPB significantly improved production compared to the control plants. Plant type had no effect on fruit dry matter and firmness, whereas eggplant grafted on *S. macrocarpon* showed a significant increase in soluble solids content (SSC) and fruit K concentration compared to non-grafted plants. The results also indicated that *S. torvum* and *S. macrocarpon* grafted plants inoculated with the PGPB had the highest ascorbic acid. Interestingly, the *S. torvum* rootstock increased the concentration of chlorogenic acid and reduced the concentration of glycoalkaloids compared to non-grafted plants. Our data also showed that *A. brasilense* significantly increased SSC, chlorogenic acid concentration and total anthocyanins compared to the control. Therefore, our study highlighted that *S. aethiopicum* rootstocks inoculated with *A. brasilense* could be a valid substitute for the common *S. torvum* rootstock. The present study could provide useful information for the vegetable plug production sector, as it showed that the use of new eggplant rootstocks responds effectively to the application of microbial biostimulants.

F.1 How to Track Biodiversity in Vineyards? The Role of Technology

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Keywords: vines; species, genetic and ecosystem diversity, inspection, control, monitoring techniques.

In the last decades, vineyard intensification has been compromising the diversity and abundance of service-providing organisms, due to landscape homogenization, loss of key structures such as stone walls and hedgerows, high mechanization, and overuse of inorganic fertilizers and pesticides. The main objective of this study is to investigate the role of technology as a means to preserve and enhance biodiversity in vineyards. The study was based on a systematic literature review. The selection of documents was performed using the Scopus database. Three keywords, i.e., "biodiversity", "vineyard*", "technolog*", connected by the Boolean operator AND, were used to identify the documents in the analyzed research field, which were then filtered by subject area, language and document types, using a detailed search protocol and selected based on the PRISMA approach. After this screening, 9 documents were excluded and a total of 26 documents were considered eligible for the analysis and included in the content analysis. Studies were classified according to the levels of diversity (species, genetic and ecosystem) and to the type of technology adopted in vineyards to preserve or enhance them. The results of the content analysis revealed that 55.6% of the studies are focused on species diversity, 59.26% on genetic diversity, and 25.93% on ecosystem diversity, with more than one half of studies including more than one level of diversity. The technology adopted ranged from the remote sensing to the high-throughput, short-amplicon sequencing (HTS), and from microsatellite markers to RFID. The study findings highlight a significant attention given to the preservation and promotion of the species and genetic diversity, while further research efforts are needed to identify how technology can effectively support ecosystem diversity in the vineyards.

F.2 Digitization of Natura 2000 Standard Procedures for Monitoring *Cerambyx cerdo* Populations in Apulia

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Keywords: Natura 2000, *Cerambyx cerdo*, App, Conservazione, Habitat.

Italy has a unique biodiversity heritage in Europe, and "Natura 2000" a network of areas designated for the conservation of Nature throughout the European Union established by the Habitats Directive 92/43/EEC is the main instrument of EU policy for the conservation of biodiversity. Monitoring of species of Community interest included in Annexes II, IV and V of the Directive is an obligation for all member states under Article 11. This study sets out the activities carried out to monitor the *Cerambyx cerdo* beetle in the Apulia Region. The purpose is to update the standard forms related to the Apulian sites of the European Natura 2000 Network regarding the species *Cerambyx cerdo* increasingly threatened by the deterioration of forests and the consequent lack of large and old oaks and to innovate monitoring activities using easy and intuitive digital technologies that can be a guide for the 'field operator to the application of the methodology standardized by ISPRA. Aerial funnel traps were used for the research at 12 sites in the Apulia Region to ascertain the presence of the species. The selection of survey sites was done by overlaying cartographic land-use themes with cells from the national monitoring plan of the Natura 2000 Network in Italy. Capture activities were conducted in line with the Monitoring Manuals for Species of Community Interest published by ISPRA in 2016. To facilitate the survey, data storage and processing activities, a special Android application was developed to guide the field operator in applying the methodology standardized by ISPRA. Populations of the beetle *Cerambyx cerdo* were surveyed in Apulia to establish the presence of the species in the area. The presence of *C. cerdo* was established for only two sites in the Apulia Region out of the 12 investigated. The poor capture results at the investigated sites demonstrate the small size of *Cerambyx cerdo* populations in Puglia. The main limiting factor to the populations of the species is certainly the young age of the oak stands investigated. The only sites where the species was captured present old trees characterizing the best habitat conditions for the species. Population estimation studies will be conducted during the 2023 breeding season (June-July 2023) at the two sites of established presence of *C. cerdo* in Apulia using the app.

F.3 The management plan of the lake ecosystem adopted by the Trasimeno Fisheries Cooperative to protect the fish populations of Lake Trasimeno. The case study of the Trasimeno pike (*Esox flaviae*) and the Trasimeno carp (*Cyprinus carpio* L.)

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The Trasimeno Fishermen's Cooperative is made up of a workforce of at least fifty people who are an integral part of a complex and constantly evolving ecosystem. The activity of the fishermen of the Cooperative is in perfect symbiosis with the fish populations of the lake, protecting their balance through fully sustainable fishing. In the municipality of Magione near the village of S. Arcangelo, in the immediate vicinity of the lake, there is the Trasimeno Ichthyogenic Center. This is a fish farm specialized in the production of fish species from restocking of warm waters, such as pike, perch, carp and tench. The structure is divided into two distinct sectors: a covered hatchery and an external sector with earth tanks. The Center carries out the reproduction, incubation of the eggs and the first phase of breeding, as well as a brief housing of the reproducers and the finished product before sowing.
The two native fish of Lake Trasimeno, the Pike (*E. flaviae*) and the Carp (*C. carpio* L.), after a further scientific study carried out in collaboration with the DCBB of the University of Perugia, have been registered in the Regional Register of Autochthonous Genetic Resources which is held at the competent Service of the region and at 3A-PTA, implementing body of Chapter IV of Regional Law 12/2015. These two species have a primary value in the activities of the Trasimeno Fishermen's Cooperative as well as in the local gastronomic economy of the lake. The synergistic contribution of the Trasimeno Fisheries Cooperative, the Trasimeno Ichthyogenic Center and the Umbria Agri-Food Technology Park aims to safeguard and conserve these fish resources which are so precious for the entire biosystem of Lake Trasimeno.

F.4 Effective governance of Protected Areas to enhance regional development: an analysis of stakeholder's perspectives

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Keywords: protected areas, environmental economics, stakeholders' analysis, q-methodology, regional development.

Protected areas represent places of great importance for the conservation of environmental resources and biodiversity. However, divergent interests among different stakeholders can undermine the effectiveness of conservation goals. Poor management can favor decisions that favor short-term economic interests over long-term preservation. To address this problem, it is essential to adopt integrated approaches involving the participation of local communities, collaboration between different actors, long-term planning and the implementation of sustainable conservation and management measures. Research has highlighted the importance of participatory and collaborative approaches in the management of protected areas, to ensure the sustainability and effectiveness of conservation measures. However, there is a lack of clear evidence on which governance approaches are more effective in governing protected areas to achieve these goals. This study aims to investigate the views on protected areas of four main categories of stakeholders: biodiversity experts, tourism operators, agricultural entrepreneurs and local administrators. The final goal is to identify the drivers and barriers to effective management of Protected Areas on environmental, economic, political and social levels. The Q methodology is applied, which is recommended to elicit views on environmental issues and policies in ecological economics research. From the analysis, 3 different main points of view emerged: one very conservative and oriented towards highlighting the ecological advantages, one politically critical and the last one oriented towards economic-strategic aspects. These viewpoints can often be combined in the management and planning of protected areas, depending on specific needs and local circumstances.

F.5 Are medicinal plants an effective biodiversity conservation tool? A MCDM approach

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Keywords: biodiversity, ecosystem services, MCDM, medicinal plants, economic sustainability.

Biodiversity loss is a major problem that occurs when levels of diversity of species, genes and ecosystems are lost and reduced. This loss of biodiversity can have negative consequences on various aspects, including ecological, social and economic ones. In this context, medicinal plants provide a series of ecosystem services that can contribute positively to the protection of biodiversity, while maintaining economic sustainability. Previous literature has highlighted the positive effects on biodiversity generated by investments in urban gardens and home gardens. However, there is a lack of studies analyzing the direct link between medicinal plants and ecosystem services, in order to direct future environmental and regeneration policies towards effective solutions. In the present work, through the application of an MCDM model, the ecosystem services provided by the main medicinal plants were analyzed, in order to obtain a ranking of crop alternatives based on the effectiveness of achieving biodiversity conservation objectives. The methodology used consists of four different steps. In a first phase, a panel of experts was convened to identify a list of medicinal plants corresponding to the alternatives of the model. In a second phase, the literature analysis was conducted to identify the criteria, corresponding to the ecosystem services provided by medicinal plants, on the basis of which to rank them. In the third stage, a weight is assigned to each sub-criterion using analytical hierarchy process (ANP). Lastly, a multi criteria decision method (MCDM) is used to normalize, assess, and aggregate the results and produce final scores for the different types of medicinal plants to be ranked. The analysis led to obtaining a ranking of medicinal plants, ordered on the basis of their ability to preserve biodiversity.

F.6 The conservation variety regime for preserving horticultural biodiversity in Italy

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Keywords: Conservation varieties, biodiversity, landraces, seed regulation, *in situ* conservation.

Conservation varieties were introduced in Europe on 14 December 1998, with the European Council's Directive 98/95/EC, as a derogation from the seed regulation, with the aim of protecting Vegetable Genetic Resources (VGR) of agricultural and horticultural species that are naturally adapted to local and/or regional conditions, traditionally cultivated and threatened by genetic erosion, by promoting their conservation *in situ* and sustainable use practices. With reference to vegetable species, 191 varieties have been registered in Europe since 1998, of which 43 (23%) for Italy. Comparing this figure with the number of varieties of vegetable species registered in the Common European Catalogue - about 21,593 - and considering that in Europe today there are estimated to be thousands of varieties used in agriculture, many of them landraces, for the protection and valorization of which the conservation variety scheme has been specifically established, the low number of varieties registered to date seems to be a missed opportunity for European agriculture. The work aims to describe the state of the art of the horticultural conservation variety regime in Europe and, in particular, in Italy, analysing its historical and regulatory evolution, evaluating its limits, derogations, actual and potential applications in the field, and finally identifying possible future prospects for this conservation scheme.

F.7 From the preservation of agro-biodiversity to the spread of minor grapevine varieties in the Veneto region

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Keywords: *Vitis*, traditional products, wine.

Over time, various factors that have led to the cultivation of a limited number of varieties and clones have drastically reduced the agro-biodiversity of cultivated grapevine germplasm.
In order to counteract this trend, a great deal of research has been carried out for a long time with the aim of preserving the grapevine genetic resources and also with the aim of valorizing typical products closely linked to the territory. In the case of the Veneto region, important actions have been carried out since 1980 to safeguard the biodiversity of the grapevine, mainly concerning the conservation of germplasm identified in the area and the recovery of neglected varieties historically present in the region but in danger of being abandoned and disappearing. The clear interest shown by producers in growing these "minor" varieties demonstrated the impact of these activities. An analysis of the regional wine-growing areas for the period 2017-2023 ("Schedario Viticolo Veneto - Regione del Veneto - AVEPA") shows a general increase in the area planted with these varieties over this seven-year period, highlighting the clear interest of winegrowers in increasing the diversification of production. Although the cultivated area remains at a relatively low level, some varieties more than doubled their area: “Recantina” (+14.4 ha, +157%), “Grapariol” (+12.8 ha, +137%), “Pavana” (+7 ha, +104%), and “Corbina” (+5.7 ha, +108%). These varieties, linked to the oenological history of the Veneto region, are proving to be modern and up to date, capable of producing interesting quality wines linked to the territory where they are historically present. This framework is a good example of how the conservation and study of agro-biodiversity could be of direct benefit to farmers.

F.8 Supply Chain Strategies selection for Biodiversity Conservation in the Agri-Food Sector

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Keywords: biodiversity, supply chain strategy, agri-food, MCDM, ADAM.

Biodiversity conservation is a critical global challenge, and European, national, and regional policies play a pivotal role in shaping efforts to address this issue. The agri-food sector plays a crucial role in shaping biodiversity outcomes, as agricultural activities can significantly impact ecosystems and species diversity. To mitigate these impacts and promote sustainable practices, supply chain strategies can be implemented. This paper aims to identify key supply chain strategies that can contribute to achieving the biodiversity aims defined by these policies. Sustainable sourcing (S1), traceability and transparency (S2), collaboration and partnerships (S3), sustainable logistics (S4), and stakeholder engagement and awareness (S5) are identified as some of the most promising strategies. They are evaluated regarding multiple criteria: impact potential, feasibility, urgency, collaboration potential, policy alignment, supply chain leverage, and stakeholder and consumer demand. For solving the defined multi-criteria decision-making problem, a novel hybrid model is defined. The model combines Analytical Hierarchy Process (AHP), for obtaining criteria weights, and Axial Distance-based Aggregated Management (ADAM) for ranking the supply chain strategies. The results indicate that the most supportive strategy is S4, followed by S3, S5, S2, and S1, respectively. By implementing sustainable logistics practices (greener transportation modes, minimization of emissions and habitat disruption, energy efficiency, etc.), supply chain management can reduce the carbon footprint associated with biodiversity-related activities.

F.9 Unlocking Economic Benefits through Ecosystem Services valuation: A PES scheme for Improving Resilience of Bivalve Mariculture in the Little Sea of Taranto

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Keywords: bivalve farming, ecosystem services valuation, payment for ecosystem services, ecological compensation, Apulia.

Aquaculture is the fastest growing food-producing sector in the world and is expected to expand further over the next decade. The aquaculture production in the marine environment (mariculture) is increasingly seen as an alternative to fishery in providing a growing human population with high-quality protein. Specifically, non-fed bivalve farming holds the potential to address the challenge of delivering food security and, at the same time, providing many ecosystem services (ESs) to society, emerging as one of the most sustainable types of mariculture and animal protein production. Remunerating the provided ESs is possible through the adoption of the Payments for Ecosystem Services (PES) approach. Based on this approach, already established in the literature, this study identified the ESs provided by bivalves, presented the methods for their economic valuation (i.e., cost-based approaches, stated and revealed preferences), and identified potential buyers. A survey was conducted among a sample of 15 bivalve farmers of the Little Sea of Taranto to understand the challenges they face, whether they are implementing strategies to enhance environmental sustainability, and their recognition regarding the importance of sustainability in ensuring a lasting development of the bivalve mariculture sector. The findings lead to a PES scheme which includes economic investments in new infrastructures aimed at enhancing the ESs supply and allowing for the transition of bivalve mariculture towards more ecological and resilient practices. Overall, the presented PES scheme serves as a useful tool for policymakers and stakeholders to promote local socioeconomic development.

F.10 Propensity of farmers towards ecosystem services provision with tree landraces

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Keywords: agrobiodiversity, farmer intention, TPB, SEM.

Agrobiodiversity encompasses the diverse range of agricultural crop systems. The adoption of agrobiodiversity leads to the provision of valuable ecosystem services, highlighting the importance of biodiversity in the context of food and agriculture. Unfortunately, significant loss of genetic diversity has occurred in recent decades, resulting in a severe decline in provisioning, regulating, support, and cultural services. The conservation efforts of farmers have played a crucial role in preserving landraces, which involves the exchange of propagating materials, seeds, and information on traditional cultivation techniques. Farmers are therefore vital agents in the conservation of genetic resources. This study aims to analyze Apulia's farmers' intentions to incorporate agrobiodiversity into their farms, considering various factors that influence crop choice. An extended version of the "Theory of Planned Behavior" (TPB) is adopted: attitudes, social norms, and perceptions of control are examined as determinants that interact with factors such as knowledge of landraces, socio-demographic characteristics, profiles of farms, and opinions on different types of valorization processes. The use of structural equation modeling (SEM) allows for the exploration of the pathways for agrobiodiversity valorization. Preliminary findings reveal that farmers are more likely to accept and adopt agrobiodiversity when it aligns with certain respondent profiles, such as self-consumption or local markets oriented and those who possess familiarity with valorization processes and environmental issues. This study contributes to the identification of factors that can contribute to achieving the goals of a more sustainable agriculture in terms of ecosystem services provision.

F.11 An ecosystem condition-based approach for accounting purposes: Assessing the economic value of the carbon sequestration capacity of *Posidonia oceanica* at Tremiti Islands Marine Protected Area

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Keywords: ecosystem condition, ecosystem services, natural capital accounts, *Posidonia oceanica*, carbon sequestration assessment.

In the context of limiting global warming, the seagrass *Posidonia oceanica* is one the most effective carbon storage sink among seagrasses. To assess and monitor the change of environmental conditions and economic values of natural resources, the System of Environmental-Economic Accounting—Ecosystem Accounting (SEEA EA) serves as a tool to help shaping ad-hoc valuations and setting adequate policies. To contribute to the above accounting ecosystem, the main aim of the present study is to assess the economic value of the carbon sequestration capacity of *P. oceanica* at Tremiti Islands Marine Protected Area (MPA), based on an ecosystem condition approach. The latter is seen as a driver to link the ecosystem condition and ecosystem services provided by *P. oceanica* meadows in the context of Tremiti Islands. Furthermore, the present work shows the added value offered by an ecosystem condition-based approach compared to a baseline of no ecosystem condition-based scenario to assess the monetary value. To this end, the carbon sequestration capacity is investigated as pilot ecosystem service of the *P. oceanica* and compared across three different methodologies. Main findings highlight the existence of differences across carbon ecosystem services provided by *P. oceanica* meadows in the context of Tremiti Islands. Furthermore, the present work

F.12 Biodiversity conservation and ecosystem restoration: the challenges and opportunities of the new European Nature Restoration Law

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Keywords: Restoration, nature, biodiversity, ecosystems, conservation.

As part of the European Green Deal, the European Commission has adopted the Biodiversity Strategy for 2030, which sets objectives and priority actions to halt biodiversity loss and protect and restore nature. In particular, among the priority actions of the Strategy, the definition of an ambitious nature restoration plan is envisaged, based on legally binding objectives, aimed at restoring degraded habitats and ecosystems and keeping them in good conservation status. In this regard, on June 22, 2022, the European Commission presented the proposal for Nature Restoration Law, aimed at contributing to the long-term recovery of biodiversity and nature in all terrestrial and marine areas of the European Union (EU). The Nature Restoration Law sets binding restoration objectives and obligations for a wide range of terrestrial (forests, agricultural land, freshwater and urban ecosystems) and marine ecosystems. The aim of the proposed regulation is to implement nature restoration measures on at least 20% of EU terrestrial and marine areas by 2030. The regulation will integrate the directives 2009/147/EC "Birds" and 92/43/EEC "Habitats," setting deadlines for achieving the objectives and requiring ecosystem restoration even outside Natura 2000 areas. The regulation offers a significant opportunity, but it also presents us with new challenges to address. Through the national restoration plans to be prepared by Member States, the regulation will elevate the experiences gained so far in the field of nature restoration measures and Nature-Based Solutions (NBS). Furthermore, it has the potential to yield a positive effect on the primary economic sectors, especially those that are strongly dependent on natural resources and ecosystem services (agri-food, forestry, fishing, etc.). Nature restoration activities do not inherently exclude economic activities, as they do not imply cessation of activities in the affected ecosystems. The introduction of legally binding ecosystem restoration targets will, however, necessitate investments that involve financial costs and opportunity costs for land and natural resource managers, which should be compensated through public or private incentives. Ecosystem restoration benefits all segments of society, must be carried out within an inclusive process, and has a positive impact on those directly dependent on a healthy environment for their livelihoods.

F.13 Tree-related microhabitats and inventory parameters in a new index for mapping and assessing forest biodiversity

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Keywords: biodiversity index, habitat trees, Forestry, integrative forest management, marteloscopes.

Forests are one of the world's principal biodiverse ecosystems. The increasing anthropic pressure and demand for even more forest services, fostered forest degradation and depauperation, with consequent loss of biodiversity. Considering the complexity of the forest ecosystem, monitoring forest biodiversity is a critical challenge, so much to several biodiversity indicators were developed, among which tree-related microhabitats (TreMs). Occurring on living or standing dead trees, TreMs constitute an essential substrate for several species, representing a key element for the indirect assessment of forest biodiversity. Despite the numerous studies conducted in recent years, studies on their spatial distribution at the forest stand level are missing. This study, conducted in 109 marteloscopes belonging to the EU marteloscope Integrate network, aims to introduce a new biodiversity index based on the occurrence, richness, and spatial distribution of TreMs. The index results useful and very practical for assessing forest biodiversity, regardless of forest types or categories, and forest management systems. Its versatility lets to think that will be used in the future for assessing forest biodiversity and for spatializing such forest-related features and driving forestry interventions to balance timber production and biodiversity conservation.

F.14 Sustainable regeneration as a driver of biodiversity: a review and content analysis

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Keywords: biodiversity, regeneration strategies, landscape, bottom-up processes, network analysis.

Natural disasters and anthropogenic actions cause environmental shocks to larger or smaller portions of land. The solution to these shocks lies in land regeneration, a complex system of actions and strategies aimed at restoring the balance and integrity of places. The scientific literature on the regeneration continues to develop rapidly, including different fields and there is an urgent need to systematize its knowledge structure and thus make future research and policy makers' actions more vigorous. The first objective of this paper was to analyze the regeneration proposals in the interdisciplinary literature from a holistic perspective. Next, in the context of environmental regeneration, the role of regenerative actions as a tool for biodiversity protection was investigated. The methodology used to achieve the first research objective was network analysis, which provides a holistic understanding of multidisciplinary research efforts in the analyzed field. To apply this methodology, 554 eligible papers were examined from which the keywords of their respective abstracts were extracted by analyzing their co-occurrence to reveal the most prevalent features and relevant issues. To achieve the second objective, content analysis was adopted, providing a more comprehensive understanding of the reviewed papers. The network analysis showed that the different key points of the regeneration strategies analyzed can be clustered into three declinations of regeneration: environmental, landscape and socio-economic, the three clusters appear to be distinct but strongly related. The content analysis showed that the most effective strategies have in common bottom-up processes and the decentralization of decision-making powers towards organizations closer to the territories concerned.

G.1 Molecular Variability of *Helicotylenchus* populations in Italy

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Keywords: nematodes, variability, ribosomal DNA, sequencing, *Helicotylenchus.*

Plant-parasitic nematodes of the genus *Helicotylenchus* are cosmopolitan species of economic importance for crops and grasses. Proper management of these nematodes is reliant upon correct molecular identification and characterization, but this is complicated due to the interspecific variability that exists within the genus. As a result of changes in the environment, many *Helicotylenchus* species display high phenotypic variation in the morphological characters within the same species leading to potential misidentification and mismanagement. In this study, soil samples were collected from the rhizosphere of grapevine and maize fields in various Italian areas to evaluate the specific *Helicotylenchus* species occurrence. Extensive investigations, by light microscope morpho-biometric analyses and molecular analyses by PCR, ITS-RFLP and sequencing of the main ribosomal (D2-D3, ITS, 18S rRNA) and mitochondrial (cytochrome oxidase I or COI) molecular markers revealed the presence of two different *Helicotylenchus* species and the presence of different populations for each species in both crops. These results agree with data from phylogenetic analyses and confirm a high variability characterizing each of the species.

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G.2 Ancient and new phytosanitary problems threaten the revival of fig cultivation in Italy

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Keywords: fig tree, phytosanitary problems, alien insects, Italy.

In the Mediterranean area, the fig tree (*Ficus carica* L.) is one of the oldest fruit tree crops, capable of adapting to different climates and soils. The lack attention to this crop and the abandonment of the areas previously cultivated with figs, has brought out old phytosanitary problems and favored the spread of alien insects some of which accidentally introduced with ornamental *Ficus* species. Among the non-native pests, the following species endanger fig cultivation in Italy: *Aclees taiwanensis* Kôno (Curculionidae, Scolytinae) was reported in nurseries, currently present in various regions of central-northern Italy; *Cryphalus dilutus* Eichhoff, found in Europe for the first time in Malta in 1991, and reported in Italy in 2014, precisely in Sicily. Another alien bark beetle recently found in the European continent is *Xyleborus bispinatus* Eichhoff. *Cryphalus dilutus* originates from the Asian thermophilous regions, while *X. bispinatus* has a circum-tropical diffusion and it is usually transported in new areas with the woody international commerce. Recent investigations have associated the death of fig trees in southern Italian regions with bark beetle infestations and their symbiosis with fungi of the *Fusarium* genus (*F. solani* and *F. lateritium* complex), recognized as highly pathogenic against numerous tree species in the Mediterranean basin. Also remember the presence on *Ficus carica* of the Asian aphid *Greenidea ficicola* Takahashi, found for the first time in Italy in 2005 in Sicily and Calabria regions on ornamental *F. microcarpa* L.f.

G.3 Dietary supplementation with extruded linseed and oregano in autochthonous "Facciuta Lucana" kids: effects on meat parameters and sensory quality

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Keywords: autochthonous goat, Facciuta Lucana, meat quality, fatty acid profile, sensory quality.
Extruded linseed (*Linum usitatissimum* L.) has been investigated in ruminant diets to improve the nutritional value and healthiness of meat fat, also in association with oregano (*Origanum vulgare* L.), which has antioxidant activity able to preserve lipid peroxidation. This study evaluated the dietary effects of extruded linseed and oregano on the quality traits and sensory properties of meat obtained from kids of a Lucanian goat population named "Facciuta Lucana". Thirty-six male kids weaned at about 20 days of age were divided into three homogeneous groups (n. = 12) fed a control feed (C), or a diet containing 3% extruded linseed with or without addition of 0.6% oregano ("LO" and "L", respectively). Meat from the *Longissimus lumborum* muscle obtained from the two linseed groups showed a lower ($P<0.05$) content of fat compared with the control. No significant differences between dietary treatments were found for meat tenderness. The L group showed a greater meat yellow index ($P<0.01$). The LO and L diets led to a significant ($P<0.05$) decrease of the content of saturated fatty acids in meat, in turn of a greater amount of monounsaturated fatty acids. The L diet also lowered ($P<0.01$) the thrombogenic and atherogenic indices of meat. Oregano addition to the linseed diet proved to be effective in preserving meat shelf-life, since it lowered ($P<0.01$) the malondialdehyde (MDA) concentration after 10 days of storage, and improved ($P<0.05$) meat succulence, tenderness, juiciness and overall acceptance.

G.4 Big Data analytics for biodiversity conservation with DataLabs: LifeWatch Italy Collaborative Coding Platform

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Keywords: big data, collaborative coding, ecological modelling.
The conservation and protection of biodiversity is essential for the sustainable development of our planet. In this context, the role of big data analytics in biodiversity conservation has become increasingly important. DataLabs provides a coding environment that supports R, Python and MATLAB, making collaboration between researchers more accessible and efficient. Through integration with LifeWatch Italy, a leading data-driven research portal, DataLabs provides a unified platform for publishing scripts, deploying web services and managing projects. This integration streamlines research workflows and promotes the sharing of code and results among the scientific community by enabling the use of FAIR principles and Open Science practices. DataLabs simplifies data access and analysis within the LifeWatch-It environment. Researchers can retrieve, filter and analyse data from the LifeWatch-It Data Portal through a unique integrated platform. Scripts can be launched directly from the platform and transformed into web services, enabling researchers to publish their research products within the LifeWatch-It Metadata Catalogue; published web services are uniquely identified with a DOI, enriched with metadata tags and made readily available to the scientific community. By harnessing the power of big data analytics and providing a collaborative encoding platform, DataLabs helps the research community more effectively address the major challenges of biodiversity conservation. ultimately, DataLabs facilitates data-driven research and promotes the dissemination of scientific knowledge, thereby contributing to the collective effort to conserve our planet's precious biodiversity.

G.5 Building up collective knowledge through semantics

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Keywords: semantic platform, ontology, annotation, knowledge integration and synthesis.

The fast-increasing volume of research products in the biodiversity and ecosystems domain requires the implementation of novel paths, tools and technologies to build up a collective shared knowledge among stakeholders. Semantic-based approaches offer new ways of describing, processing and interpreting existing knowledge. Thus, information becomes readable and actionable both by humans and computers, enabling machines to search, retrieve, organise, reuse and combine existing information in innovative ways, thereby ensuring the interoperability and discoverability of scientific knowledge. With this in mind, LifeWatch Italy has released the first version of its Semantic Platform based on a semantic model which combines different ontologies, with additional custom semantic relationships, created in order to improve the efficiency of the platform. Information retrieval is performed through an ETL pipeline which converts all LifeWatch Italy services and resources into RDF triples that the model is able to exploit. Users can interrogate the platform by using simple and advanced searches, SPARQL queries, and can create annotations in metadata fields, values and datasets. The Semantic Platform represents one of the first attempts at deploying a software for semantic search and annotation in biodiversity and ecosystems research. It is envisaged that the further implementation might allow the information retrieval from multiple platforms within and beyond the LifeWatch e-Infrastructure.

A.1 Chemical characterization of the pea variety "pisello nano di Zollino"

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Keywords: elemental profile, ICP-AES, *Pisum sativum* L., Salento (Apulia Region).

The recovery and valorisation of local varieties of agricultural interest also passes through their morphometric and chemical characterization. In the recent years, the pea variety "pisello nano di Zollino" (*Pisum sativum* L.) has established itself on the local market for its goodness and ease of cooking, also imposing itself on other local pea varieties. The nutritional properties of this exclusively Salento variety motivate its conservation and the development of cultural protocols that can preserve them.

Elemental profile in pea samples was determined by using the Inductively Coupled Plasma Atomic Emission Spectroscopy (ICP-AES). Samples were weight and mixed with 4 mL of H_2O_2 and 6 mL of superpure HNO_3 69%, then treated at 180°C for 10 min using a microwave digestion system (Milestone START D). The samples were then cooled, diluted with superpure water, filtered through syringe, and measured for element content using an ICP-AES (Thermo Scientific, iCap 7000 Series) spectrometer. The spectrometer was previously calibrated for quantitative analysis with five multi-element standard solutions containing known concentrations of the elements: 0.001, 0.01, 0.1, 1.0, and 10 mg/L. The results were expressed as the average (± standard deviation) of three different measurements, and the element concentrations were expressed as ppm (mg/kg of sample weight). This work was realized within the SaveGrainPugliaLeg project, CUP B97H22003970009.

A.2 "Cummitoru a pappacocu" variety: morphological and chemical characterization

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Keywords: ICP-AES, Salento (Apulia Region), *Solanum lycopersicum* L.

The "cummitoru a pappacocu" is a tomato variety (*Solanum lycopersicum* L.), found in the Alezio-Parabita area and which is characterized by long clusters of large, globular, red-vermilion colored berries, is at high risk of extinction. Conservation and valorisation programs have been launched for this variety, by *in situ* and *ex situ* cultivation. In the present work, the data on the morphological characterization and on the elementary profile are reported, detected on a population of Alezio and on a population of Campi Salentina, created with seedlings taken in the original area.

Elemental concentrations in tomato samples were measured using the Inductively Coupled Plasma Atomic Emission Spectroscopy (ICP-AES). Fresh samples were weight and mixed with 4 mL of H_2O_2 and 6 mL of superpure HNO_3 69%, then treated at 180°C for 10 min using a microwave digestion system (Milestone START D). The samples were then cooled, diluted with superpure water to a final volume of 20 mL, filtered through syringe, and measured for element content using an ICP-AES (Thermo Scientific, iCap 7000 Series) spectrometer. The spectrometer was previously calibrated for quantitative analysis with five standard solutions containing known concentrations of the elements: 0.001, 0.01, 0.1, 1.0, and 10 mg/L. The results were expressed as the average (± standard deviation) of three different measurements, and the element concentrations were expressed as ppm (mg/kg of sample weight). This work was realized within the BiodiverSO Karpos project, CUP B97H22003670009.

A.3 Metabolite biodiversity in pepper fruits: a non-targeted NMR approach to characterize pepper landraces from Puglia Region

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Keywords: *Capsicuum annuum* L., local varieties, NMR fingerprinting, nutraceuticals, biodiversity.

Pepper (*Capsicum annuum* L.) is one of the most cultivated and representative species of the *Capsicum* genus. It is widely grown in the Mediterranean region, particularly in Italy, where soil and climate characteristics allow the cultivation of diversified landraces with distinct morpho-agronomical properties and quality-related features. Pepper fruits are an essential ingredient of all diets worldwide, being appreciated for its taste and its beneficial health effects, since they are a good source of fibers, vitamin C, vitamin E, carotenoids, and flavonoids in general, the latter being responsible for their antioxidant activity. Current research focuses on phenotypic and genetic diversity of several pepper local varieties from the Puglia region (South Italy), their fruit quality traits and agronomic yields (BiodiverSO and BiodiverSO Karpos, PSR Puglia 2014-2020, Mis. 10.2 Projects). In this study, we took advantage of a non-targeted spectroscopic method combining NMR studies and multivariate data processing to provide an overall view of the chemical composition of 10 pepper landraces from Puglia, with the ultimate goal of valorising local pepper landraces for their specific nutritional characteristics. The qualitative results of the metabolic profiling showed that local peppers are rich in hydrosoluble compounds (sugars, organic acids, essential amino acids, ascorbic acid and phenolic compounds) all contributing to their nutritional value.

A.4 Anthocyanin-producing carrots from the local biodiversity

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Keywords: anthocyanin, carrot, polyphenol, Apulia Region.

Among vegetables, carrots (*Daucus carota* L.) are one of the most cultivated, with a worldwide production of around 45 million tons. The species harbors a broad range of phenotypic variation, which has been exploited for decades by breeders, resulting in a variety of color shades due to the presence of different class of pigments: carotenoids in yellow-orange varieties, anthocyanins in purple and black carrots, and a mix of both classes. Anthocyanin-containing carrots have been developed inside modern carrot breeding programmes, to increase the nutritional quality, as anthocyanin consumption has been associated with various health benefits. In this work, we report on the polyphenolic characterization of local genotypes, from Apulia Region, in order to valorize them, avoiding genetic erosion, and because it is known that local genotypes are best suited for local environments. Purple carrot from Polignano (municipality of Bari) and Tiggiano (municipality of Lecce) have been characterized for their nutraceutical features (content of anthocyanins, polyphenols and antioxidant capacity). The anthocyanins profile in both varieties are similar: five cyanidin-based anthocyanins with the predominant ferulic acid derivative of cyanidin 3-xylosyl (glucosyl) galactoside. At quantitative level, anthocyanin content and antioxidant capacity of Tiggiano carrots were 50% and 60% of the Polignano carrot, respectively.

A.5 Phenolic compounds evolution in myrtle fruits under postharvest storage

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Keywords: *Myrtus communis* L., polyphenols, cold storage, weight loss, anthocyanins.

Myrtle (*Myrtus communis* L.) is a perennial shrub that is characteristic of Mediterranean maquis. Considering the increasing temperatures projected for the coming years, it is of interest to investigate the response of plant chemical components to different postharvest temperatures. This study aimed to assess polyphenol, tannin and anthocyanin changes in myrtle berries from four cultivars during postharvest storage under different temperatures. Myrtle berries were obtained from the University of Sassari's collection field in Fenosu, Central-Western Sardinia, Italy. The four cultivars analyzed were 'Maria Antonietta' and 'Ilaria' (pigmented berries), 'Grazia' and 'Caterina' (unpigmented berries). Samples were collected at full ripeness and divided into eighteen trays per cultivar, which were then weighed and stored at temperatures of 2 °C, 10 °C, or 16 °C. Weight loss was measured after 7, 14, and 21 days, followed by a 3-day period at room temperature for subsequent weighing. At harvest time and after 14, 21 and 24 days a sample of the berries was deprived from their seeds and ground using liquid nitrogen. The resulting powder was combined with acidified ethanol for maceration and subsequent filtration. Chemical analyses were conducted immediately or after storage at -20 °C. In all cultivars, the greatest weight loss occurred in berries stored at 16 °C, while berries stored at 10 °C maintained higher hydration levels. The cultivar 'Ilaria' had the greatest weight loss, 58% of its initial weight, in berries stored at 16 °C. In contrast, it showed a 32% weight loss in berries stored at 10 °C. The pigmented berries showed a higher polyphenol content, while the unpigmented berries showed a higher tannin content and an insignificant anthocyanin content.

A.6 Transcriptional responses within a biostimulant-plant-pathogen system

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Keywords: transcriptomics, endophytism, biostimulant-plant-pathogen interaction.

Plant diseases and pests have a significant negative impact on crop productivity worldwide. To face this issue, the use of biostimulants and antagonistic microorganisms is highly beneficial due to their non-toxic properties. *Pochonia chlamydosporia* (Pc), an endophytic fungus, is widely employed as a biological control agent against the destructive root-knot nematode (RKN) *Meloidogyne incognita*. Pc triggers defense-related genes in host plants, leading to effective resistance in the fungus-nematode-plant interactions. However, the specific mechanisms through which these defense responses suppress RKN impact on roots are not fully understood. Therefore, in this study we conducted a comprehensive analysis of transcriptional reprogramming in the roots of *Capsicum annuum* treated or not with Pc and inoculated or not with RKN in order to gain insights into this complex tri-trophic system. We identified genes and pathways acting during Pc endophytism, RKN parasitism, and Pc-RKN interaction in the host environment. Shared responses uncovered up-regulated genes involved in defense response processes, carbon metabolism, and protein phosphorylation and modification processes. Treatment specific responses ranged from a marked down-regulation of peptidase, hydrolase, and ethylene-related processes under Pc treatment to up-regulation of terpenoid and other stress response pathways under RKN treatment. Finally, we identified putative resistance genes differentially expressed during this tri-trophic interaction and investigated their co-expression and regulatory networks, with the aim of providing new candidate genes for breeding.

A.7 Morpho-physiological and agronomic characterization of "Canario" (*Phaseolus vulgaris* L.) included in the Campania agrobiodiversity

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Keywords: agrobiodiversity, herbaceous genetic resources, agronomic characterization, morpho-physiological characterization.

This paper presents the results of the research conducted in the year 2022 on the Canario bean, a Plant Genetic Resource included in the ABC project (PSR 2014-2020 Regione Campania Misura 10, sottomisura 10.2, tipologia di intervento 10.2.1), with the aim of comparing the behavior related to both the morpho-physiological and agronomic characterization. The morpho-physiological characterization was carried out *ex situ* at the CREA-DC farm (Battipaglia, SA) while the agronomic characterization was carried out *in situ* at a farm located at Sant'Antonio Abate (NA) in the area of origin of the bean (agro sarnese-nocerino). In both cases, two crop cycles were conducted during which the measurements were carried out.
Both experimentations confirmed for this bean a determined development. The seed has an average size of rounded to elliptical shape in longitudinal section and broad elliptical in cross section with the weight of 1000 seeds included between 363 and 406 g; it is a greenish colored seed. The surveys highlighted that the Canario is an early bean with flowering between 30 and 42 days from sowing. The height of the vegetation at the harvest was included between 36 cm and 56 cm. The earliness of this bean, verified both *ex situ* and *in situ*, determines a reduced ET. This characteristic can be of great interest for the identification of genetic resources particularly suitable for a reduced water consumption.

A.8 Use of Mediterranean aquatic crustaceans to reduce biofouling on aquatic moss-based biofilters

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Keywords: moss, Mediterranean crustaceans, biofilter, biofouling, contaminating algae.

Aquatic mosses can be used as biological filters, reducing nitrogenous compounds, heavy metals and nanoparticles in solution through absorption and uptake. They also represent an effective mechanic filter for particles in water streams. Over time, however, the biofiltering efficiency can be compromised by the formation of a biofilm dominated by filamentous algae and cyanobacteria (biofouling). The biofilm can obstruct the spaces between mosses' talli and reduce the flow of water through the filter. To maintain the permeability of the mosses biomass, it would be advisable to associate this with organisms capable of reducing biofouling. In this study (Project fish RISE; PON 2014/20 ARS01_01053), two Mediterranean aquatic crustaceans, the amphipod *Gammarus aequicauda* and the isopod *Lekanesphaera monodi*, were tested for their ability to reduce the amount of contaminating algae present on the surface of the moss *Leptodictyum riparium*, a cosmopolitan species, common in Italy. The two crustaceans were allowed to feed on contaminated *L. riparium* fragments under laboratory conditions; subsequently, the fragments of moss were observed under a confocal fluorescence microscope. From the analysis it was possible to deduce that the two species of crustaceans have a different feeding behaviour. *L. monodi* feeds preferentially on the biofilm without affecting the moss, demonstrating that it may represent a good candidate organism for preserving the moss permeability and its effectiveness as a biofilter.

A.9 Discovering the resistance of the almond tree to *Xylella fastidiosa*

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Keywords: climate change, abiotic–biotic stress, combined stress, drought, plant disease.

Under field conditions, plants are often exposed to diverse biotic and abiotic stresses at the same time. Because the climate change is expected to increase the frequency and intensity of such stress combination, is needed to study how stress combination is affecting crops, also in order to understand the physiological and molecular mechanism associated with stress response. In Salento, *Xylella fastidiosa* causes huge damage for the local economy, hence the need to necessary to carry a crop renewal with the aim of creating new production chains and increasing the biodiversity of the area, using species considered immune or resistant to the bacterium. The almond (*Prunus dulcis* Mill.) tree is an excellent candidate, because as able to grow in conditions of water shortage, without requiring irrigation, and, in particular, in the Apulia region, almond cultivation has great traditional and economic relevance. In this work, we report the physiological and molecular response to drought and *Xf* infection in *cv* Filippo Ceo under individual stress (drought or pathogen stress) and combined stress in field conditions. We evaluated the change in some physiological parameters such as proline content, and the expression profiles of genes encoding proteins and transcription factors (TFs) directly involved in response to water deficit and pathogen stress. Our finding confirmed the almond tree's tolerance to drought and to the vascular pathogen *Xf*, thanks to higher accumulation of proline and the upregulation of genes encoding TFs in the infected plants analyzed.

A.10 Filtration activity of nitrogenous compounds by different species of aquatic mosses

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Keywords: moss, nitrogenous compounds, Mediterranean biodiversity, phytofiltration, Hypnales.

The use of plants for phytofiltration is one of the promising trends in environmental biotechnology to purify wastewater. Aquatic moss biomasses, due to the ability of the gametophyte to absorb pollutants through the whole of its surface, can act as live filtering material, in addition they represent a natural scaffold for detoxifying bacterial. In this study, in the frame of the project fish RISE (PON 2014/20 ARS01_01053), the changing in the amount of nitrogenous compounds such as nitrites, ammonium ions and urea by two species of moss, *Taxiphyllum barbieri* and *Leptodictyum riparium*, was tested, both in sterile and non-sterile conditions, over a period of 287 hours. The possibility to observe a different behavior and, as a consequence, different phytofiltration efficiency was investigated. From the results obtained it is possible to confirm the ability of the mosses to change the concentration of the nitrogenous compounds tested. These decrease in time. The use of Nitrogen compounds related to different metabolic steps allow to discuss in more detail the action of the two compared species. The nature of pollutants was selected having in mind the needs of aquaponic biofiltration, but the applicability is wide. This highlights how these mosses are particularly suitable as an adaptable biofilter, representing a new opportunity for the eco- sustainable reclamation of water.

A.11 Violet-scented irones in *Iris pallida* rhizomes from different geographical origin

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Keywords: *Iris pallida*, iridals, irones, fragrance, oxidative degradation.

Iris pallida Lam., a well-known species in the perfume industry, is particularly appreciated for the violet-scented compounds (irones) contained in the dry rhizome. These are chetonic compounds formed during rhizome ageing by the natural oxidation of their terpenoid precursors, the iridals. Therefore, the content of iridals in the rhizomes indicates the potentiality of the fresh tissues to produce irones by gradual oxidative degradation, although the actual yield in irones can be assessed only after three years storage of the rhizomes following three years of cultivation. Five *I. pallida* cultivars, three from France and two from Italy, were transplanted in an experimental plot (Pisa, Tuscany) and grown for two years. After one year, the lyophilized tissues from fresh rhizomes contained similar concentrations of iridals as those found after two years. In order to accelerate the postharvest storage, rhizomes were oven-stored to undergo slow air oxidation at 40 °C or subjected to forced oxidation under pressure at 50 °C. While the irones were already found in the rhizome after only one month, forced oxidation improved the yield of these compounds as compared to slow oxidation and allowed a distinction among the cultivars. The relevant outcome was that the production of irones in plants from different geographical origin differed significantly, with the Italian cultivars showing the highest concentrations. This opens future perspectives for cultivar selection and for a remarkable reduction of the typical postharvest maturation time of *I. pallida*.

A.12 Genetic variability and genome wide association mapping of grain size in a *Triticum turgidum* collection

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Keywords: tetraploid wheat, thousand kernel weight, grain size, SNP genotyping, GWAs.

Thousand kernel weight and grain size are important breeding target traits to increase grain yield in durum wheat. These traits are stable yield components and are correlated also with flour yield. Therefore, information on the genetic control of grain size is useful for increasing breeding efficiency. Genetic variability of thousand kernel weight and morphometric grain traits were analyzed in a *Triticum turgidum* collection including wild, domesticated and cultivated accessions evaluated for three growing seasons. Highly significant differences between accessions for all traits were found in each year, while the combined analysis across years revealed significant effects of genotypes, and a strong genotype x environment interaction. A large variation was observed for thousand kernel weight, grain length and area. Thousand kernel weight was significantly positively correlated with grain length, grain width and area in all years and across years. A genome wide association analysis was performed using the genotyping data obtained with an SNP array. Mixed Linear Model incorporating the Kinship matrix and the genetic structure of wheat collection was used. Different stable QTLs were detected for each seed trait, some of them resulted co-located in the same chromosome position.

A.13 Antioxidant Potential of *Diplotaxis tenuifolia* (L.) DC.: A Case Study from Salento

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Keywords: antioxidant activity, bioactive molecules, *Diplotaxis tenuifolia* (L.) DC., wild species.

The Salento peninsula is renowned for its rich biodiversity, boasting a wide variety of naturally occurring edible herbaceous plants that not only serve as a valuable food source but also hold medicinal and artisanal value for the local populations. Among these plants, *Diplotaxis tenuifolia* (L.) DC., known as wild rocket, stands out as a spontaneous perennial. This plant has gained recognition not only in Europe but also worldwide due to its versatility, serving multiple purposes including vegetable crops, oil production, animal feed, herbal medicine, and even beekeeping. Given its significance, our primary focus is on investigating the antioxidant compounds found in its leaves. The analysis involved collecting basal rosette leaves from plants in the pre-flowering phase, gathered from various locations within the province of Lecce. These locations included a spontaneous meadow within the University Campus Ecotekne (Lecce), the edge of a cultivated field in Campi Salentina, and a roadside in Tricase's agricultural area. Fresh samples were used to evaluate the fractional antioxidant activity, encompassing hydrosoluble, liposoluble, and matrix-bound activities, as well as the content of diverse bioactive molecules.
Consistently, the results demonstrated that the hydrosoluble antioxidant activity exceeded the liposoluble activity. Moreover, both the Lecce and Campi Salentina populations exhibited significant contributions from bound antioxidants. Among the analyzed samples, the Tricase population displayed the highest levels of antioxidant activity, along with elevated levels of polyphenols, flavonoids, condensed tannins, and anthocyanins. This variation may be attributed to differences in climatic and soil conditions, as well as a healthier rural environment compared to the other two collection sites.

A.14 Biometric characters and germination of seeds of wild olive genotypes

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Keywords: oleaster, genetic resources, variability, seed morphology, propagation.

Oleaster is the wild relative of the cultivated olive (*Olea europaea* var. *sativa* L.). The study and collection of oleaster accession allows to recover a reservoir of genetic resources useful for the advances of the olive industry. The research program carried out in the Sardinia land was aimed to measure the biometric characters of fruit, seeds and leaves sampled from a population of 31 oleaster accessions and to observe the seed germination performance. Samples were harvested in December and seeds extracted from mature fruit, washed with water and stored 120 days under 4 °C temperature. Subsequently, germination tests were performed *in vitro* after shell cracking and disinfection and incubation at 25 °C in Petri dishes. Results showed the wide range of variability observed in the studied population. Fruit weight was comprised between 0.12 and 0.63 g, with length ranging from 0.78 to 1.44 cm and width from 0.50 to 0.97 cm. The seed weight was between 0.05 and 0.68 g; the length between 0.66 and 1.24 cm; and the width between 0.38 and 0.62 cm. Leaf length ranged from 2.85 and 5.24 cm and width between 0.67 and 1.33 cm. Seed germination was recorded with values comprised between 20 and 78%, while the average time of germination was comprised between 14 and 90 days. From a morphological point of view the occurrence of double seeds in the same shell for many accessions and sometimes of three seeds was absolutely original and characteristic.

A.15 Altitudinal shifting of the major forest tree species in Italian mountains under climate change

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Keywords: species distribution modelling, mountains, forests, SDM, suitability.

Climate change has significant implications for biodiversity, particularly in mountainous regions where species distribution is highly sensitive to environmental changes. Understanding the effects of climate change on forest species is crucial for effective conservation and management. However, there is a knowledge gap regarding the future dynamics of climate suitability for native forest species in specific mountainous areas. This study examines potential shifts in altitudinal range and suitability for 20 native forest species in Italy's mountainous regions. Using species distribution modeling, we demonstrate divergent impacts among species and scenarios. While most species are projected to experience a contraction in their altitudinal range, some have the potential to extend beyond the current tree line. The Northern and North-Eastern Apennines exhibit significant impacts on all species, highlighting their vulnerability. Our findings show the complex and dynamic nature of climate change impacts on forest species in Italy. The projected impacts on mountain biodiversity necessitate comprehensive conservation and management strategies. This study emphasizes the importance of using high-resolution climate data and considering multiple factors and scenarios when assessing species vulnerability. The findings have implications at local, regional, and national levels, highlighting the ongoing need for reliable datasets and forecasts to inform conservation efforts and management strategies in the face of climate change.

A.16 Morphometric, Chemical and Genetic Description of *Ficus carica* L. accessions

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Keywords: *Ficus carica*; biodiversity, SSR, polyphenols, geometric morphometric, multivariate analysis

In this study we have explored the fig diversity using a parallel approach of molecular analysis (SSRs), chemical profile (polyphenols and antioxidant capacity) and geometric morphometric variables. (landmarks and the angles measurements). Chemical and morphometric data were determined on leaves. Hierarchical agglomerative cluster analysis (HCA) was applied to the standardized data to investigate the similarity and dissimilarity between the fig varieties. To evaluate the correspondence of the results obtained with the different analyses Multiple Linear Regression (MLR) has been conducted.
The set of chosen markers resulted highly polymorphic, and allowed the characterization of all the studied accessions. The geometric morphometry data displayed variation in leaf traits among varieties. Chemical analysis highlighted considerable diversity among fig accessions, in particular their amounts were variety-specific. The combined use of these methods with statistical analysis has confirmed the variability in Tuscan figs accessions, despite their limited geographical distribution.

A.17 Seed production and characterization of two local varieties of carrot: *Bastinaca* di San Vito and *Pestanaca* di Sant'Ippazio.

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Keywords: Agro-biodiversity, agronomic value, *Daucus carota* L., local variety, seed legislation, self-production.

Bastinaca di San Vito and *Pestanaca di Sant'Ippazio* are two local varieties of carrot from two Apulian municipalities (Polignano a mare and Tiggiano, respectively). These are, therefore, "variable populations, however well identifiable, and usually has a local name. They have not been the subject of d program of genetic improvement, are characterized by specific adaptation to the environmental and growing conditions of a given area, and are closely associated with the customs, knowledge, habits, dialects, and recurrences of a human population that has developed it or continues its cultivation". Since ancient times, local varieties have been mainly reproduced by resorting to self-production of seeds in order to obtain propagation material to be used for the following year and reproduce they indefinitely. Even today, this practice is of fundamental importance for local varieties also in consideration of the current seed regulations which prevent the marketing of the seed of those varieties that have not certain genetic and agronomic characteristics. The present work aims to describe the seed self-production techniques of these two local varieties of carrot, evaluating the agronomic aspects, as well as the morphological and qualitative characteristics of the seed obtained, finally identifying any critical points for this delicate phase of the production chain.

A.18 Structural and chemical defence in *Xylella fastidiosa* asymptomatic olive cultivars

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Keywords: vascular pathogens, secondary metabolites, xylem vessels, host defence.

Xylella fastidiosa (*Xf*) was first described in Italy in late 2013 causing Olive Quick Decline Syndrome (OQDS). Since from the first in field surveys, differential responses of the olive cultivars to the pathogen were observed. Several in field exploratory missions were conducted to identify asymptomatic olive plants (positive to the diagnostic test but with no symptoms on the canopy) in orchards severely affected. These plants were analysed for: anatomy and histology of xylem vessels, patterns of *Xf* distribution in host tissues (by the Fluorescent In Situ Hybridization, FISH technique) and secondary metabolites analysis from stem tissues. Through the anatomical analysis, it has been shown that xylem vessels of the asymptomatic plants have an average diameter (28.8 ± 5.3 μm) significantly lower than that one of susceptible plants (35 ± 2.5 μm); while the histochemical staining of xylem vessels highlighted an increase of the lignin in the parenchyma cells of the medullary rays of the wood. The role of these cells in the defense against vascular pathogens is well known since they have the function of transversally connection between the tissues of the stem. The 3D images obtained from FISH revealed that *Xf* cells mostly appeared as individual cells or as small aggregates; anymore, these bacterial cells looked to be incorporated in the autofluorescence signal of gels and phenolic compounds. In fact, the metabolomic data highlighted the significant increase in the asymptomatic plants of some compounds such as the luteolin, a naturally derived flavonoid compound with antibacterial properties and with well- known anti-biofilm effects. These studies are essential for the olive biodiversity screening within the REGEROP project (CUP B97H22003770009) financed by Apulia Region.

B.1 Halophytic Plant Growth Promoting Bacteria: a new tool for a sustainable valorization of marginal areas

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Keywords: plant growth promoting bacteria, rhizosphere, endosphere, halophytes, marginal areas.

Plant Growth Promoting Bacteria (PGPB) are microorganisms able to contribute to the host's adaptation to adverse environmental conditions, improve tolerance against various biotic and abiotic stresses, reduce pathogen infection, without conferring pathogenicity.

The main goal of this study was the isolation, characterization, and selection of potential PGPB from *Cakile maritima* plants collected in Apulian marginal areas. In particular, the microbiological sampling of leaf and roots was performed at two phenological stages to select and count mesophilic bacteria, *Pseudomonas* spp., *Bacillus* spp., Actinobacteria, and nitrogen fixing bacteria. Colonies with different morphology were randomly isolated, then purified and characterized in relation to some preliminary phenotypic tests (microscopic observation, Gram staining, spore production, catalase, oxidase,) and some specific tests (urease, ammonium production, nitrification, phosphate solubilisation, and salt tolerance).

Mesophilic and nitrogen fixing bacteria showed the highest cell number (ca. 7 log CFU/g), whereas Actinobacteria, spore-forming bacteria and pseudomonads were at lower levels (ca. 6 log CFU/g). Approximately 150 isolates were obtained, mainly Gram-negative (58%) and catalase-positive (70%). Concerning other traits assessed, a great variability was recorded since the isolates showed different abilities, at various levels (weak, moderate or high), in terms of ammonification/nitrification, phosphate solubilization, and salt tolerance.

B.2 Could biofertilizers persist and modulate soil microbiota? A preliminary study on wheat

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Keywords: plant growth-promoting bacteria, soil microbiota, biofertilizers, wheat, sustainability.

Plant Growth-Promoting Bacteria are defined "plant bio-fertilizers" able to stimulate nutritional processes and plant growth through direct or indirect mechanisms. Many times, a challenge is strains' survival and their ability to prevail and modulate soil microbiota. Thus, the aim of this research was to study the ability of some selected PGPB strains to persist and survive in soil when used as biofertilizers, as well as their impact on soil microbiota and biodiversity. The experiment was conducted in Southern Italy (Foggia County) on two durum (Antalis, Fuego) and one bread (Solehio) wheat varieties. Three replicates with three genotypes and eight bio-fertilization strategies were adopted for the study, including a commercial PGPB strain (*Bacillus subtilis*) and a wild strain previously characterized (*Pseudomonas migulae*). Soils samples were analysed immediately before inoculation (sowing) and at booting development stages (after first and second raised plant). Microbiological analysis concerned the determination of total bacterial count, spore forming bacteria, nitrogen fixing bacteria, pseudomonads, actinobacteria and soil bacteria grown at 22 °C. In addition, agronomic parameters were evaluated. Microbiological analysis of soil confirmed the increase in PGPBs due to inoculation; mainly, pseudomonads count increased by 1-2 log CFU/g, thus suggesting the robustness of the wild *Ps. migulae* strain to persist into the soil. Higher counts in bacilli were also found in the soils inoculated with the commercial strain sample. Moreover, a partial modulation of microbiota was found, thus suggesting promising perspectives for the strains hereby proposed.

B.3 The ENEA microbial culture collection in the PNRR SUS-MIRRI.IT

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Keywords: ENEA microbial culture collection, microbial consortia, sustainability, bioeconomy.

ENEA is partner of the SUS-MIRRI.IT project being involved with four Operational Units. ENEA microbial collection (EMCC) has been created over 30 years by an interdepartmental team of researchers that has collected microbial strains (bacteria, fungi, microalgae, microbial consortia, virus) from different environments (contaminated sites, hypogea and archaeological sites, food, lake sediments, sea, soil, rhizosphere, water). The microbial collection has several environmental applications: i) sustainability and protection (soil, bioremediation, restoration of artistic heritage, biorefinery), ii) plant disease suppression and plant growth promotion, iii) production of high-value and bio-based molecules for the development of a sustainable and circular bioeconomy (nutraceutical, cosmeceutical, pharmaceutical and green chemistry sectors), iv) a vegetable virus with applications in the biomedical sector. In addition, molecular tools as Next Generation Sequencing (NGS) and metagenomic approaches have increased the detection of biodiversity in different environments. In the agri-food sector, the large EMCC include rhizobacteria with plant-growth promoting activity, nitrogen-fixing strains, biocontrol agents against several phytopathogenic fungi. The microbial strains were characterized and used in single applications and in SynCom in several sectors. A brief overview of the EMCC and its potential application for the development of the bioeconomy and biosustainability will be presented. https://www.enea.it/it/Stampa/comunicati/ambiente-il-grande-archivio-enea-di-microorganismi-tra-le-eccellenze-della-ricerca-europea

B.4 Microbes as biostimulants in Mediterranean plants: the effect of *Azospirillum baldaniorum* Sp245 in cuttings of olive (*Olea europaea* L., cultivar Leccino)

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Keywords: PGPR, bacterial biostimulant, agamic propagation, olive, semi-hardwood cuttings.

The research assesses the effectiveness of *Azospirillum baldaniorum* Sp245 in stimulating the induction processes related to adventitious root formation in the Leccino olive cultivar (*Olea europaea* L.). Semi-hardwood cuttings were collected at different sampling times and subjected to root-inductive treatments with *A. baldaniorum* strain Sp245 (AZO) and indole-3-butyric acid (IBA), the most employed synthetic auxin used in nursery production of olive plants. Histological assays were carried out to identify the main cellular changes leading to adventitious root formation. The adopted protocol allowed to identify the crucial histological events related to the emergence of root primordia within a few days of rooting treatments. *A. baldaniorum* Sp245 showed a strong attitude as biostimulant and as a potential alternative rooting inducer. In particular, the microscopic observations carried out up to 24 DAT with IBA and AZO allowed for identifying the phases leading to the formation of adventitious roots, as a function of rooting treatments, substrate type, and experimental seasons. The positive responses of semi-hardwood cuttings of Leccino cultivar to AZO provide the possibility of replacing IBA and develop perspectives in a context of organic nursery systems where alternative compounds, able to improve the rooting rate of cuttings, could substitute the non-permitted synthetic rooting agents.

B.5 Evaluation of multi-starter cultures to improve sparkling wine production

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Keywords: *Saccharomyces cerevisiae*, non-*Saccharomyces* yeasts, Champenoise method, sparkling wines.

The co-inoculum of a flocculent *Saccharomyces cerevisiae* (F6789) and *Torulaspora delbrueckii* (TB1) or *Starmerella bacillaris* (SB48) was used to shape the oenological and aroma characteristics of sparkling wines obtained with the Champenoise method. Sparkling wines produced with *S. cerevisiae* F6789 + *Starm. bacillaris* SB48 were characterized by the highest concentration of glycerol and free amino acids, suggesting a better autolytic potential of this strains' combination. Sparkling wines showed different aroma and sensory profiles. The sparkling wines obtained with *S. cerevisiae* as pure culture were characterized by the highest content of esters, followed by those obtained with *S. cerevisiae* +*T. delbrueckii* and *S. cerevisiae* + *Starm. bacillaris*. The sparkling wines produced with *S. cerevisiae* + *T. delbrueckii* had the highest concentrations of higher alcohols. The different aroma fingerprint reflected a diverse sensory profile. In fact, sparkling wines obtained with *S. cerevisiae* + *Starm. bacillaris* were well differentiated from the others due to their high score for the descriptor for spicy, bread crust, freshness and floral. *S. cerevisiae* + *T. delbrueckii* sparkling wines showed the highest scores for fruity.

The obtained results showed that the use of specialized non-*Saccharomyces* strains along with a selected *S. cerevisiae* strain may improve the autolysis during the aging and modulate sparkling wines' sensory profile. Therefore, well-selected non-*Saccharomyces* strains may be used in multispecies fermentations to valorize native grape cultivars to be used for sparkling wines production.

C.1 Genetic diversity of the endemic species *Q. trojana* Webb. in Southern Italy: case study of the National Biodiversity Future Center

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Keywords: *Q. trojana*, genetic diversity, fragmentation, gene flow, conservation.

Studying the genetic diversity and structure of the current forest populations is essential for evaluating the ability to survive future biotic and abiotic changes and planning conservation strategies. This is also in line with the objective of the National Biodiversity Future Center (NBFC), whose vision is to promote the sustainable management of Italian biodiversity at all its levels.

Quercus trojana Webb is an eastern Mediterranean tree species with a fragmented distribution range, and its westernmost outposts are located in Southern Italy. The demand for timber and cropland over the centuries has severely reduced its occurrence in this part of the range. In a previous preliminary work, we assessed, the genetic diversity and structure of 17 populations of *Q. trojana* by means of six polymorphic nuclear microsatellite markers. In the present study, within the NBFC project, we expanded the sampling to other 12 sites to cover the whole distribution area in Italy. We also increased the number of markers for the genotyping to 12 microsatellites. The aims of this research are: 1) to estimate the main genetic parameters for evaluating population genetic diversity and divergence 2) to detect fragmented areas 3) to identify valuable areas and reservoirs of genetic diversity, and 3) to provide guidelines for adequate measures to reestablish gene flow and reduce fragmentation. The ongoing results will be a useful tool for proposing suitable conservation and management programs for the species.

C.2 Ecological importance of *Parainocellia bicolor* (Costa, 1855) predator in vineyard agroecosystem

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Keywords: snakefly, Raphidioptera, ecosystem services, resilience, natural enemies.

The pest control carried out by natural enemies is one of the ecosystem services provided by biodiversity. This service is favored in vineyards by the presence of generalist predators such as *Parainocellia bicolor* (Costa, 1855) (Raphidioptera: Inocelliidae). The larvae are corticolous and represent the only predatory stage. The aim of this work was to investigate on bio-ethological aspects of *P. bicolor* larvae, specifically their distribution in the vineyard, as well as the structure of the overwintering larval population. Sampling was conducted in two organic vineyards (A and B) where previous surveys had shown the presence of *P. bicolor* larvae and also infestation by pest insect *P. ficus*. The analysis of the collected data revealed the spatial distribution of *P. bicolor* larvae in the respective vineyards. The average presence was 2.21 ± 1.89 larvae/plant in (A) and 1.71 ± 1.12 larvae/plant in (B). The larval density varied greatly, ranging from 0 to 8 larvae /plant (A) and from 0 to 4 larvae/plant (B). The larvae were well distributed in the vineyard, with only 17.86% of plants without larvae in both vineyards. The distribution was homogenous without significant differences between the adjacent rows. The structure of the overwintering larval population was composed by three distinct groups based on the measure of larvae head length. In conclusion, the presence of *P. bicolor* in the vineyard agroecosystem contributes to its' resilience against corticolous pests.

C.3 Assessment of Soil Biodiversity from different land use: preliminary research through QBS-ar approach in Sardinia Island

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Keywords: QBS-ar, soil quality, temporal dynamics, pedological propriety, microarthropods.

The lack of quantitative standardized data at a large scale has resulted in poor understanding of how soil biodiversity could be incorporated into legislation for the protection of soil quality. Among several indices developed in the last years, QBS-ar (Soil Biological Quality-arthropod) index joins the biodiversity of soil microarthropods community with the degree of soil vulnerability. In this study, data (n=140 samples) from 10 continuous years of QBS-ar measurements over 10 ecosystems of Sardinian were summarized to analyze the response of the index to climate and soil. Stepwise regression analysis indicated that, the QBS-ar decreased ($P<0.001$) with an increase in Temperature (R^2=-0.67) and Bulk density (R^2=-0.33); however, the index increased ($P<0.001$) with an increase in CSC, Organic carbon, Water content and Concentrations of nitrogen (R2=-0.43, -0.37, -0.25, -0.25, respectively). Analyzing the index as the number of taxa per sample shows different behaviors of the microfauna for land use (forest, cultivated and grazing area) and temporal phase (corresponding to phenological dynamics: T1 green, T2 dry and T3 regreen). Considering the importance of soil biodiversity to support the provision of ecosystem services, the ability to create knowledge on the diversity of microarthropod within soil biodiversity is a key to future environmental policy, optimization of land use and support for land management decisions, considering the loss and profits on soil biodiversity.

C.4 Ornithological diversity of the ecological network and the sheep tracks connecting Cervaro and Candelaro rivers (FG)

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Keywords: *Aves*, ecological network, agroecosystem, sheep tracks, biodiversity.

Aim of this work is to present first data on ornithological biodiversity of natural and agricultural areas of local ecological network and sheep-tracks located between the Cervaro and Candelaro rivers (province of Foggia, Italy). The study area is characterized by a large agricultural context, made up of non-irrigated arable land (cerealcrops), irrigated arable land (vegetables) and, to a lesser extent, vineyards and olive groves. In this context, characterized by small fragments of natural and semi-natural ecosystems (riparian woods, tree-lined stripsand old reforestation of *Eucalyptus* sp.), there are also important natural biotopes such as the forests and grasslands of the Bosco Incoronata Regional Natural Park (also Natura 2000 Site) and the wetlands and coastal lagoons of the Oasi Laguna del Re, both sites are also in Natura 2000 network.
From April to July 2023, 20 minutes sessions of bird watching and listening of 16 sampling points were carried out in order to detect the species and their numerical consistency. These data, associated with land use and presence of natural ecosystems and agroecosystems, was therefore used to calculate and compare ornithological biodiversity in the study area. The first results show evident differences in biodiversity according to the contexts under study.

C.5 *Xylella fastidiosa*, a (legal) threat to Salento's plant biodiversity

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Keywords: Mediterranean bush, plant biodiversity, phytosanitary legislation.

The term 'Mediterranean scrub' is understood to mean either evergreen shrub vegetation composed of tall sclerophylls with a closed or lower and sparse canopy structure, like garrigue. This vegetation, which represents one of the highest hotspots of plant biodiversity in the Mediterranean environment, can develop on various substrates with different thermophilous and mesophilous phytocoenoses and can be the result of the degradation of ancient Mediterranean forests or represent a pre-forest community, or more simply a permanent community of xerophilous plants. The plant species that characterise high scrubland are shrubs of the genera *Arbutus*, *Pistacia*, *Myrtus*, *Erica*, *Phillyrea*, *Cistus* and *Salvia*.

The present work intends to examine the positive findings of the disease, on which considerations are made, in some plant species included in the list of host plants of the bacterium *Xylella fastidiosa* subsp. *pauca* annexed to Commission Implementing Regulation (EU) 2021/2130 of 2.12.2021. Attention has been focused on the native species characteristic of the shrub phytocoenosis typical of the Mediterranean bush of southern Apulia (especially Salento), which in the aforementioned list are "notoriously susceptible to *Xylella fastidiosa*"; for them there is a ban on marketing and planting, and consequently the impossibility of using them in environmental restoration works.

Considering the quantitative and qualitative importance of the above-mentioned species in the structuration of this habitat and the low incidence of positive findings, the possibility of carrying out further analyses on the subject is suggested, to satisfy the great need for regeneration of the Salento's ecosystem.

C.6 Permaculture as a tool to safeguard biodiversity and farm workers' health

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Keywords: permaculture, natural farming, biodiversity, aqueous extracts, farm workers.

Permaculture has been defined *"the conscious design and maintenance of agriculturally productive ecosystems, which have the diversity, stability and resilience of natural ecosystems"*. It proposes a way of cultivating that pays attention to all living beings and their environment to preserve biodiversity and support the resource's regeneration by natural cycles. In this study, carried out on a hilly farm respecting the territory's biodiversity, the permaculture effects on agricultural production, and environmental protection, and on the agrarian workers' health were investigated. A cultivated permaculture soil and an organic were compared. The obtained results confirm that permaculture strengthens biodiversity (mixed cultivation of vegetables, fruit, herbs and flowers, green manure, cover crops, and plant intercropping to achieve the maximum synergistic and allelopathic effects) and increases soil fertility (improvement of the structure, increases the organic matter in the soil, the CO_2 capture, and increases microorganisms, meso, and macrofauna). In addition, to replace phytosanitary products and synthetic fertilizers, with consequent benefits for the environment, consumers, and farm workers, medicinal plants' self-produced aqueous extracts, crop protective, and phyto-stimulants, have been used.

C.7 Whole genome scan reveals genetic diversity of Tunisian durum wheat germplasm

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Keywords: durum wheat, landraces, SNP diversity, genetic distances, divergent loci, spike morphology.
Durum wheat landraces can be a useful resource to restore the genetic diversity of modern cultivars. Tunisia has several accessions kept in the National Genebank which are still unexplored. In this work, a panel of Tunisian durum landraces and modern cultivars were investigated using morphological descriptors and the Illumina iSelect 15K wheat SNP array to study the genetic relationships and discover divergent loci involved in Tunisian breeding history. A panel of 5,555 polymorphic SNPs was used to investigate the population structure, which identified wo landrace groups and one group of cultivars; this genetic structure was validated by AMOVA and diversity indices. A total of 529 SNP loci were found divergent between landraces and modern cultivars, and candidate genes related to plant and spike architecture were identified. Divergent genes related to grain composition and biotic stress (leucine-reach repeats proteins and disease resistance proteins) were also found, suggesting that Tunisian durum germplasm may represent an important source of favourable alleles that can be used in future durum breeding programs to develop resilient cultivars better adapted to the challenges of climate change.

C.8 Climate change and Agricultural Biodiversity in the Marche Region: studies and strategies

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Keywords: agriculture biodiversity, indicators, climate change, resilience, safeguarding.
The Industrial Revolution has brought significant transformations in agriculture, aimed at increasing productivity and selecting high-yielding plant varieties and animal breeds. However, this has resulted in a considerable loss of agricultural biodiversity. In the Marche Region, Regional Law No. 12 of June 3, 2003, "Protection of the animal and plant genetic resources of the Marche territory," was established to preserve native or to introduce genetic resources that have been living in the territory for at least fifty years. However, this law does not explicitly address the implications of climate change on agricultural biodiversity. This research analyzes the consequences of climate change on Agricultural Biodiversity in the Marche Region, with particular attention to the Regional Law, evaluating the climate impact on conservation policies. Climate change represents a significant challenge as it can put genetically threatened resources at risk of extinction, requiring the adoption of additional protection measures beyond those provided by the law. The protected plant varieties and animal breeds, such as the *Capra Facciuta*, *Agrumi del Piceno* and *Visciola di Cantiano*, which have been present in the Marche Region for over fifty years, have demonstrated remarkable resilience and substantially contribute to the identity of the territory. However, it is essential to understand the climate change impacts on their survival and to adopt appropriate safeguarding strategies to mitigate these threats. This research is meant to describe the species resilience by means of indicators, aiming to guide future interventions and policies for the effective preservation of at-risk genetic heritage.

C.9 Phytoalimurgical ecotypes detected in the 'Laguna del Re' wetland (FG): mapping, collection, nursery and cultivation

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Keywords: wetland, wild edible plants, peasant food.

In the past, wild edible plants were an extremely useful source of food to cope with recurrent famines and poor peasant conditions. Today, it is very important to preserve this cultural heritage due to the high nutraceutical value of these plants and their interesting genetic traits of excellent adaptation to local environmental constraints. The Laguna del Re is a coastal wetland of about 40 hectares in the Gulf of Manfredonia (FG), within the Gargano National Park. This area has recently been restored to its original wetland state through the reconstruction of canals and flooded areas. For this reason, it became a study area in the frame of the national AGRITECH project (WP7.3.3) to provide a showcase for several nature-based solutions. A 50 m mesh grid was superimposed on the land cover map to define a strategy for systematic surveying along defined and permanent transects. Surveys were carried out in spring 2023. For each species found, location, biological form, chorology, ecology and plant associations were defined. The following "focus species" were identified: P*ortulaca oleracea* L., *Cichorium intybus* L., *Beta vulgaris* L., *Salicornia fruticosa* L. *and Suaeda vera* J.F.Gmel. *Glycyrrhiza glabra* L. has been observed in other nearby wetlands, but not yet in the Laguna del Re. In any case, it has been included in the basket. The climate is distinctly Mediterranean, with pronounced semi-arid summer conditions, and the soil is saline-sodic with a predominantly clayey texture. Growing conditions are therefore very critical to plants. The research protocol also includes the following activities: seed collection, seedling nursery, transplanting and cultivation according to organic and regenerative methods.

C.10 Genomic and genetic diversity of the endemic Italian alder (*Alnus cordata* Loisel.) across its native range

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Keywords: *A. cordata*, genetic and genomic diversity, gene flow, conservation, landscape structure.

In line with the main objectives of the National Biodiversity Future Center (Spoke n. 4- "Ecosystem functions, services and solutions"), we focused our attention on the Italian alder (*Alnus cordata*), a Mediterranean endemic forest tree species of conservation and management interest, for which little information is available so far on the genetic diversity and adaptive potential of populations in its native range. According to the species distribution range, twenty-three natural populations of Italian alder were collected in three regions of Southern Italy: Campania, Basilicata and Calabria, for a total of 482 individuals. In this study, we aim to genotype all the sampled individuals of *Alnus cordata* with neutral microsatellite markers (SSRs) and to characterize patterns of genome-wide genetic diversity in a subset of samples covering the whole Italian distributional range, by means of a Whole Genome Sequencing (WGS) approach. Specifically, our objectives are (*i*) inferring and mapping the genetic structure of alder populations (*ii*) estimating intraspecific genetic diversity of the species, (*iii*) addressing the role of landscape on affecting gene flow between populations, (*iv*) searching for signatures of local adaptation to different environmental variables across different bioclimatic areas of Southern Apennines. We will also examine the extent of putative hybridization of *A. cordata* with the sympatric species *A. glutinosa*, and its impact on the genetic diversity and population structure of alder trees. Here, we present our preliminary data and discuss our results in the context of conservation and management of alder genetic resources in Italy.

C.11 Conservation of Crop Wild Relatives in Lebanon: Safeguarding Genetic Resources for Food Security in a Scenario of Climate Change

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Keywords: crop wild relatives, conservation, Lebanon, genetic reserves.

The growing recognition of conserving global biodiversity in the face of climate change underscores the importance of protecting plant diversities and habitats. Crop wild relatives (CWR) play a crucial role in ensuring food security and agricultural sustainability under environmental challenges. This study aims to assess the conservation status of CWR in Lebanon as a strategy to mitigate the impacts of climate change on food security and genetic diversity. We compiled a comprehensive list of 40 CWR taxa from *Aegilops*, *Avena*, *Triticum*, *Hordeum*, *Pisum*, *Lens*, and *Cicer* genera, essential for global food security. Occurrence data from Genesys, GBIF, and ICARDA genebank databases, along with field surveys conducted during 2022-2023, were used. We recorded data from 38 sites, detecting 345 new occurrence points for the mentioned genera. Notably, 12 sites for *Triticum dicoccoides*, 2 for *Triticum urartu*, and 1 for *Lens culinaris* subsp. *orientalis* were deemed critical for ex situ collections and in situ conservation. We added 12 accessions of *Triticum dicoccoides* and 2 accessions of *Triticum urartu* to ICARDA's genebank. Revisiting previous collection sites of *Triticum boeoticum* revealed one site with ongoing occurrence in 2023, while two new sites with large populations were identified. Our study highlights the importance of conserving CWR for global food security amid climate change. Future steps involve identifying suitable genetic reserves to safeguard genetic diversity for plant breeders.

C.12 Inclusion in EURISCO of records of in situ wild relatives of cultivated plants from the regions of Apulia and Basilicata (Southern Italy)

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Keywords: crop wild relatives - CWR, *in situ* conservation strategies, EURISCO database.

The wild relatives of domesticated plants (CWR), as well as species more or less closely related to them, represent an increasingly important resource for improving agricultural production (Bohra et al., 2021) and maintaining sustainable agroecosystems (Heywood et al. 2007), especially in the perspective of increasingly severe climate change (Mueller et al. 2021). In recent decades, considerable efforts have been made to collect and conserve CWR *ex situ*. More recently, both the scientific and agricultural communities have increased their focus on integrated or complementary conservation of CWR, with an emphasis on *in situ* conservation strategies. To maintain the diversity of wild populations suitable for crop improvement, these populations must thrive in their natural habitats and adapt to changing environmental conditions (Meilleur & Hodgkin 2004; Engels & Thormann 2020). CWRs native to Europe are related to many socioeconomically important crops and therefore represent important resources for maintaining food security and crop production in the region. Many EU countries have established national CWR checklists and priority lists and implemented national CWR conservation strategies and action plans (Labokas et al. 2018). Italy was recently included in the project "Extension of EURISCO for Crop Wild Relatives (CWR) *in situ* data and preparation of pilot countries' data sets". In this project, CWR populations belonging to 7 taxa were identified in the Apulia and Basilicata regions, based on data from the Mediterranean Germplasm Database (https://www.ibbr.cnr.it/mgd/), from the literature and through direct observations. *In situ* populations are mainly distributed in protected areas and national/regional parks and are monitored and assessed for conservation status. The information is collected and organized according to the guidelines of the EURISCO database.

C.13 Biodiversity of Plant Parasitic Nematodes associated with grapevine in Lombardy (Northern Italy)

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Keywords: grapevine, plant protection, plant parasitic nematodes, sustainable strategies, *Xiphinema*.
Soil nematode biodiversity is becoming an issue in ecological debates for of its important role in soil ecosystem functioning. In 2020-2023 a survey was carried out in Franciacorta vineyards in Lombardy in the framework of the project NemaGest. Soil samplings were conducted to assess the occurrence of *Xiphinema index*, as virus-vector of the Grapevine Fanleaf Virus (GFLV). Nematode extraction revealed the presence of different *Xiphinema* spp., numerically consistent. Morphological and molecular characterization confirmed the presence of *X. index* in all soil samples and the occurrence of other two nematode species, *X. pachtaicum* and *X. rivesi*, both belonging to *X. americanum* group. Furthermore, this study revealed the presence of other plant parasitic nematodes associated with grapevines. *Helicotylenchus* spp. were recorded in all samples at lower densities, while *Criconemoides* and *Pratylenchus* spp. occurred in few samples. This result clearly demonstrated that the characterization of nematodes associated with grapevine can be used as "in-situ bioindicators" of soil health helping researchers to identify proper sustainable control strategies.
NEMAGESTproject funded by Lombardy Region (Bando 2018 per Progetti di ricerca in campo agricolo e forestale – d.d.s. n. 4403 del 28/03/2018.

C.14 Biodiversity assessment of the habitat *Mediterranean Temporary Ponds 3170**. The case-study of the region Apulia (South East Italy)

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Keywords: Mediterranean temporary ponds; temporary communities; Apulia.
On the basis of the Habitat Directive 92/43 1992, the Mediterranean Temporary Ponds (MTP, cod. 3170*) are considered of particular interest for the biodiversity presence and for its vulnerability. The flora is characterized by species belonging to the phytosociologic association *Isoeto-Nanojuncetea*. In a study of 2011, 37 species of such an association were recognized among the 171 species found in a total of 20 Apulian MTPs 3170*. Already that study recognized a certain interest also for faunal aspects. Following that suggestion, the present study proposes an analysis of the Apulian MTP 3170* biodiversity, carried out on a total of 47 sites. A total of 48 animal aquatic taxa have been identified at the minimum taxonomic level of family in 27 flooded ponds. A preliminary statistical analysis (nMDS + PERMANOVA) demonstrated how (notwithstanding the rough taxonomical grouping) the structure of animal communities had not any relationship with the habitat classification, nor with the geographical localization of sites MTP 3170*. In addition, with the exclusion of some sites distinguishable on the basis of abiotic features, the aquatic animal communities clustered accordingly three main groups, but no one of these can be considered completely internal to the habitat MTP 3170*. Consequently to this result, a dataset more detailed is necessary, other than a comparison with past investigations. The present data, however, already allow us to consider as insufficient the classification of MTP 3170* exclusively funded on flora, and the merging of flora with fauna data will be able to allow a better monitoring and protection plan dedicated to MTP 3170*, other than a better identification of the possible many habitats today present under a unique definition.

C.15 (Bio)diversity as a resource for sustainable social environments

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Keywords: human diversity, social inclusion, disability, social farming, microgreens.

A case history will be presented of (bio)diversity exploitation. The program *Utilità marginale* (i.e.: *Marginal utility*) pursued the aim of social inclusion of persons with intellectual disability involved in social farming carried out on abandoned croplands in the peri-urban area of Lecce. Cultivation of ancient crops (saffron), underutilized crops (Jerusalem artichoke) and innovative crops (microgreens of several species, included local landraces) granted job and training opportunities to a group of 22 young adults with disability. A wide network of stakeholders including parents, clients, restaurants, suppliers took part to a network of relationships in which participants were involved.
The program is proposed ad a possible model to combine biodiversity exploitation, abandoned croplands recovery, and social inclusion of human diversity, in view of sustainable social environments.

C.16 Sensitivity of *Mytilus galloprovincialis* hemocytes motility to environmental chemical contamination: implication for the development of a novel bioassay for environmental quality assessment

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Keywords: *Mytilus galloprovincialis,* biomarker, pollution, hemocytes, biomonitoring.

Pollution is recognized as one of the major pressures driving biodiversity loss, particularly in coastal areas because of the high anthropogenic use of the coastal habitats. The assessment of the entity of the organism's exposure to pollutants in a certain environment and the extent of the induced ecotoxicological effects is of pivotal importance for decision-making related to habitat and species protection. The present work aimed to study the sensitivity of immune cell motility to environmental chemical contamination in the bioindicator organism *Mytilus galloprovincialis* in view of the development of a sensitive bioassay for the early detection of the subtle effects of pollution in aquatic organisms. We developed a cell motility assay for testing the ecotoxicity of aqueous environmental samples on hemocytes adhering to the bottom of a 96-well microplate. Hemocytes were exposed for 1h to the elutriates of sediments sampled from 6 sites along the coast of the Salento Peninsula (Italy), two control sites, and four anthropogenically impacted sites. Cell motility was quantified by cell tracking under timelapse microscopy imaging. Significant alterations in cell velocity and trajectory directness in the cells exposed to the elutriates of sediments from impacted sites were observed. The obtained results demonstrated the sensitivity of hemocyte motility to environmental chemical contamination and highlight its suitability for the development of an ecotoxicological bioassay suitable for biomonitoring and environmental assessment applications. Considering that motility is a general basic characteristic of all immune cells, the obtained results pave the way for further application of immune cell motility alterations also in other species, including endangered species.

C.17 Opportunity for the spontaneous plants of the National Park of Cilento, Vallo di Diano, Alburni

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Keywords: biodiversity, erosion, water resource conservation, new products, ecosystem services.

The experimentation was conducted in the period 2021-23 in a farm representative of a hilly area of the NCVDA Park, cultivated with olive trees and characterized by a very high average slope (40%), sandy clayey soil with a high presence of skeleton. In the spring period of the first year, the reconnaissance of the plant communities present was carried out according to the Braun-Blanquet phytosociological method. 60 species have been identified and among these, 6 were chosen which were deemed most suitable for overseeding in the following years. Conservative interventions, such as grassing, have effect on the physical properties of the soil by improving its structure and therefore the water reserve, the defense from erosion, microbiological activity, the root growth, the increase in plant biodiversity. The vegetation cover and the water content were evaluated in the following years, in comparison with the soil subjected to traditional tillage. Among the species, *Sanguisorba minor* Scop. recorded a high settlement capacity. Furthermore, in spring 2021, the transplantation of oregano seedlings (*Origanum heracleoticum* L.) was carried out, reproduced from seed collected from native plants and multiplied at the COVIMER nursery (Battipaglia, SA), in order to optimize the vegetation cover in the slopes, favor pollinators, offer new company products with high territoriality.

D.1 Micropropagation of *Viola ucriana* Erben & Raimondo a critically endangered taxon for the Mediterranean region

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Keywords: biodiversity conservation, micropropagation, *Viola ucrìana*.

Plant tissue culture is a technique in which plant cells, tissues or organs are isolated from mother plants and growth on artificial media. It is a powerful tool that could be used not only for micropropagation of crops, decorative plants, and production of metabolites but also for biodiversity conservation purposes. *In-vitro* conservation, based on micropropagation, is considered as one of the most efficient methods for *ex-situ* conservation. Moreover, it could be considered strategic for preventing biodiversity losses and for reinforcing populations in regions of the word known to be rich in biodiversity like Mediterranean area. In particular, this region is rich of endemic plants species that evolve differently to adapt better to a specific environment. For this reason, it has been recognized as one of the first 25 Global Biodiversity Hotspots. Unfortunately, the biodiversity of this region is threatened by human activity. One example is represented by *Viola ucriana*. Ucria's violet is a rare plant which has been recognized as Critically Endangered Species according to International Union Conservation for Nature (IUCN) Red List Criteria. In addition, it is included in the top 50 of the threatened plant species of Mediterranean islands. Ucria's violet appear to be near to the extinction and preservation measures are needed. Shoot tips were obtained from germinated seeds collected near the peak of Mt. Pizzuta (Palermo, Sicily) and successfully sub-cultured *in-vitro*. We developed an efficient micropropagation protocol for Ucria's in which we combined the use of two different plant growth regulators (BAP and Zeatin) at different concentration. This protocol increased the laboratory plants population but a specific concentration of Auxin was needed to produce plants with a complete developed root apparatus. The protocol permitted us to produce well developed plant useful for reintroduction and translocation activity. The first trial will take place in Autumn in the University of Salento botanical garden.

D.2 A multidisciplinary approach for studying the invasion mechanisms of the alien tree species *Ailanthus altissim*a (Mill.) Swingle

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Keywords: invasive species, remote sensing, C and N stable isotopes, metagenomic analysis, microbiome.

Ailanthus altissima is a fast growing species, originating in Asia, introduced in Europe for ornamental purposes in the second half of the 18th century. It is currently considered as one of the most invasive woody plant in Europe, so as to be included in the list of invasive alien species of European Union concern. This species shows a strong pioneering character, easily adapting to a wide range of urban, rural and forest ecosystems; it has spread widely in temperate and Mediterranean regions of the world. Winged seeds dispersion, numerous root suckers, as well as adaptability to different soil types and water regimes, have favored the spread of *A. altissima*, especially in disturbed areas along roads. It also threatens biodiversity through competition, population reduction and habitat modification. Effective management and control of such species is needed to reduce the pressure on ecosystem and limit further spread. Within the frame of the CNR-funded USEit project (Use of operational synergies for the integrated management of invasive alien species in Italy), we used a multidisciplinary approach for investigating *A. altissima:* we selected several pilot experimental sites across central and southern Italy, with the following aims: i) detecting and mapping the spatial distribution by GIS and remote sensing; ii) investigating the symbiotic relationships between *A. altissima* and associated mycorrhizae by means of stable isotopes techniques; iii) understanding the role of microbiomes in the Evolution of Increased Competitive Capacity (EICA) of *A. altissima* by metagenomic sequencing analysis of bacterial and fungal communities colonizing the root system of *A. altissima.* The original results of this study will be discussed in the frame of the current state of the art of *A. altissima* mechanisms of invasiveness.

D.3 Characterization of the olive endophytic community in genotypes displaying a contrasting response to *Xylella fastidiosa*

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Keywords: ecological role, metabarcoding, olive cultivars, *Phaffia*, *Rhodotorula*.

Xylella fastidiosa subsp. *pauca* is a highly virulent pathogen that causes Olive Quick Decline Syndrome (OQDS), which is currently devastating olive plantations in Apulia region (Southern Italy).
To investigate this issue, we delved into the bacterial and fungal endophytic communities of *Olea europaea* L. trees sampled from groves severely affected by the pathogen. Our focus was to understand the microbiota role in genotypes with varying pathogen responses. Endophytes play a pivotal role in mediating interactions between plants and other microorganisms. The functional aspects of these interactions, which support plant-growth promotion and tolerance to stresses, signify the ecological relevance of the endosphere microbiome. Our results indicate that the fungal endophytic community played a more prominent role compared to the bacterial one with the presence of specific microbial taxa clearly associated with asymptomatic or paucisymptomatic genotypes. Moreover, we identified well-adapted genetic resources that have survived years of pathogen pressure and are associated with microorganisms such as *Burkholderia*, *Quambalaria*, *Phaffia*, and *Rhodotorula*. These findings represent a crucial starting point in understanding how plants act in defence against *X. fastidiosa* subsp. *pauca* in infected areas, and how these genetic resources could be used to improve the biodiversity of the infected area.

D.4 New evidence for population-specific responses to drought events from tree ring chronologies of *Pinus nigra* ssp. *laricio* across the entire distribution range

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Keywords: climate-growth model, conifer forests, drought resilience, tree rings.

Drought periods are becoming more frequent and extended worldwide due to global warming. Greater intensity, frequency and duration of drought negatively affects radial tree growth, particularly in drought-prone regions, such as the Mediterranean. Geographical and climatology variability that characterizes the Mediterranean Basin can determine different growth responses to the climate in populations of the same species. In this study, we analysed growth-climate relationships and growth responses to drought events (i.e., resistance, recovery, and resilience) in 13 forest stands of black pine (*Pinus nigra* Arnold), encompassing the whole and peculiar distribution range of the ssp. *laricio* (Calabria, Sicily, Sardinia, and Corsica). Analysis focused on the 1981–2010 period, which is commonly covered at all sites. Stem radial growth of trees increased under a positive spring/summer water balance. However, abundant winter precipitation had a negative impact on stem radial growth. Populations in Corsica were more sensitive to drought, showing lower resistance and resilience than those in Sicily and Sardinia. Older trees were more resistant to drought events than younger trees. Our results highlight that population-specific responses to drought events are mainly explained by tree age and local environment, suggesting geographically related patterns in tree growth and forest productivity correspond to different populations. Intraspecific variability in sensitivity to drought events should be included in species distribution models to predict the range of forest productivity responses to climate change.

D.5 A Regional Strategy for the Conservation of the Endangered Native Crayfish *Austropotamobius pallipes* in Lombardy, Italy

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Keywords: endangered biodiversity, alien species, native crayfish, conservation stategy.

The freshwater crayfish (*Austropotamobius pallipes*) is an "endangered" species according to IUCN, and the Italian subspecies are at risk of extinction. The main threats (which add up to others such as, e.g., the fragmentation of habitats, the introduction of salmonids into streams and water pollution) come from the invasions of alien crayfish species and the diseases they carry, in particular the crayfish plague (*Aphanomyces astaci*). For these reasons in Lombardy, within the framework of various LIFE projects, a conservation strategy for *A. pallipes* has been developed. It is aimed at maintaining a healthy metapopulation in the Natura 2000 sites of the piedmont and alpine area, preventing its contact with alien crayfish that have invaded the lowland area and, consequently, with the disease they carry. The strategy needs to be based on various actions: (1) the monitoring of native and alien crayfish populations, in order to maintain an updated knowledge of their distribution and to identify potential contact areas; (2) support to *A. pallipes* populations, with actions including habitat restoration, restocking of populations where necessary, possible reintroduction of the species in case of local extinctions; (3) containment and localized eradication of invasive alien species where their distribution range is expanding towards native crayfish populations; (4) raising awareness about correct human behaviors to be adopted to prevent the species from being at risk. The strategy must also deal with climate change, and, thus, a continuous flow of information is necessary for future planning to that effect.

D.6 Alien ambrosia beetles (Coleoptera: Curculionidae, Scolytinae and Platypodinae) in Italian Natural Protected Areas: a National Biodiversity Future Centre (NBFC) research study

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Keywords: invasive alien species, ambrosia beetles, beetle native community, natural protected areas.

The introduction of invasive alien species, a phenomenon compounded by climate change, negatively impacts native biodiversity. The magnitude of this threat is increasing globally and, considering the Mediterranean region, frequent arrival of new non-indigenous ambrosia beetles (AB) species (Coleoptera: Curculionidae, Scolytinae and Platypodinae) has caused great concern, turning into a priority issue. This three-year PhD study, as part of National Biodiversity Future Center Project, aims to determine the species composition of AB in low and high naturality degree ecosystems dominated by *Fagus sylvatica* L. and to assess their impact on biocenosis in Natural Protected Areas (PAs) in Italy. This study also aims to evaluate the efficiency of PAs zoning strategies in the management of invasive AB by determining the species diversity and community structure of beetles. From March to October of each year, we will deploy ethanol baited Multifunnel traps on the plants at 2 m height in beech forests. Traps will be inspected fortnightly for samples collection and ethanol lure replacement. This research study will provide an overview of the current status of AB species in protected beech forests and estimate the population density trends over time. Furthermore, the results will contribute to a better understanding of the possible consequences of invasive AB on native beetle communities in ecosystems of interest within areas managed for the conservation of indigenous biodiversity.

E.1 Volatile oil composition of aerial parts and fruits of a local ecotype of parsley from the province of Trento, Italy

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Keywords: *Petroselinum crispum,* ecotype, volatile oil.

A local ecotype of parsley of the province of Trento, Italy, was compared with two commercial cultivars, Comune 2 and Gigante d'Italia, for the composition of volatile oils obtained both from aerial parts and fruits. Investigated accessions were cultivated in open field conditions during the years 2019-2020, according to a randomized block design with 3 replications per accession. Volatiles were extracted by hydrodistillation from fresh aerial parts and dry fruits, harvested respectively at the first and second year of cultivation. The qualitative and quantitative relative composition of the volatile fraction were determined by GC/FID and GC/MS. A total of 22 and 16 compounds were detected in all accessions in the volatile fractions obtained from aerial parts and fruits, respectively. With regard to the aerial parts, the main components among investigated accessions were 1,3,8-p-menthatriene (64.25%), limonene (9.12%) and β-myrcene (4.59%), while apiole (45.38%), myristicin (31.98%) and 1-allyl-2,3,4,5-tetramethoxybenzene (9.40%) were the most abundant ones in fruits. The aerial parts of the local ecotype had the highest relative amount of 1,3,8-p-menthatriene (78.42%), a compound known for its contribution in the definition of parsley aroma, and the lowest of apiole (0.05%), a compound with known for its possible toxic properties, while its fruits had the lowest content of 1-allyl-2,3,4,5-tetramethoxybenzene (0.50%) and did not differ from the commercial cultivars for the content of apiole and myristicin. The local ecotype resulted interesting for its consumption as fresh herb, due to the volatile oil composition which contributes in defining the quality of its aerial parts.

E.2 From Campania, a rediscovered identity: the "new" historic vines

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Keywords: biodiversity, autochthonous vines, historicity, known varieties, vine domestication.

In 2023, the sending of registration applications of twelve autochthonous vines to the "National Register of vine varieties and clones" (RNVV) at MASAF represents an important step in the process carried out over the last five years for the protection and sustainability use of viticultural Biodiversity in Campania, realized thanks to the projects "RGV-FAO for the conservation, characterization, use and enhancement of plant genetic resources for food and agriculture" and BAS-VO (CNR) about "historic agricultural Biodiversity". The twelve autochthonous vines, candidates for registration as "known" wine grape varieties, were discovered and tuned up, that is morphologically and phenologically characterized, directly in the retrieval sites, from the Gulf of Policastro (Salerno) to the Sorrento Peninsula (Naples), along the road from the Caserta hills and the plain south of the Volturno basin to the slopes of the Taburno Camposauro massif in the Beneventano area. The historicity of *Arulo*, *Castagnara*, *Racina piccola*, *Reginella*, *Sabato*, *Suppezza*, *Tennecchia* and *Tesola*, with black berries, and *Agostina*, *Cocozza*, *Ingannapastore* and *Uva Urmo*, with white berries (these are the varietal denominations found and proposed), is described in this work on the basis of historical-archaeological sources, oral testimonies of the custodian winegrowers and in relation to their exclusive Italic origin, in geographical areas delimited by the borders of that wider area of central-southern Italy which from the second half of the 14th century BC stands out as the third center of vine domestication.

E.3 Combining cultural ecosystem services and biodiversity conservation in planning and management of the "Laguna del Re" Wetland (FG-Italy)

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Keywords: wetland, cultural ecosystem services, biodiversity, recreation, bird species.

The combination of semi-natural spaces and cultural practices reinforces each other and creates cultural benefits for human well-being, resulting in so-called cultural ecosystem services (CES), which are often undervalued in land planning and management. Our research focused on the relationships between CES and biodiversity in the "Laguna del Re" wetland (Gulf of Manfredonia), the result of a LIFE project to restore a typical transitional coastal environment, with flooded areas and dry land, also for agricultural use, equipped with structures to promote birdwatching and recreation. Since May 2022, a questionnaire survey has been carried out among visitors to investigate their reasons for visiting, their perceptions of the ecosystem services in the area, and their needs in terms of CES. To investigate the relationships between CES and biodiversity, transect bird censuses have been carried out over the years and seasons, starting in 2019. We observed a positive trend in wintering and nesting bird species typical of both agroecosystems and wetlands. These naturalistic data correlate well with visitor responses on the use of wetland services and the most attractive wetland features. The results show that the main reasons for visiting are landscape aesthetics and biodiversity; the preferred landscape is the mosaic of habitats rather than a single habitat type. This clearly indicates that visitors have a strong affection for natural systems and a high level of awareness of the importance of biodiversity. The questionnaire also defined a socio-cultural profile of the 'normal' visitor. In general, the results show that wetland restoration, low-intensity agriculture and nature-based solutions not only play an important role in conserving biodiversity, but also in providing CES, which in turn can guide decision-makers in identifying priorities for planning and management.

E.4 Exploring biodiversity through EcoLogicaCup: a national online competition for schools

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Keywords: biodiversity, e-education, schools, sustainability.

Today science and scientific methodologies cannot be limited to the small percentage of science students in schools: all students must understand these processes and the part they will play in the future. Moreover, ecological topics, such as biodiversity and sustainability, give rise to much interest in many scientific and non-scientific areas, although they are only marginally covered at school. Here, an innovative tool to teach biodiversity and other ecological topics at school is shown to awaken students and public opinion to problems regarding the health of our Biosphere. EcoLogicaCup is the first national online competition on ecological issues for primary and secondary school students in Italy (https://training.lifewatchitaly.eu/en/education-and-schools-2/ecologicacup/). Students explore in depth ecological topics available on the platform, they do online tests to pass the first selections and finally compete with other schools on ecological subjects such as biodiversity, climate change, ecology of lagoons, sustainability. EcoLogicaCup generated much interest: overall about 800 students, organized in teams, from primary and secondary schools in Italy, participated in last edition. The winners had the opportunity to participate in laboratory activities in the Botanical Garden of UniSalento to discover and explore plant biodiversity. EcoLogicaCup contributes to stimulating the interest and the curiosity of young people about biodiversity and ecology, as well as making students aware of the importance of biodiversity and the role they can play in preserving biodiversity.

E.5 Characterization of elephant garlic (*Allium ampeloprasum* L.) ecotypes for use as potential gourmet product: morphology, production and antioxidant activity

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Keywords: biodiversity, garlic, vegetable, by-product, circular economy.

Allium ampeloprasum L. is at risk of extinction due to the drastic reduction of the areas cultivated with local ecotypes. In order to valorize the local biodiversity, a randomized two-year study was conducted on the characterization of 12 ecotypes ('Gravina 3', 'Altamura 2', 'S. Paolo Albanese', 'Poggiorsini 2', 'Irsina', 'Lecce','Lavello', 'Pisticci', 'Ispica', 'Aglione della Valdichiana', 'Palomonte 1' and 'Contursi Terme') come from 5 geographical origins, by evaluating the morphology, production and antiradical activity. The highest plant height was obtained by 'Contursi Terme' with a mean value of 59.5 cm. The highest leaf area, neck thickness, yield and bulb weight, were reached by 'Ispica', with a value of 750 cm^2 $plant^{-1}$, 20.7 mm, 8.5 t ha^{-1} and 129.5 g, respectively. Approximately, 45% of the flowering scape, considered as a by-product, can be use in gastronomy. 'Contursi Terme' gave the best results and obtained the highest weight, height and thickness of the scape with a value of 41.8 g, 68.8 cm and 9.1 mm, respectively. The ecotypes had IC_{50} values ranging between 2.1 to 56.0 mg mL^{-1}. The recovery of local ecotypes could increase the income of rural companies and obtain new gourmet products with high health-promoting effect.

E.6 Traditional Apulian fermented products and Apulian typical raw materials of interest for the design of new fermented foods and beverages

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Keywords: fermentation, sustainability, innovation, tradition.

The production of fermented foods and beverages represents one of the strategies to improve the environmental, social and economic sustainability of regional food systems. In fact, the fermentation processes, particularly when controlled, require low energy inputs, valorise 'microbiodiversity', improve nutritional/functional quality and ensure higher safety standards. In regional contexts, *i)* optimizing the management of microbial resources for the production of traditional fermented products and *ii)* the design of new fermented foods associated with typical raw materials represent elements of strategic planning to improve sustainability, food sovereignty and promote gastronomic heritage. Here, we report a thematic case study, using Puglia (Southern Italy) as a model region, proposing an overview of the traditional fermented products and typical raw materials of interest for the design of new fermented foods and beverages. It is of particular interest to underline how the fermentation cross-over strategies represent a driver of innovation between these two contexts, envisaging the transfer of microorganisms from one traditional fermentation process onto a new substrate. The activities are performed in the framework of the ongoing projects 'AGRITECH' and 'ONFOODS' financed by the European Commission's Next Generation EU programme - Italian National Recovery and Resilience Plan (NRRP) projects.

E.7 The health properties of the historical grapes of the " Beneventan rays training system"

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Keywords: grapes, polyphenols, antioxidant activity, biodiversity, health.

The "Beneventan rays training system" is a typical traditional practice that has characterized the territory of the same name from a landscape point of view over the millennia. As part of the projects "RGV-FAO for the study, identification and recovery of grape germplasm" and "BAS-VO (CNR) on "historic agricultural biodiversity", it was possible to rediscover some of the autochthonous vines that are still cultivated today with this form of cultivation that gives an optimal development of the plant, suitable for the environment, and consequently health and quality to the grapes. This work evaluated the health properties of six "Beneventan rays training system" vines: *Arulo (Vernaccia d'Arulo)*, *Tennecchia (Tentiglia)*, *Tesola (Vernaccia di Vigna)*, with black grapes, and *Agostina*, *Cocozza*, and *Uva Urmo*, with white grapes. The total polyphenols were measured in the skins of these vines, and the total anthocyanin content was evaluated for the coloured berried grapes. These secondary plant metabolites are known for their beneficial effects on human health. Their chemical structure is responsible for their ability to neutralize free radicals, which, if present in excess, cause many pathologies. In this work, therefore, the antioxidant capacity of polyphenolic extracts of the grapes under study was evaluated using two tests: DPPH and ORAC. The results demonstrate that these historic grapes of the " Beneventan rays training system" are excellent sources of bioactive compounds and, therefore, worthy of recognition for the sustainable use of Campania's viticultural biodiversity.

E.8 Germination responses of *Cakile maritima* population from Puglia region

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Keywords: Halophytes, stratification, scarification, seed dormancy, salinity

Sea rocket, *Cakile maritima* Scop. is an annual succulent halophyte considered a promising species for domestication, however, its propagation needs specific investigations. Using freshly harvested (FH) (2022) and after-ripened (AR) (2020) fruits of plants from Margherita di Savoia (MdS) (BAT -Italy), germination tests were performed on a) seeds and b) chemically scarified siliques. No germination was observed. Therefore, intact AR and FH siliques were stratified (Sept. 2022-May 2023) A portion of FH siliques was maintained in saline water (EC 36,3 mS cm^{-1}) (FHs) before stratification. Plantlets' emergence started 175 days after the beginning of the stratification (DAS). The highest emergence was observed with AR seeds (69.3%) reaching 99% of this value (T99) close to 62 DAS. The FH seeds highlighted lower germination (32.6%) which occurred within 44 days (T99). For FHs treatment, only 20.8% of the seeds germinated with a slower pattern (T99=64.7 days). These results demonstrate that the after-ripening did not improve the germination of *C. maritima* seeds, however, it seems crucial for dormancy release as, after moist stratification, AR seeds exhibited higher germination compared to FH ones. Temporary saline stress imposed on FH siliques seems to exacerbate seed dormancy. This study was carried out within the Agritech National Research Center and received funding from the European Union Next-GenerationEU (PIANO NAZIONALE DI RIPRESA E RESILIENZA (PNRR) – MISSIONE 4 COMPONENTE 2, INVESTIMENTO 1.4 – D.D. 1032 17/06/2022, CN00000022). This manuscript reflects only the authors' views and opinions, neither the European Union nor the European Commission can be considered responsible for them

F.1 Directing funds towards the biodiversity objectives: the approach of Life IP Gestire 2020 in Lombardy

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Keywords: complementary funds, RDP, life programme, Natura2000.

The Life IP Gestire 2020 (Gestire2020) is active since the 2016 and it is aimed at the improvement of the conditions of biodiversity in Lombardy (Italy). Considering the size of the territory (the entire Region, almost 25,000 square meters), the social complexity (about 10 million inhabitants) and the environmental characteristics (246 Natura2000 sites in a highly urbanized and industrialized area with a predominantly of the intensive agriculture), Gestire2020 exploits the complementary funds, in addition to those made available through the Life program. Complementary funds include all those funds (both local, regional and European) which can directly or indirectly contribute to the improvement of the conservation status of biodiversity. To do this Gestire2020 makes use of technical facilitators (TF) with the task of helping the managing bodies of protected areas, farmers and any other stakeholder to participate in tenders for the implementation of projects. During almost 8 years (Gestire2020 will finish at the end of 2023) the TF have produced more than 400 projects, for an amount of around 50 million €. Many of these have already been financed and many other are still in the preliminary phase. In parallel, the Gestire2020 staff works closely with the management authorities of regional and private funds, collaborating with them with the objective of making the tenders more effective and attractive. This contribution also concerns the consultancy activity for regional policies which involves the new European policies 2023-2027, particularly the Rural Development Programme (RDP). This innovative approach has been appreciated by stakeholders who have found it as a useful tool to fill gaps and deficiencies. Strengths and weaknesses will be exploited for the next activities, starting from 2024, through the future NatConnect2030 project.

G.1 Study of the effects of polyethylene terephthalate (PET) nanoplastics on the motile behavior of the marine organism *Artemia franciscana*

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Keywords: *Artemia franciscana,* PET, nanoplastics**,** motility, behavior, biomarker, biomonitoring.

Micro and nanoplastics (MPs/NPs) have become a priority issue in recent years due to their presence and accumulation in all environmental matrices. The study of the responses of the organisms to these emerging contaminants and the assessment of the impact that they exert on biota is of pivotal importance for supporting biodiversity conservation strategies. The present work aims to study the effects of polyethylene terephthalate (PET) NPs on the motility of mesozooplankton, using *Artemia franciscana* as a model organism. This species is a mesozooplanctonic organism widely used in ecotoxicological studies. Specimens of *A. franciscana*, both adults and neonates, were exposed to polyethylene terephthalate (PET) environmentally relevant model NPs, produced by means of a fast top-down approach based on mechanical fragmentation, similar to the mechanical abrasion of microplastics occurring in the aquatic environment. Behavior analysis of the organisms exposed for 24 and 48h to PET NPs was performed using a cell phone camera employing image recognition protocols for automated analysis, allowing real-time integration of behavioral recordings with measurements of physiological outcomes during exposure to PET NPs. It makes possible to directly "on field" monitor Artemia movements and behavior. PET NPs exerted a significant impact on the motile behavior of the studied organism represented by alterations in velocity and trajectories. The results highlight the potential impact that PET NP litter can exert on marine mesozooplancton and open the way for future perspectives in the development of user-friendly microscopy for the study of the effect of nanoplastics in *in field* biomonitoring applications.

G.2 First observations of the pearlfish *Carapus acus* (Brünnich, 1768) symbiotic with sea cucumbers in the Southern Adriatic Sea (Salento peninsula, Southern Italy)

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Keywords: *Holothuria tubulosa*, Mediterranean Sea, Salento peninsula, Commensalism, Conservation

The Salento peninsula, in southern Italy (Mediterranean Sea), is a strip of land in the middle of the Adriatic and the Ionian Seas, both characterized by peculiar currents, different geological and physical background, and a quite diversified fauna. Along this area, a study aimed to investigate the spatial distribution of marine microplastics and its interaction with benthic organisms and specimens of the sea cucumber *Holothuria tubulosa* (Echinodermata) were collected at four stations (two in the Adriatic Sea, two in the Ionian Sea) in spring and autumn 2020. In this context, five specimens of the commensal pearlfish *Carapus acus* (Brünnich, 1768) were found in the back intestine of four *H. tubulosa* collected in autumn at "Grotta Verde" at Marina di Andrano (Lecce). Three out of seven sea cucumbers hosted one pearlfish each, whereas a fourth cucumber simultaneously hosted two symbiotic fishes. Morphometric analyses of fishes recorded total length ranging from 5.9 to 17.9 cm, with an average of 9.73 ± 4.84 cm, while weight ranged from 0.08 to 0.34 g, with an average of 0.22 ± 0.10 g. To our knowledge, this represents the first report of *C. acus* in Apulian waters; apparently, the recorded association with *H. tubulosa* is less common than that with another holoturian, i.e., *Parastichopus regalis*. The current findings - at a single station and in one season only - are not trivial, delivering baseline information for conservation purposes and for determining levels of protection and uses of coastal areas within the Marine Protected Area "Capo d'Otranto - Grotte Zinzulusa and Romanelli - Capo di Leuca".

G.3 Abundance of European turtle dove (*Streptopelia turtur*) in Apulia

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Keywords: European turtle dove, abundance, monitoring, management, hunting.

The European turtle dove (*Streptopelia turtur*) is a migratory bird species that arrives in Apulia in Spring to nest. Its presence has a strong managerial interest as, despite being in an unfavorable state of conservation, it can be hunted in the month of September. Both on a continental and national level, Action Plans have recently been implemented to bring the species back to a satisfactory state of conservation, in balance with sustainable hunting management also through the conservation and increase of the national and international population in transit through Italy, to balance the impact of agricultural practices and hunting. The starting point of this action is the monitoring of the abundance of the species, also delegated to the individual regions. For Apulia, there is recent information on the distribution (Atlas of Breeding Birds in Italy) and trends (Farmland Bird Index - FBI) of breeding pairs, but not on their abundance. The sampling plan adopted for the FBI calculation was specially intensified to obtain a more homogeneous coverage of the sampling points and therefore to calculate the average density and to estimate the abundance of the breeding population at the regional level. The preliminary results collected in Apulia provide an estimate of the density of about 0.21 specimens every 10 listening stations and of a number of nesting specimens equal to about 1,600-1,685.

G.4 Biodiversity patterns in marine annelids associated to intertidal coralline algae along the Salento Peninsula

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Keywords: marine annelids, intertidal area, coralline algae, Salento peninsula.

The Salento Peninsula is the eastern-most region of the Italian Peninsula and, due to its geographical position, represents a boundary between the western and the eastern Mediterranean Sea. Within the frame of the project MAPWORMS, intertidal coralline algae were sampled along the whole Salento coastline in six sites (three on the western coast, three on the eastern coast) and the annelid fauna associated was characterized to the species level. Overall, 39 species of annelids were retrieved, two of which [*Dorvillea similis* (Crossland, 1924) and *Pseudonereis anomala* Gravier, 1899] are considered Lessepsian invaders in the Mediterranean Sea and are recorded for the first time for the study area. Univariate and multivariate analyses failed in identifying significant differences between the two sides of the peninsula, while significant differences were retrieved between sites within the same side of the peninsula, suggesting that processes occurring at lower spatial scales might be more relevant in shaping the distribution and diversity of intertidal marine annelids.