CITAB

Centre for the Research and Technology of Agro-Environmental and Biological Sciences

2025

RESEARCH CHALLENGES

GROUP MEETINGS

FEBRUARY 12TH

https://www.citab.utad.pt/

R&D1 – NATURAL RESOURCES, BIODIVERSITY & CLIMATE CHALLENGES

Operational groups:

KR&D1 is devoted to the **interplay between climate, water, soil, landscape management, and agroecology & biodiversity**, aiming to develop **sustainable natural resource management strategies** while enhancing **ecosystem services (ES) and biodiversity conservation**. These objectives align with multiple **Sustainable Development Goals (SDGs)**, reinforcing **resilient agrarian value chains** and ecosystem health, and fostering synergies with **R&D2 and T&I**.

The **specific activities for R&D1 are structured** across the **following thematic areas**:

Climate Research

Addressing **climate change impacts** through **modelling, projections, impact assessment, and risk analysis**, this research seeks to:

- Assess the implications of climate change on **natural resources, agrarian value chains, and ecosystems**.
- Develop **adaptive strategies** that enhance agroecosystem resilience and **safeguard human health**.

R&D1 focuses on addressing climate change impacts through **modelling, projections, impact assessment, and risk analysis**, aiming to develop **adaptive strategies** that enhance agroecosystem resilience and protect human health. Key initiatives include ongoing projects such as WaterQB (FCT) and VineAdapt2Climate (PRR – Recovery and Resilience Project), as well as planned projects like TerraFarmers and FutureCrops. Future research will emphasize **AI-driven mapping of forest species** health and climate suitability assessments for agricultural and forestry species. Raising awareness through participation in international seminars, including the **IUFRO Kenya World Congress**, and organizing thematic workshops for stakeholders in the agri-forest sector will further knowledge exchange and collaboration.

To disseminate findings, R&D1 will contribute to a **symposium organized by APMG at UTAD in March 2025** and propose **outreach activities**, including workshops on **climate concepts** and **short courses on climate data analysis**. The **technological transfer of climate research** is supported through platforms like MySense, with additional web tools being developed for Montevitis and WaterQB. A significant technological innovation includes the **SeedPods project**, a drone-released seeding capsule designed to enhance afforestation and ecosystem restoration efforts.

Water Resources Research

Fostering **ecosystem health and ES**, this domain prioritizes:

- **Connectivity restoration** to decrease **aquatic ecosystem fragmentation**;
- Sustainable **watershed management** and mitigation of **anthropic and extreme event impacts** through **EcoHealth and ecotoxicological approaches**.

This research domain focuses on **fostering ecosystem health and ecosystem services (ES)** by prioritizing **connectivity restoration** to reduce aquatic ecosystem fragmentation and sustainable watershed management to mitigate anthropogenic and extreme event impacts. Using **EcoHealth and ecotoxicological approaches**, researchers aim to improve resilience and biodiversity in water systems. Ongoing initiatives include **annual workshops** utilizing zebrafish embryos as ecotoxicology models, while planned efforts involve **teacher training (CCPFCaccredited) and certified modular courses**. Knowledge dissemination is ensured through participation in **Water Congress, the Iberian Congress on Water Management and Planning, and the National Seminar on Sustainability in Water Resources**.

To support these efforts, funding sources include **FCT, Water4All, Interreg, and ERC grants**. Future initiatives aim to expand outreach through **webinars and training courses on water resource management and nature restoration law**. Dissemination strategies also include **Ciência Viva activities and specialized webinars on aquatic pollution, water directives, and ecosystem services**. Technological advancements, such as **SmartHisto—a smartphone-based application for biological data acquisition and analysis—will enhance research methodologies**. Further innovation will explore **remote sensing techniques to map ecosystem services and environmental status**, reinforcing sustainable water management practices.

Sustainable Landscape Management

Defining strategies for **biodiversity conservation and ES valorization**, this research line aims to:

- Increase **forest resilience to climate change and fire risks**;
- Develop **forest-based products and circular economy models**;
- Promote **technology-driven biodiversity monitoring, including**:
  - **LiDAR technology for pine forest valorization**;
  - **Genetic characterization of resilient tree varieties**;
  - **Alternative materials to pine wood for hive production**;
  - Advance **apiculture research** for ecological conservation and economic valorization.

This research area focuses on **biodiversity conservation, ecosystem service (ES) valorization, and sustainable land use**. Key objectives include **increasing forest resilience to climate change and fire risks**, developing **forest-based products** that strengthen **circular economy models**, and advancing **technology-driven biodiversity monitoring** through **LiDAR technology for pine forest**

valorization and **genetic characterization of resilient tree varieties**. Ongoing efforts integrate **beekeeping for ecological regeneration, sanitization technologies in viticulture, and biodiversity monitoring using molecular and imaging techniques**.

To further enhance landscape sustainability, planned initiatives aim to **promote alternative beekeeping products, strengthen ecological monitoring**, and **increase stakeholder engagement through citizen science programs** such as **BioBlitz 2025**. Dissemination activities include **training programs on sustainable beekeeping, workshops on regenerative land-use practices**, and **strategic meetings with winery stakeholders to implement sustainable sanitation methods**. On the technological front, projects like **TECHPAISAGEM** propose **UV disinfection for wineries, submersible drones for aquatic ecosystem assessment**, and **digital innovation for sustainable natural resource management.**

Agroecology & Biodiversity and Soil Research

Soil research focuses on **improving soil health and quality** while promoting **resource conservation and soil fertility**. Key strategies include the use of **agroforestry organic materials, microorganisms** (composting, biofertilizers, biopesticides), and **invertebrates** (vermicomposting) to enhance soil sustainability.

The Agroecology & Biodiversity research area emphasizes **agroecosystem monitoring** through **active stakeholder engagement**, aiming to **strengthen functional biodiversity, enhance ecosystem services (ES), and restore degraded habitats**.

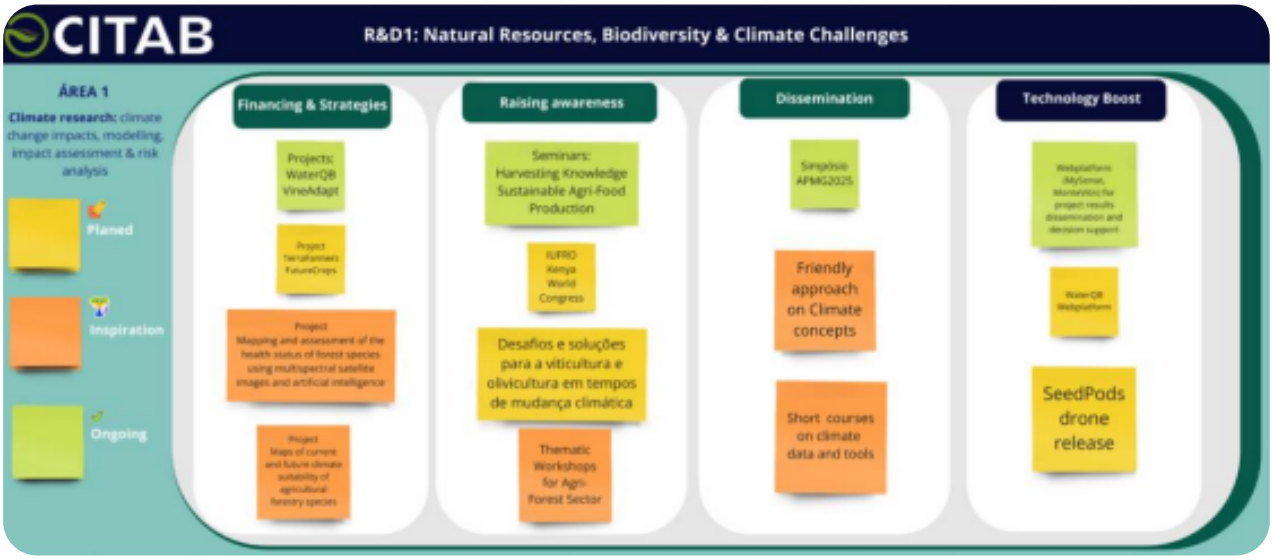
Efforts are supported through **service provision by CITAB labs, national and international funding calls, and the CRUSOE Network**, with future plans to seek **patronage funding and Horizon project participation**. However, challenges such as **internal and external funding limitations and limited availability of trained personnel** remain significant obstacles.

Planned initiatives include **courses on soil science, bioinformatics, and ethics, workshops on molecular techniques for biodiversity studies**, and the **creation of microcredentials** to expand knowledge in these fields. Future developments will leverage **digital twins, knowledge transfer networks, and Agriculture 4.0 & 5.0 technologies** to integrate research outputs into practical applications, ensuring the **sustainability of agricultural, forestry, and natural system management.**

By integrating **multidisciplinary research, innovative technology, and stakeholder engagement**, R&D1 aims to **fortify natural resources management, enhance biodiversity conservation, and promote ecosystem resilience** in the face of climate change and environmental challenges.

R&D1 – NATURAL RESOURCES, BIODIVERSITY & CLIMATE CHALLENGES

1. **Climate research:** climate change impacts, modelling, impact assessment & risk analysis



A - Financing and Strategies

- **Ongoing projects** include Project "WaterQB", financed by FCT, and Project "VineAdapt2Climate", financed by PRR – Recovering and Resilience Project.
- **Planned projects** include the "TerraFarmers" and "FutureCrops" projects.
- During the workshop, two future projects were also discussed:
  - "Mapping and assessment of the health status of forest species using multispectral satellite images and artificial intelligence";
  - "Maps of current and future climate suitability of agricultural forestry species"

B - Raising Awareness

- CITAB climate researchers participate in ongoing seminars, namely "Harvesting Knowledge"
- and "Sustainable Agrifood Production";
- Prof. Teresa Fonseca will soon participate in the IUFRO Kenya World Congress;
- Dr. António Fernandes will soon organize a workshop/seminar on "Challenges and Solutions for Viticulture and Oliviculture under Climate Change";
- Thematic workshops for workers and business owners in the agri-forest sector could be organized in the future to continue the increase awareness on climate change impacts.

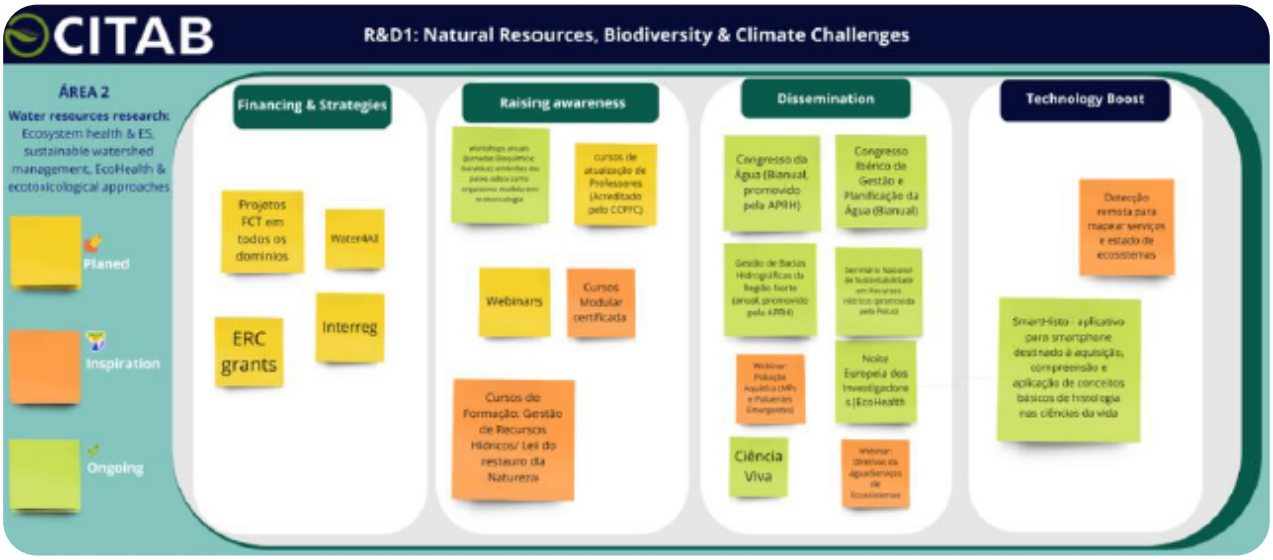
C - Dissemination

- Dissemination activities for the near future include a symposium organized by the Portuguese Meteorological and Geophysical Association (APMG) that will be held at UTAD in March 2025.
- Ideas for future dissemination and outreach activities were discussed, such as a workshop on “Friendly Approach on Climate Concepts”, as well as short courses on climate data and tools.

D - Technology Boost

- The technological transfer of CITAB’s climate research outputs is being made through web platforms, such as “MySense” (platform developed by CITAB’s T&I group researchers);
- Similar web platforms will be developed for the Montevitis and WaterQB projects, in which AppClim Laboratory researchers are participating;
- Another recent technological development made by CITAB researchers is the “SeedPods”, a drone-released seeding capsule.

2. **Water resources research:** Ecosystem health & ES, sustainable watershed management, EcoHealth & ecotoxicological approaches



A - Financing and Strategies

Planned:

- FCT projects in all domains;
- Water4All;
- Interreg;
- ERC grants.

B - Raising Awareness

Ongoing:

- Annual workshops (Biochemistry; Genetics): zebrafish embryos as a model organism in ecotoxicology.

Planned:

- Teacher update courses (Accredited by CCPFC);
- Certified modular courses.

Inspiration:

- Webinars;
- Training courses: Water Resource Management / Nature Restoration La.

C - Dissemination

Ongoing:

- Water Congress (Biennial, promoted by APRH);
- Iberian Congress on Water Management and Planning (Biennial);
- Watershed Management in the Northern Region (Annual, promoted by APRH);
- National Seminar on Sustainability in Water Resources (Promoted by Polus).

Planned:

- Ciência Viva.

Inspiration:

- Webinar: Aquatic Pollution (MPs and Emerging Pollutants);
- European Researchers' Night | EcoHealth;
- Webinar: Water Directives / Ecosystem Services.

D - Technology Boost

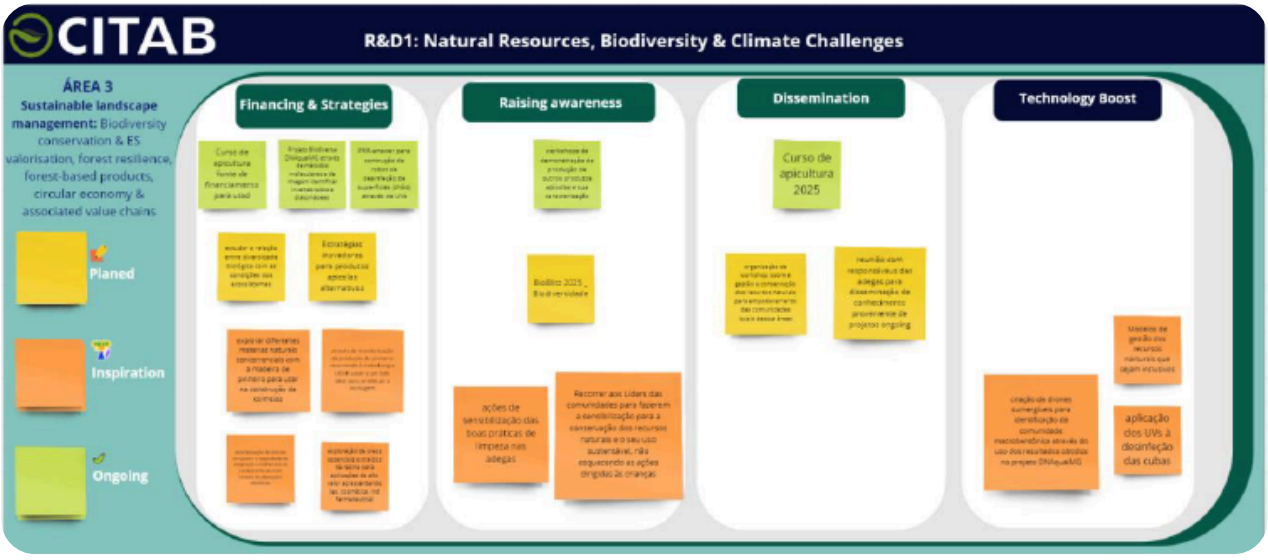
Ongoing:

- SmartHisto – smartphone application for acquiring, understanding, and applying basic histology concepts in life sciences.

Inspiration:

- Remote sensing for mapping ecosystem services and status.

3. Sustainable Landscape Management



A - Financing and Strategies

Ongoing - combines technological innovation, biodiversity conservation, and economic value generation, contributing to an integrated approach to sustainable landscape management:

- **1) Beekeeping as a source of funding and ecological regeneration:** Development of beekeeping courses to generate revenue for UTAD while promoting biodiversity conservation through pollination and the sustainable management of agroforestry landscapes;
- **2) Technology for sanitization and sustainability:** Leveraging the PRR project "ANSWER" to adapt and expand the use of UV disinfection robots for winery protection, reducing dependence on chemicals and promoting environmental health;
- **3) Biodiversity monitoring with advanced methods:** The Biodiversa project "DNAqualMG" focuses on molecular and image-based identification of invertebrates and diatoms, enabling effective monitoring of watercourse ecological quality and supporting sustainable management and ecological restoration practices.

Planed - projects that strengthen the connection between biodiversity and a sustainable economy, contributing to the enhancement of ecosystem services and the development of new sustainable solutions for the agroforestry sector:

- **1) Ecological monitoring for sustainable management:** Study of the relationship between biological diversity and ecosystem conditions, enabling the identification of ecological indicators to assess habitat health and guide conservation and landscape restoration strategies;
- **2) Innovative beekeeping and the valorization of alternative products:** Development of innovative strategies for alternative beekeeping products, exploring new applications of hive derivatives (e.g., propolis, speciality waxes, bioactive compounds) and promoting sustainable production practices.

Inspiration - For an integrated approach to sustainable landscape management, these ideas can converge into an innovative program that combines technology, forest adaptation, and the valorization of natural resources:

- **1) Sustainable Pine Forest Valorization Program (VSP):** Smart monitoring of production through the application of LiDAR technology to map and track pine productivity, allowing for the determination of the optimal period for resin extraction, maximizing yield while minimizing impacts on the tree;
- **2) Genetic characterization and adaptation:** Analysis of nursery-grown trees to identify varieties more resilient to local climatic conditions, promoting forest adaptation to climate change scenarios;
- **3) Alternative materials to pine wood:** Research and testing of competitive natural materials to replace pine wood in beehive production, reducing pressure on forest resources and promoting sustainable solutions;
- **4) Valorization of resin products:** Exploration of essential oils extracted from resin for high-value applications in the cosmetics and pharmaceutical industries, diversifying the market and increasing the profitability of forest resources.

B - Raising Awareness

Ongoing - Empowering producers and communities by encouraging practices that combine biodiversity conservation with economic innovation, contributing to a more resilient and sustainable landscape:

- **1) Demonstration and innovation workshops:**
  - **a)** Practical sessions on the production and characterization of alternative beekeeping products (e.g., propolis, royal jelly, pollen, speciality waxes), promoting knowledge about their properties and sustainable applications;
  - **b)** Sustainability and diversification in beekeeping: Integrating beekeeping practices into sustainable landscape management, highlighting the role of bees in pollination and ecosystem regeneration, while fostering the creation of distinctive products with a lower environmental impact.

Planned - **Citizen Science and Biodiversity Conservation Program**, combining environmental awareness, community engagement, and ecological monitoring. This program strengthens the interaction between science, citizenship, and sustainability policies, making biodiversity monitoring an active tool in landscape management:

- **1) BioBlitz 2025:**
  - **a) Participatory biodiversity monitoring:** A citizen science event engaging the community in identifying and recording local biodiversity, promoting ecosystem appreciation and raising awareness for conservation.
  - **b) Connection to sustainable landscape management:** The data collected during BioBlitz can contribute to assessing habitat ecological quality, supporting ecological restoration practices, sustainable forest management, and the conservation of natural areas.

Inspiration - **Proposal for Education and Best Practices Programs for Sustainability (ECOLEADERS)**, combining community leadership, environmental awareness, and sustainable practices:

- **1) Community leadership in natural resource conservation:**
  - **a)** Engaging local leaders as active agents in raising awareness about ecosystem conservation and the sustainable use of resources, fostering a participatory and culturally integrated approach.
  - **b)** Placing strong emphasis on developing specific initiatives for children, ensuring that environmental education starts early and has a lasting impact.
- **2) Best practices in sustainable winery management:** Raising awareness of sustainable practices in winery floor sanitation, reducing the environmental impact of the wine industry, and promoting the responsible use of less harmful products for ecosystems.

C - Dissemination

Ongoing - Strengthening the connection between beekeeping, biodiversity, and sustainability, promoting a responsible production model aligned with landscape regeneration:

- **1) Beekeeping Course 2025 – Training for Sustainable Beekeeping:**
  - **a)** Theoretical and practical training on responsible hive management, beekeeping production, and the impact of bees on biodiversity.
  - **b)** Emphasis on the crucial role of bees in pollination and ecosystem regeneration, reinforcing their importance in sustainable landscape management.
- **2) Integrating Beekeeping into Landscape Conservation:**
  - a) Promoting best practices for apiary installation, ensuring compatibility between beekeeping activities, natural habitat conservation, and sustainable agriculture.
  - b) Exploring alternative beekeeping products and innovative practices to diversify the rural economy and enhance the value of natural resources.

Planned - **Planned actions focused on community empowerment and knowledge transfer for natural resource management:**

- **1) Workshops for local community capacity-building:**
  - **a)** Training sessions on the sustainable management and conservation of natural resources, reinforcing active community participation in ecosystem protection.
  - **b)** Promotion of regenerative practices that balance environmental preservation with local development, ensuring the responsible use of landscapes and their resources.
- **2) Strategic meetings with winery stakeholders:** Knowledge sharing and dissemination of best practices from ongoing projects, encouraging the adoption of more sustainable, costeffective, and efficient winery sanitation methods.

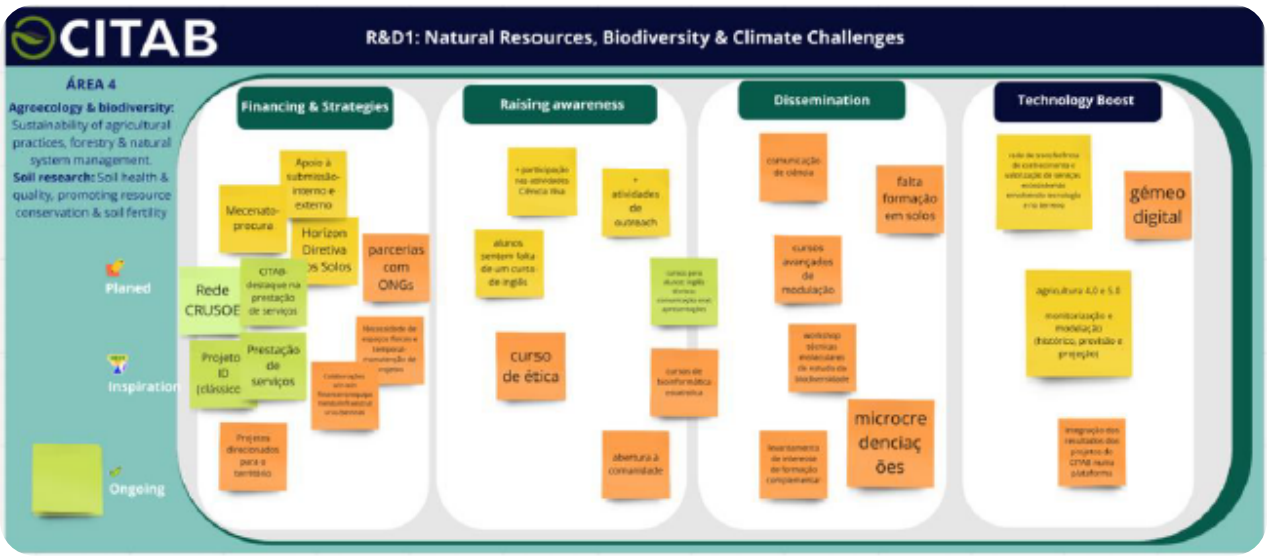
D - Technology Boost

Ongoing - **Proposal for a Technological Innovation Program for Ecosystem Sustainability (TECHPAISAGEM)**, integrating technology, conservation, and inclusion in natural resource management:

- **1) Sustainable sanitation in viticulture:**
  - **a)** Application of UV technology for the disinfection of wine tanks, reducing the use of harsh chemicals and minimizing the environmental impact of winemaking.
  - **b)** Expansion of these technologies to plant nurseries and agricultural infrastructures.
- **2) Inclusive models for natural resource management:** Development of participatory strategies involving local communities, experts, and policymakers in the creation of sustainable management plans, ensuring equitable access to and responsible use of natural resources.
- **3) Advanced monitoring of aquatic ecosystems:** Development of submersible drones for the identification and characterization of macrobenthic communities, using innovative methodologies based on the findings of the DNAquaIMG project. This advancement will enable more efficient and cost-effective ecological quality assessments of aquatic environments, integrating molecular monitoring techniques and remote imaging for biodiversity analysis and conservation status evaluation.

4.

Agroecology & biodiversity: Sustainability of agricultural practices, forestry & natural system management.
Soil research: Soil health & quality, promoting resource conservation & soil fertility



A - Financing and Strategies

Ongoing:

- Highlight on service provision by some CITAB labs;
- National and international calls;
- CRUSOE Network – in the startup phase, with calls expected soon.

Planned but not executed:

- Seeking funding through patronage;
- HORIZON projects – implementation of the new Soil Directive (lack of trained personnel);
- Inability to do more due to lack of internal and/or external support and shortage of ETIs (some are too busy) to apply for more projects.

Inspiration:

- Partnerships with NGOs;
- Win-win collaborations (funding/equipment/infrastructure/people vs. data);
- Projects targeted at the territory.

It was discussed the lack of physical space and time for certain types of work (long-term follow-up).

B - Raising Awareness & C - Dissemination

Planned for execution:

- Courses for students/grant holders – Technical English, Oral Communication, and Presentations.

Planned but not executed:

- Ciência Viva activities;
- Need for more outreach activities.

Inspiration:

- Courses: Ethics, Bioinformatics, Statistics, Science Communication, Soil Studies, Advanced Modeling – with greater community engagement;
- Workshop on molecular techniques for biodiversity studies;
- Creation of microcredentials (consideration of overhead charges);
- Conducting a survey to assess interest in complementary training.

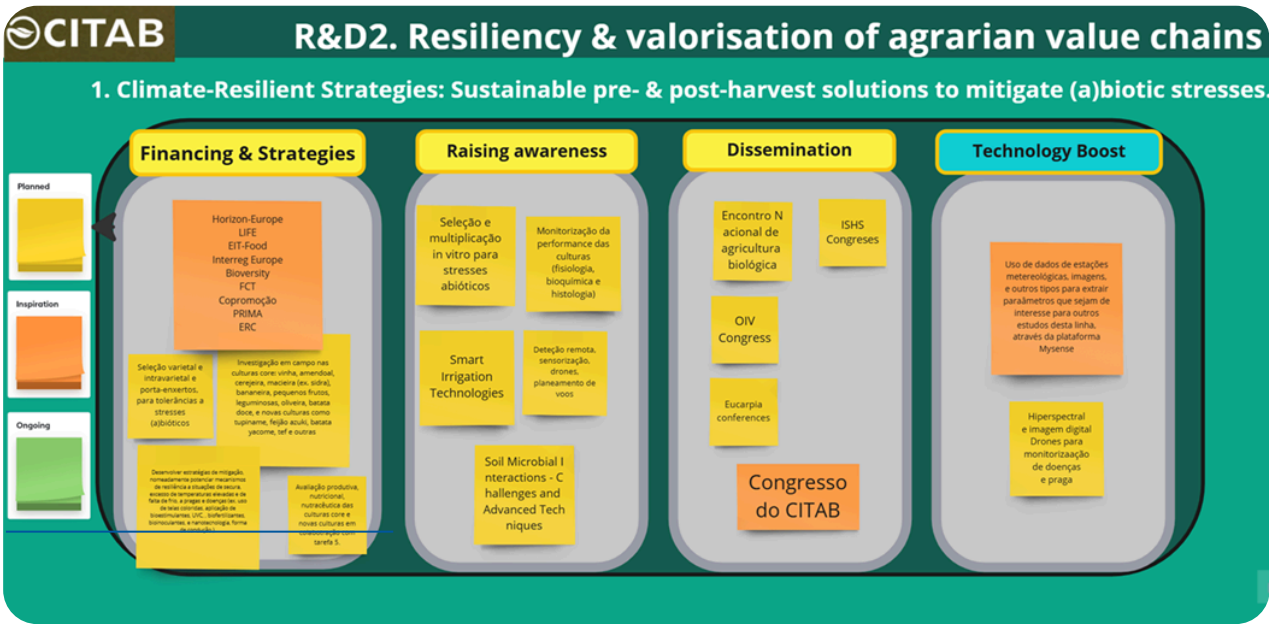
D - Technology Boost

- Creation of a knowledge transfer network – both on-site and in situ;
- Agriculture 4.0 and 5.0.
- Development of digital twins;
- Integration of CITAB project results into a platform.

R&D2 – RESILIENCY VALORISATION OF AGRARIAN VALUE CHAINS

Operational groups:

The R&D2 group's research is aligned with the **FAO's vision**, which focuses on the resilience of people, communities, and ecosystems for sustainable food and agricultural systems. This group aims to provide short and long-term measures and strategies, responding to current and future multi-stakeholder needs while enhancing competitiveness and growing income across the targeted agrarian value chains, with particular emphasis on Mediterranean crops.



1. **Climate-Resilient Strategies:** Sustainable pre- & post-harvest solutions to mitigate (a)biotic stresses

An initiative to revitalise the northern interior of Portugal through the recovery of traditional crops, the promotion of walking routes associated with agricultural and natural heritage, mountain tourism, and the creation of bridges between science, local authorities and political decision-makers. The project includes proposals to encourage young people to settle and the diversification of sustainable economic activities.

The R&D2 - Resiliency Valorisation of Agrarian Value Chains encompasses a considerable number of researchers dedicated to the specific objective 'Develop innovative and environmentally sustainable pre- and post-harvest strategies to mitigate the negative impacts of (a)biotic stresses'. The current and future research involves strategies to enhance the resilience mechanisms to situations of drought, excessively high temperatures and lack of cold, pests and diseases, such as the varietal, intravarietal and rootstock selection, agronomic practices (e.g. use of colored screens, training systems) and use of UVC, biostimulants, elicitors, biofertilizers and biocides, including nano-formulated. Research will focus mainly in core Mediterranean crops which face the challenges of climate change (grapevine, almond, olive, cherry, apple, legumes), insular crops as banana and sweet potato and promising new crops for future climatic scenarios as tef, artichoke, yacon potatoes, azuki beans and others. In these, in addition to their agronomic characterization and environmental resilience, valorization will also involve knowledge of their nutritional and nutraceutical value. Our research will be funded by the programs Horizon-Europe; LIFE, EIT-Food, Interreg Europe, Bioversity, PRIMA, ERC, FCT, and Co-promotion projects among other.

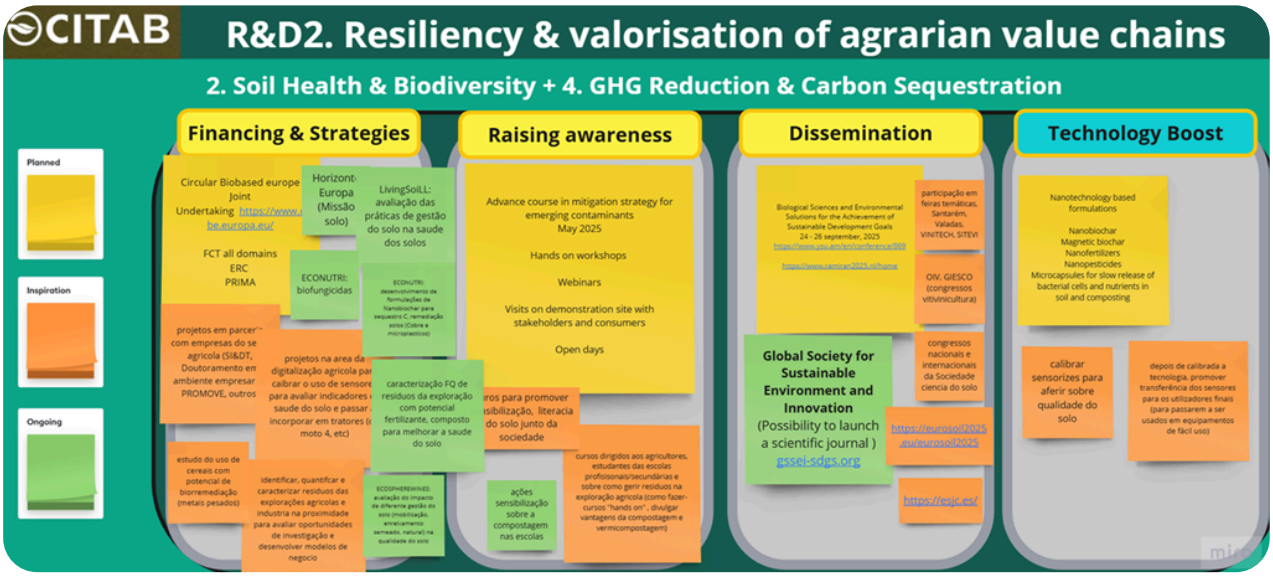
(Inter)National conferences on multidisciplinary research and innovation will be the stage for dissemination of the results namely **International Society for Horticultural Science** (ISHS) **congresses, XI Eucarpia Conference** (May 26-28, Coimbra), 46th. **World Congress of Vine and Wine** (June 16-20, Republic of Moldova), **National Symposium on Organic Horticulture**. **"CITAB Conference" is proposed to disseminate CITAB research outdoors.**

Short- and medium-term advanced courses and **workshops on scientific areas** for which the R&D2 researchers and visiting scientists have leadership, targeting mainly university students in undergraduate and graduate programs to rise awareness and provide skills in this specific objective of mitigating (a)biotic stresses. 'In vitro selection for abiotic stress', 'Monitoring of crops

performance (physiology, biochemistry and histology)', 'Soil microbial interactions – challenges and advanced techniques', 'Smart irrigation technologies' and 'Remote sensing, sensing and drones' are a few examples of training bringing together expertise from R&D2 and technology and innovation.

To achieve this R&D2 specific objective of mitigating the negative impacts of (a)biotic stresses, technology has a pivotal role. The platform MySense may provide data from weather stations, images, and other data to extract parameters that are of interest to attain this objective. Hyperspectral and digital imaging provide high throughput data, and the use of drones will leverage the R&D2 research for monitoring several vegetative and (a)biotic indices, e.g. pests and diseases.

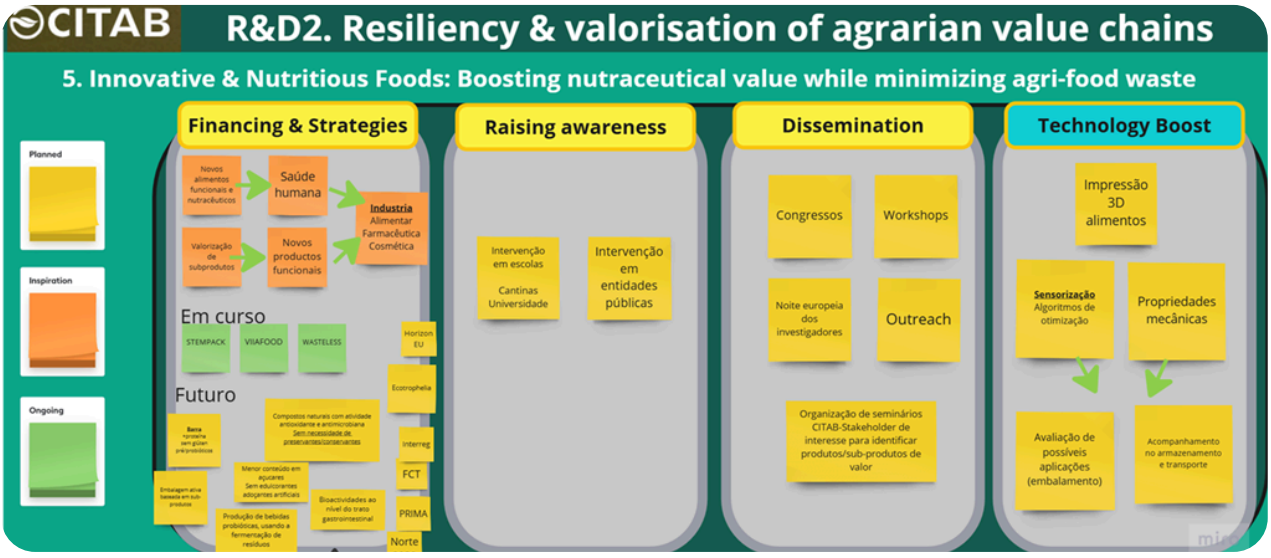
2. Soil Health & Biodiversity: Enhancing fertility via organic matter, cover cropping, and bioremediation. + 4. GHG Reduction & Carbon Sequestration: Lowering emissions through manure treatment & agroforestry.



Long term research plan with integrated and inclusive participation of team members and directing a focused operation is one of best strategy to achieve the end goals. Soil health & biodiversity and GHS emission reduction and carbon sequestration lines joined together and discussed in 4 different specific strategic objectives, mainly 1) Financing and strategies, 2) Raising awareness, 3) Dissemination and 4) Technology boost. First point included the ongoing remarkable projects like living soil/econutri/mission soil etc. and future tactics to improve and broaden the research area while upcoming funding calls like Circular Biobased Europe Joint Undertaking, ERC,

PRIMA and FCT opportunities were discussed to plan in advance to ensure the ongoing research in a smooth way. Raising awareness was discussed to organize the educational events, advance informative courses and generate our scientific content to simple awareness material to a broaden the audience who can find it interesting and valuable, and may contribute together for a greener and better tomorrow. Dissemination activity involved the exploration regarding important national and international conferences of our area and interest to exchange the knowledge and also to improve the internationalization of center. Development of new scientific society by inclusive partnership of CITAB was discussed to bring more international collaborations. Technical boost included the discussion about new sensors technology for soil quality assessment, innovative nanomaterials development to address the emerging environmental concerns and biological fungicides and disease control. Orchestrating such a wonderful and visionary team building event by organizing team is gratefully acknowledged, it was exactly what CITAB needed.

3. Innovative & Nutritious Foods: Boosting nutraceutical value while minimizing agri-food waste



In line with the valorisation of the agricultural value chain, we have highlighted the development of novel functional foods and nutraceuticals and functional products (e.g. active packaging) as strategies to valorise autochthonous plant species and co-products/by-products produced by local agri-food industries. The "Innovative & Nutritious Foods" theme aims to build on the research developed in the other research themes, seeking to valorise products and by-products relevant to the northern region and researched by other CITAB researchers (grapevine, wine, olives, MAPs, legumes, and various fruits). This strategy aims to increase the value of these products for the food, pharmaceutical, and cosmetic industries, and various research groups are already developing R&D activities within these themes. In order to boost applications within Horizon EU,

NORTE2030 or Interreg calls, for example, we drafted three research topics that may used as thematic for future proposals that should include a large number of CITAB's researchers:

- **1.** Development of healthy snacks based on functional foods and nutraceuticals, targeting specific dietary needs/restrictions (e.g. protein bars, no gluten, low/no sugar, pre/probiotics);
- **2.** Plant bioactivities as natural sweeteners, antioxidants and antimicrobials to reduce the use of synthetic preservatives, sweeteners;
- **3.** Developing active packaging solutions based on by-products.

These topics should focus on products/by-products of agricultural value chains addressed by other research groups in R&D1 and R&D2 and involve the different experts in plant production, selection of resilient species/varieties adapted to climate change scenarios, assessment of bioactivities of natural products, assessment of phytochemical composition, and nutritional value or microbiology. These topics should also be considered with a strong input for the I&T line of research, where 3D printing of food should be prioritised as a novel technology with high impact in the future. In addition, I&T can make a valuable contribution to the assessment of mechanical properties of novel food products and provide optimisation algorithms and sensing to track changes during packaging, shelf-life, and transport.

Future research proposals should include a **stronger focus on scientific communication to the non-academic community**, including activities in schools and universities, bars/canteens, and public institutions related to health (namely institutions related to malnutrition, dietary trends, diabetes, oncology, etc.).

Outreach activities may include increased participation in events organised by the above-mentioned institutions, but also the organisation of an international congress on these topics, and **participation in Ciência Viva** and **European Research Night initiatives**.

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