

2017

Activities

Report

CITAB

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Compiled by

**CITAB Executive  
Committee, Dr. Ana  
Coimbra, Dr. Alfredo  
Aires and Prof. Pedro  
Mestre**

Edited by

**Samantha Jane Hughes  
& CITAB Secretariat**

- Sustainable Agro-food Chains - SAC
- EcoinTEGRITY - EI
- Biosystems Engineering - BE

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## 1 Executive summary

This report presents activities made during a year of change. CITAB has a newly elected Director. Professor Ana Barros, her new team of vice directors, Principal Researchers, Coordinators and Executive Committee will build on the exemplary and visionary work of the previous team that was led by Professor Eduardo Rosa, together with Professor Pedro Melo-Pinto and Professor Rui Cortes.

CITAB's 2017 Activity Report Plan shows continuing success in the realisation of the Strategic Plan (SP); levels of scientific productivity and participation in international projects (e.g. INTERREG Atlantic Area) and doctoral programmes (Water, Sustainability and Development- in collaboration with the University of Vigo and Porto Polytechnic) continue to rise as well as links with stakeholders and strategically important partners (INESC-TEC). The centre's strategic mission is to create opportunities for stakeholders through scientific and technological innovation in agro-food and forestry chains that support environmental sustainability. The 2015-2020 Strategic Plan has two thematic areas:

- Sustainability of Agri-food and Forestry Ecosystems in a changing environment;
- Technology & innovation in Agri-food and Forestry chains for a more competitive bio economy.

The new team has streamlined tasks within each thematic area over 2017; the streamlining process was based on assessment of past performance per task, feedback from members and metrics obtained from the previous reports. The new board of directors has also nominated new coordinators and task leaders. However, the aims of the new tasks still focus on stakeholder needs for more competitive and sustainable Agri-food and Forestry chains through innovative scientific and technology. The new streamlined tasks maximise integrated research among the three research lines of Sustainable Agro-food Chains, EcoIntegrity and Biosystems Engineering.

CITAB continues to receive just 200 000, 00€ FCT funding, equivalent to the amount awarded for pluriannual funding. CITAB researchers, in particular the contracted post-doctoral research fellows, continue to search and apply for external funding from national and European project calls and consultation with private and public sector stakeholders. The new director is fully committed to addressing the uncertainty that faces non-faculty researchers by dedicating funding to contracting skilled human resources to ensure that PEST deliverables and milestones are met. A new strategic partnership was formed with INESC-TEC, an internationally oriented multidisciplinary Associate Laboratory with over than 30 years of experience in R&D and technology transfer. The INESC-TEC mission to “to

achieve advancement in science and technology and to enable science-based innovation through the transfer of new knowledge and technologies to industry, services and public administration” goes hand-in-hand with that of CITAB. This new partnership will improve capacity for obtaining funding in key areas of SP and generate new synergies. The first meeting of CITAB - INESC TEC researchers took place at CITAB in December 2017.

This is the last Activity Report before CITAB is assessed in 2018. The resulting classification will dictate the amount of funding until 2020. Built upon a foundation of excellence, experience and vision, CITAB looks ahead with optimism, competence and enthusiasm to accept new challenges.

## 2 Objectives and Achievements

### 2.1 Unit Description

CITAB activities focus on interdisciplinary research on agro-food, forestry and the environment, with input from engineering technologies to enhance agro-food and forestry production chains in Portugal. Implemented in 2015, the Strategic Project (SP) brought a more focused, streamlined approach based on two thematic areas created to resolve public and private sector issues in agriculture and forestry production chains and their impact on the natural environment. The SP aims to balance scientific excellence with benefits and consequences across multiple dimensions of environmental and socio-economic needs.

CITAB activities are based upon on the contribution of integrated members (members with a PhD) and collaborators who are selected according to international benchmarking criteria. Most CITAB members are primarily lecturers; thus, the Unit offers international doctoral programmes (a total of three in 2017) and supports post-graduates from the host institution and others higher education institutes.

The CITAB management structure is “bottom-up”: the Directorate (1 Director and 2 Vice-Directors) is supported by the Executive Committee (ExCo; 6 members; 2 members from each Working Group, guided by the ExCo president) to form a dynamic two-way link between members and the Directorate for strategy development, progress checking and decision-making. Major strategic issues are discussed by the scientific council (members with PhD) and put to the vote.

The ExCo is also responsible for compiling information for reports and collaborating in actions to promote CITAB on local, regional, national and international platforms. The Directorate and the ExCo meet “face-to-face” approximately once every 2 months, but are in constant contact via e-mail and telephone concerning day-to-day management issues. Research group members also hold regular meetings to evaluate progress according to SP and Activity Plan milestones. CITAB regulations stipulate that the Scientific Council must meet a minimum of 4 times a year. In reality, the “bottom up” approach means that the actual number of meetings tends to be higher. This was the case in 2017 as the new director and her new supporting team (vice-directors, ExCo and thematic strand leaders) settled into their new role. Two contracted managers deal with all administrative and financial tasks, and provide support to the Directorate and the ExCo.

## 2.2 General Objectives

The SP aims to solve societal, public, private (such as small and medium enterprises - SMEs) and third sector problems in agriculture and forestry production chains, including their impact on the environment. The SP applies scientific excellence and innovation to reap benefits across environmental and socio-economic dimensions. The SP is highly multidisciplinary, embracing benchmark science and the human dimension of contemporary issues.

The SP embodies strong challenges, research priorities and objectives that are drawn up by consulting stakeholders, public institutions and private and public associations in the agriculture and forestry production sectors. The SP also considers the objectives of the 2014-2020 National Programme for Rural Development (PDR), the Portugal 2020 national strategy for improving competitiveness and internationalization of economic activities and the international Horizon 2020 programme. By developing the SP in tandem with key national and international strategies, CITAB reinforces its relevance in the development and implementation of national and international policies and obtains external funding to support tasks that contribute to meeting SP objectives.

The two overarching SP research topics were drawn up and validated by the CITAB Stakeholder Committee, the CITAB Scientific Advisory Committee, and the Scientific Council. The research topics address national and regional needs to improve capacity and fill gaps in science. Predicted outcomes are drawn up in accordance with the FCT finance requested to fund the SP as well as other sources of finance.

The SP provides a model for developing sustainable but competitive agri-food and forestry chains. R&D initiatives serve as pilot projects for agri-food and forestry chains and environmental issues to boost competitiveness, empower stakeholders and SMEs, sustain livelihoods and promote responsible stewardship of the natural environment and the ecosystem services it provides.



**Figure 1.** The CITAB Strategic Plan focuses two related topics or Thematic Strands. Under the new CITAB directorate, the tasks and subtasks within each Thematic Strand have been streamlined and new coordinators have been appointed.

### 2.3 Scientific Objectives

The overarching topics of the Strategic Plan allow CITAB to:

- attain a higher research profile based on international benchmarking criteria;
- carry out ground-breaking national and international research;
- guide the effective governance and management of natural resources.

Research priorities must be cost effective, environmentally compatible and driven by sustainable socio-economic paradigms. Research is carried out under two strongly multidisciplinary thematic strands (TS) that build on existing expertise to meet specific goals within tasks set out in Table 1.

TS tasks and subtasks have been revised in 2017, following assessment of past performance per task, feedback from the Scientific Council and metrics obtained from the previous Activity Reports. New coordinators and task leaders have also been nominated. However, the aims of the new tasks still focus on stakeholder needs for more competitive and sustainable Agri-food and Forestry chains through innovative scientific and technology. The new tasks continue to maximise integrated research between the 3 research lines of Sustainable Agro-food Chains, Ecolntegrity and Biosystems Engineering.

**Table 1. A summary of the thematic strands and updated tasks of the 2015 - 2020 Strategic Programme.**

| <b>TS1 - Sustainability of Agri-food and Forestry Ecosystems in a changing environment</b>                   |  |
|--|--|
| Task 1.1 Integrated monitoring of climate and environmental impacts  | Sub-task 1.1.1. Development and implementation of new analytical techniques and integrated monitoring system |
|  | Sub-task 1.1.2. Modelling development and testing scenarios and indicators of environmental change           |
| Task 1.2. Sustainability in agri- food and forestry ecosystems   | Sub-task 1.2.1. Adaptation and mitigation strategies   |
|  | Sub-task 1.2.2. Conservation and recovery strategies for natural resources and ecosystem services            |
| <b>TS2 - Technology &amp; innovation in Agri-food and Forestry chains for a more competitive bio economy</b> |  |
| Task 2.1 - Innovative technologies and processes   | Subtask 2.1.1 - Management tools to increase the productivity and yield of crops and forestry resource       |
|  | Subtask 2.1.2 - New technological applications to agriculture and forestry                                   |
| Task 2.2. Valorization of bio-based products and co-products   | Subtask 2.2.1 - Structural characterization of bio-based products and co-products                            |
|  | Subtask 2.2.2 - Biological and toxicological activities  |
|  | Subtask 2.2.3 - Innovation and development of new added-value products                                       |

### **Thematic Strand 1 - Sustainability of Agrifood and Forestry Ecosystems in a Changing Environment**

TS1 monitors and assesses how different types and scales of impacts affect agri-food and forestry chains systems, biodiversity and ecosystem services. TS1 develops and tests integrated measures for sustainable strategy development, planning and governance. It applies multidisciplinary research to develop integrated tools and methodologies to monitor how multiple scale impacts affect ecosystems and biodiversity.



TS1 tests innovative monitoring techniques and develop spatially appropriate dynamic models to test regional adaptation & mitigation strategies and support decision-making processes. The two tasks set out under TS1 are Task 1.1 Integrated monitoring of climate and environmental impacts and Task 1.2. Sustainability in agri- food and forestry ecosystems. Results allow stakeholders (e.g. water resource managers, agricultural and forestry associations) to develop optimal management strategies to guarantee sustainability and competitiveness in agri-food and forestry chain environments affected by various types of impacts.

TS1 deliverables are fundamental for governance, decision-making and planning processes in regional strategy, processes often driven by cornerstone European directives. TS1 deliverables increase regional valorization and competitiveness in agriculture and forestry production chains by reducing costs and risks, improving ecosystem sustainability and providing ecosystem services due to reduced impacts.

### **Thematic Strand 2 - Technology & innovation in Agri-food and Forestry chains for a more competitive bio economy**

TS2 focuses on regional, national and international trends in agro-food industry stakeholder profiles and regional agri-food, forestry and socio-economic characteristics. The aim of TS2 is to use innovation to strengthen sector competitiveness by improving and expanding the potential range of products on offer. The TS2 sequential mode originally comprised three tasks but has been reduced to two, tasks that are more streamlined in 2017: Task 2.1 - Innovative technologies and processes and Task 2.2 - Valorization of bio-based products and co-products. TS2 develops R&D innovative technologies and processes to valorize products and optimize processes in the recycling, reuse & recovery of raw materials in agri-food and forestry chains. TS2 deliverables provide positive feedback into TS1 by reducing environmental impacts from agri-food and forestry sectors.

## 2.4 Funding

**Table 2. A summary of sources and amounts of CITAB funding in 2017.**

|                       | 2015           | 2016           | 2017                  | Subtotal       |
|-----------------------|----------------|----------------|-----------------------|----------------|
| FCT Pluriannual       | 200.000,00€    | 200.000,00€    | <b>200.000,00€</b>    | 600.000,00 €   |
| FCT Projects          | 86.151,27 €    | 90.692,11 €    | <b>90.692,11 €</b>    | 267.535,49 €   |
| Other (National)      | 937.924,18 €   | 1.189.518,30 € | <b>2.120.680,74 €</b> | 4.248.123,22 € |
| Other (International) | 322.049,13 €   | 290.854,96 €   | <b>475.487,06 €</b>   | 1.088.391,16 € |
| Industry              | 202.814,00 €   | 589.069,37 €   | <b>759.075,78 €</b>   | 1.550.959,14 € |
| <b>Total</b>          | 1.748.938,58 € | 2.360.134,74 € | <b>3.654.935,69 €</b> | 7.755.009,01 € |

## 2.5 Main achievements and Future Research 2017

### 2.5.1 Thematic Strand 1

#### 2.5.1.1 *Main Achievements*

##### **Task 1.1. Integrated monitoring of climate and environmental impacts: adaptation and mitigation strategies**

###### **Environmental Monitoring and Modelling**

Analysis of climate variability and change, including climate change projections for Portugal under future scenarios, namely for precipitation and temperature at very high spatial resolution (<10 km), and using state-of-the-art global and regional climate models (generated within CMIP5, CIMP6 and EURO-CORDEX projects). The outcomes of these studies are of foremost relevance for developing suitable adaptation and mitigation measures in many socioeconomic sectors in Portugal, as they provide accurate information at region-to-local scales.

A new dataset of temperatures was produced at 1 km spatial resolution throughout mainland Portugal, using statistical-dynamical downscaling procedures and geospatial approaches. A characterization of the impacts on the occurrence of precipitation and temperature extremes was subsequently undertaken. This new dataset is an improvement over previous datasets and provides a tool for future research that uses climatic information in CITAB and other R&D institutions in Portugal.

Several hydrological basins in Portugal were modelled and simulated under current and future climate change conditions. Models simulations were carried out using observed flow rates and other hydrologic parameters. We developed a new method to couple hydrological models with flood risk assessment models (e.g. HSPF-IBER) including data poor regions. We produced digital maps of local flood risk to provide information for civil protection and local decision-makers. Reports of historical floods in Portugal (since the 19<sup>th</sup> century) reported from different documentary sources were identified and analysed for strength, impacts and driving mechanisms (e.g. weather types and large-scale atmospheric forcing). We applied advanced GIS approaches to the analyses.

We installed, calibrated, validated and compared two atmospheric mesoscale prognosis models (WRF and BRAMS) to simulate the state of time in high spatial resolution and developed a web platform to provide climate and weather services, including the risk of extreme events, for agroforestry systems.

Adaptation measures for several crops (e.g. grapevines, olive trees, nuts, cereals and grassland) were tested under climate change scenarios using field experiments and

process-based crop models. The influence of climate variability on vegetative vigor was also assessed for the national territory

### **Adaptation and Mitigation Strategies**

An innovative study of forestry species recovery (identification and quantification) after fire events was performed.

Kaolin particle film application in early summer was assessed as an operational tool to alleviate heat, light and drought stresses, and ameliorate grapevine physiology under Mediterranean conditions to improve yield and quality. Several advances were obtained for adaptation measures for olive rainfed orchards under changing environment through leguminous cover crops and foliar application of kaolin and salicylic acid. A new project “New management practices in rainfed olive orchards: strategies for mitigation and adaptation to climate change” developed in collaboration with key stakeholders (six farmers and three associations) was approved for funding.

Analyses were carried out on potential grape yield using morphological and histological studies of the inflorescence primordia in grape different varieties and different Portuguese regions. Optima forcing growth in dormant cuttings of grapevine cultivars was assessed to predict potential yield of grapevine before the growing season. Studies were carried to evaluate irrigation with treated municipal and winery wastewater on the physiological behavior of natural and ornamental plant species. The use of anti-hail nets on apple orchards had proved suitable for the protection of trees against hail storms.

We characterized the morphological, mechanical and antioxidant properties of Portuguese almond cultivars and compared leaf anatomy and water relations of commercial and traditional cultivars under rain-fed conditions. Almond by-products (shells) were evaluated as substrates for green bean growth.

### **Aquatic Ecological Assessments**

Mitigation of artificial impoundments in the Sabor River catchment were assessed: the maturation cycle was assessed from when reservoir capacity was reached and fish community dynamics were assessed in relation to water quality and physical stratification. River and estuary ecosystem dynamics and phytoplankton communities were assessed under climate change scenarios. Sub-individual fish data proved to be a promising approach to identify disturbances of aquatic ecosystems.

Toxicity mechanisms of microplastics, endocrine disruptors, pharmaceuticals, fungicides and heavy metals were determined in aquatic species to identify potential exposure biomarkers for biomonitoring purposes. The impact of lipid nanoparticles, which are used

as drug carriers, was assessed on alder leaf decomposition. Nanoparticles negatively affected aquatic microbial community composition and function.

We studied complex interactions by combining laboratory and field experiments and novel modelling methodologies to interpret the role of invasive alien species (IAS) in native freshwater species extinctions. Direct and indirect impacts on the native fish and mussel fauna were evaluated using five of the most important Iberian freshwater IAS from distinct functional and trophic groups (mammals, molluscs, fish and plants).

A fish behavioral barrier was designed to improve fish transposition in dammed rivers. An acoustic stimuli, light and bubble curtains were tested on native species: *Salmo trutta*, *Pseudochondrostoma duriense* and *Luciobarbus bocagei*. These results show the great potential for combined behavioural barrier systems for rheophyllic fish species.

### **Task 1.2. Conservation strategies and ecological modelling: recovering and improving sustainability in agri- food and forestry ecosystems**

#### **Environmental and Ecological Modelling**

The development of innovative ecological multi-model frameworks by integrating landscape, environmental, ecological and molecular genetic data is an ongoing forthcoming challenge. Our main achievement in 2017 was to describe and demonstrate the applicability of different modelling approaches to predict the effects of landscape structures at different levels of biological organization (genetic, population and community patterns) as ecological indicators for changing infrastructural, agroforestry and natural environments. Also, the use of invertebrates for ecological assessments in the Neotropics, where most biological and ecological information is scarce and local, was investigated.

Weather and Climate research included the characterization of weather extremes, and furthering knowledge on the influence of weather and climate on agro-forest-environmental systems and the fire regime. The spatial distribution of negligent and intentional fires in Portugal was assessed; deterministic and stochastic approaches for wildfire susceptibility mapping were also assessed. Research was carried out to help explain extreme wildfire events, including the characterization of contemporary and future heat waves in Portugal and their impact on extreme wildfires.

#### **Ecosystem Restoration and Management**

We carried out habitat restoration in regulated rivers and applied hydrodynamic modelling in restored aquatic ecosystems to define environmental flow regimes in spawning areas

for endangered fish populations (Sabor catchment, R. Vilarica). Catchment management based research focused on fire effects on water quality (P leaching) and developing procedures to identify and optimize dam location for rainwater storage to mitigate drought impact. We also developed a model to mitigate extreme hydrological events (flood and drought) using basin retention systems.

CITAB researchers have also shown that diverse landscapes and management practices such as ground cover can increase provisioning of a range of ecosystem services in vineyards in the Douro Demarcated Region. This research will help farmers in the integrated management of their land for the mutual benefit of wine production and biodiversity conservation. Other studies by CITAB researchers included the global assessment of land cover changes and rural-urban interface in Portugal.

A study on the temporal evolution of forest fires in Portugal used statistical methods developed for spatio-temporal stochastic point processes. A worldwide database was compiled on fire behaviour characteristics and carbon emissions and characterized prescribed burning in southern Europe with recommendations for improvement. We developed models describing the effects of fuel properties on fire behaviour in mixed live-dead fuels were developed from a comprehensive set of experimental laboratory fires. Characterization and quantification of various shrubs species growing in forest burnt areas. Temporal analysis and equations development for regenerated shrubs quantification in forest burnt areas.

Research on blue green infrastructures gained momentum. The INTERREG Atlantic Area project ALICE (*Improving the management of Atlantic Landscapes: accounting for biodiversity and eCosystem sErVICES*; total budget 2 976 035€) started in November 2017. ALICE will develop a common methodology that recognizes socioeconomic differences between four case study sites (Portugal, Spain, France and Ireland) and natural resource management to contribute towards more sustainable landscape management for biodiversity conservation and ecosystem services provisioning. Work is also underway on the modelling of change in blue green riparian infrastructures, ecosystem service provisioning and well-being in the Vilarica catchment of the Sabor River.

### **Agri- food and Forestry Sustainability**

We carried out research on the sustainable management and improvement of native forest ecosystems. This included improving wood production rates while providing sustainable provision of different ecosystem services. We addressed knowledge gaps about research on mixed forests, asking questions such as “What do European forest managers want to know and what answers can science provide?” Studies were carried out

on (i) the prediction of the spatial and temporal dynamics of species interactions and (ii) crown architecture and stand structure effects on light absorption in mixed and monospecific *Fagus sylvatica* and *Pinus sylvestris* forests along a productivity and climate gradient through Europe. We carried out analyses on the energy potential of shrubs as fuel in local thermal power plants and compensation costs of clear-cut shrubs in forested areas. Research on agro-industrial wastewaters focused on the remediation and the reuse of agro-wastewaters. Disinfection experiments in a freshwater pond and on winery wastewater tested oxidation sulphate radicals/transition metal/UV-A LED. Disinfection efficacy was highly dependent on microbial species and highlighted the need to use other indicator species besides *Escherichia coli* to evaluate disinfection.

We looked for sustainable optimization of intrinsic resources in agro-food and forest systems for well-being. We developed a standardized survey and grading methodology to assess potential to provide and promote healthy lifestyles (Ecosystem Health Provision Spectrum EHPS) at an ecological scale, was developed.

#### 2.5.1.2 Future Research

##### **Task 1.1. Integrated monitoring of climate and environmental impacts: adaptation and mitigation strategies**

###### **Environmental Monitoring and Modelling**

Studies on climate change mitigation and adaptation strategies and strategies increase the productivity and sustainability will proceed on olive orchards and on vineyards. We will assess different types of cover crops, biochar, zeolites, arbuscular mycorrhizal fungi, wood ash from biomass, different types of compost (manure, olive-waste cake and municipal solid waste), as mulch or incorporated into the soil, and the foliar application of various environmental stresses alleviators. Results will provide general guidelines to stakeholders. Application of crop modelling to other crops in Portugal.

We will compare atmospheric mesoscale prognostic models to simulate the state of the atmosphere with high spatial-temporal resolution and development a web platform to provide climate and weather services.

###### **Adaptation and Mitigation Strategies**

Following the assessment of stressed vineyards and kaolin application, new studies will characterize vine leaf and fruit resilience under extreme environmental conditions. Grapevine primary stress signals and responses to summer stress will be assessed as well

as the effect of this adaptation measure on yield and quality of different fruit varieties in locations.

Research will continue on key biochemical and molecular events during fruit development and ripening in response to environment. Fieldwork will be carried out to help design strategies to mitigate extreme climate effects on grapevine development and productivity. Screening of a world cowpea collection to drought in hydroponic conditions. Transcriptomic analysis of Portuguese cowpea genotypes under drought stress conditions. Characterization and selection of reaches affected by the 2017 forest fires of 2017 for rehabilitation using natural engineering techniques for improving riparian habitat, bank stability and controlling invasive species.

Identification of the patterns of wood density components and growth traits of softwood species (*Pinus sylvestris*, *Pinus pinaster*, *Pinus nigra*, *Quercus suber* and *Quercus cerris*) through alternative methods to X-rays. Developing a new technique for measuring wood density profiles by analyzing RGB components of wood images. Computing the wood density components and growth traits by RGB component analysis. Developing methods to evaluate physical and anatomical wood properties regarding quality assessment and suitable uses. Development of rapid methods to evaluate wood density (at annual ring level) for heartwood and sapwood using image analysis. Identification and quantification of the different hardwood tissues (fibers, vessels and parenchyma) by image analysis, based on the transverse dimensions of the cells.

### **Aquatic Ecological Assessments**

Post-project appraisal and monitoring of rehabilitated river segments, considering floristic succession, fish, benthic fauna and habitat improvement. Modelling of river and estuary ecosystem management and ecosystem services. Efficiency of fish transposition to improve river connectivity, upstream and downstream of dams.

Research will continue on water contaminants in aquatic ecosystems under climate change scenarios using fish and invertebrates as laboratorial aquatic models. Results will identify different levels of toxic effects and putative biomarkers for biomonitoring programs. Continued studies on leaf litter degradation as a functional indicator of disturbance in lotic and wetland systems.

Studies continue on the impact of multiple levels of IAS on native freshwater mussel fauna in Iberia. The status of highly threatened Tunisian freshwater mussels will be assessed as part of an international project that will develop holistic conservation strategies based on information on conservation genetics and conservation ecology.



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**Task 1.2. Conservation strategies and ecological modelling: recovering and improving sustainability in agri- food and forestry ecosystems****Environmental and Ecological modelling**

Focusing on a catchment level approach, one of the objectives for 2018 is to model measures to safeguard and enhance the water storage potential of landscape, soil, and aquifers, by restoring ecosystems, natural features and characteristics of watercourses and using natural processes. Ongoing ecological monitoring programmes of the lower Sabor and Tua river valleys (funded by the EDP) provide a promising starting point in collaboration with the Long Term Ecosystem Research network, to assess the ecological status of changing ecosystems and predict trends of vulnerable vertebrate communities and endangered species affected by river regulation for hydropower. Links between functional and ecological indicators for ecological impact assessment will be simulated, tested and validated by relating biological/ecological responses to selected anthropogenic stressors in changing environmental scenarios.

CITAB is coordinating Work Package 5 “Improving biophysical models to link terrestrial, riverine and coastal interfaces” of the ALICE project. CITAB will gather data on four case study catchments to develop biophysical models to map and model services. A consortium meeting will be held at UTAD in March 2018, together with a training workshop on stakeholder participation processes. A manuscript on change in blue green riparian infrastructures, ecosystem service provisioning and well-being in the Vilarica sub catchment will be submitted to a quartile 1 journal. Separate but related research will investigate farming practices to promote sustainable viticulture by maximizing functional agrobiodiversity in Douro vineyard soils. This will involve the study of (i) cover crops and (ii) compost and biochar effects on ecosystem service provisioning.

Weather/climate based research will assess agro-forest-environmental systems and improve knowledge on fire regimes in Portugal and beyond. This will include the assessment of weather, meso and microclimate effects on water resources, food and agro-forest-environmental systems and characterization of global regional fire climates. An assessment of climate change impacts on intense precipitation regimes will be carried out. We will develop generic fuel models, fire behaviour and fuel consumption models for worldwide application. We will carry out an analysis of the role of live fuel moisture content in extreme fire behaviour and identification of critical thresholds. Regional fire danger ratings will be classified and interpreted.

### **Ecosystem Restoration and Management**

Using the Douro as a case study site, catchment management focused research will develop a multi-criterion system that applies socio-economic, ecological, and environmental and soil use parameters, for decision making concerning dam removal and improving fluvial connectivity in regulated rivers. Biophysical models (k-lab procedures) will integrate biological and environmental data to assess climate change and soil use change on fluvial systems.

Sustainable management and improvement of native forest ecosystems will analyse growth patterns in native forest ecosystems in relation to management regimes. Research will continue on chestnut fertilization and irrigation, combatting the chestnut gall wasp (*Dryocosmus kuriphilus*), chestnut blight (*Cryphonectria parasitica*) and ink disease (*Phytophthora cinnamomi*). An assessment will be made of parameters (e.g. meteorological variables, remote sensing indexes) with greater predictive potential of chestnut productivity in Portugal and a climatic characterization will be made of the main chestnut producing regions, under present and future climate conditions. We will characterize and quantify self-seeding rates of *Pinus pinaster* in forest burnt areas, including a temporal analysis and the development of equations. We will carry out an analysis of the potential of *Pinus pinaster* saplings as fuel for local thermal power plants and compensation costs in the management of self-seeding *Pinus pinaster* stands.

### **Agri- food and Forestry Sustainability**

Wastewater remediation research will focus on combining biological and physicochemical methods to reduce the toxicity of winery wastewater. CITAB will launch a screening programme of *Cryptococcus* pathogenic yeasts across Portugal and niche prediction of *Cryptococcus neoformans* and *Cryptococcus gattii* in Europe. Initial results indicate that *C. gattii* distribution along the Mediterranean coast is limited by low temperatures during the winter and heavy precipitation during the dry season.

We aim to improve knowledge on associations between components of ecosystem diversity (geodiversity, biodiversity, weather and climate diversity, waterscape diversity, and biomechanical exposure diversity) linked with human senses and expected health benefits.

## 2.5.2 Thematic Strand 2

### 2.5.2.1 *Main achievements:*

#### **Task 2.1 Innovative technologies and processes**

We made technological assessments of predictive models for oenological parameter estimation for different varieties, growing conditions and harvest year, using hyperspectral imagery and machine learning algorithms.

We carried out research on different types of materials covering identification of the patterns variation of wood density components in *Pinus sylvestris*, *Pinus nigra* and *Quercus faginea*. We were able to assess quality, identify best uses, make ecological evaluations and assess best forest management practises. Further work on wood included the characterization of strain rate effects on the mode I and mode II fracture behaviour of wood bonded joints. We developed an inverse method to evaluate the elastic properties of cherry fruit cuticle, combining photogrammetry based 3D geometrical modelling of fruits, compression tests of whole fruits and finite element simulations of compression tests. We also developed an inverse method to determine the cohesive laws of cortical bone under mode I and mode II loading, as well as an identification protocol of the elastic properties of long bone cortical tissue.

The feasibility of distinct FTIR techniques was used in tandem with multivariate analyses to evaluate of different food matrices. Both the NIR (Near-Infrared) and MIR (Medium-Infrared) Intervals were used for this purpose and the performance of each technique was compared. Both intervals (NIR and MIR) allowed us to evaluate the impact of distinct freezing periods in the proximate composition and phytochemical contents of frozen cowpea pods. We were also able to discriminate between samples subject to distinct freezing periods (at 3 months, 6 months or 9 months). The FTIR-ATR technique, within the MIR Interval, has also been applied for the evaluation of antioxidant activity and olive oil yield in distinct clones of the same olive cultivar (Cobrançosa); scarce data is presently available regarding the application of this methodology to evaluate distinct genotypes from the same species and variety.

Grapevine source to sink interactions were assessed in response to environment. We observed that severe leaf removal decreased grape starch and sucrose storage capacity. Cabernet Sauvignon fruiting cuttings was found to modulate key enzyme activity sugar transporter gene expression

## Task 2.2. Valorization of bio-based products and co-products

Complying with the transition to a European zero waste policy and following the University's research strategy (integrating Douro region multiple production processes but taking into account the environmental factors) several products have been analyzed during this year, with the intent of supplying basic nutritional information on the chemical composition, digestibility, phytochemical and anti-nutritional factors. Within the analyzed raw matters, special focus was directed to agro-industrial products and co-products resulting from the agro-food resources (vegetables, fruits, olives, wine, native flora and medicinal plants).

The evaluation of winery industry co-product content (grape pomace, grape stems, and wine lees), for phytochemicals, anti-nutrients, toxins, and aflatoxins, as well as the variation of these compositions over time. We have assessed the potential presence of deleterious levels of pesticides, paying special attention to the feasibility of distinct applications for these wastes, based on their specific constitutions.

Different types of co-products from vegetables (broccoli, green bean and tomato stems and leaves) and fruits (coffee spent grounds, sweet almond hulls, sweet cherry stems) were characterized. Portuguese ethnobotanical floral species, namely nettle (*Urtica dioica*), lavender (*Lavandula angustifolia*), sweet chestnut (*Castanea sativa*), laurel (*Laurus nobilis*), and white and violet heather (*Erica arborea* and *Erica cinerea*) were chemically studied and characterized by colorimetric methods and extracts were produced.

Different extraction and purification protocols were studied, validated and optimized, while distinct types of extracts (hydrophilic and lipophilic), obtained with either polar or non-polar solvents were produced. Different types of important bioactive compounds including polyphenols, glucosinolates, triterpenoids and alkaloids, widely known as having important bioactive properties, were identified. For instance, glucosinolates and their metabolic products, display an important function for the plant defense and human health, being related to chemoprotective effects and anti-tumoural activity. chemical composition, digestibility and anti-nutritional factors of co-products from the legume grain industry, namely cowpea stovers, were analyzed to evaluate potential inclusion in herbivorous diets (ruminants and rabbits).

This aforementioned general characterization of multiple substrates was essential to the development of studies on the biological and toxicological activities as well as for the development of new products with potential impact on human and animal health and nutrition.

**Biological and toxicological activities**

Proof of the antioxidant capacity of produced extracts and other natural products, such as propolis, was obtained using different types of in vivo and in vitro bioassays such as Inhibition of lipid peroxidation, scavenging capacity of free radicals of DPPH and ABTS, cupric reducing capacity and ferric reducing power. Furthermore, antimicrobial capacity of the produced extracts was confirmed using assays of disc diffusion assays and minimum Inhibitory concentration (MIC). Significant links, from statically point of view, between phytochemicals identified in the extracts and the antioxidant, antiradical and antimicrobial activities were established.

Studies on the therapeutic and toxicological properties of plant extracts were evaluated using animal models, especially laboratory rodents. In this way, previously identified most promising extracts of in vitro biological activities were tested via dietary trials to assess capacity to modify pathophysiological biomarkers of health status in vivo. Studies on the evaluation of *Castanea sativa* flower extracts in the animal model of prostate cancer chemically induced and the evaluation of the toxicological and therapeutically properties of *Laurus nobilis* extract in the animal model of cervical cancer K14HPV16 were performed. It was initiated the study of stillage to access its potential either as a source of beneficial compounds (valorization) or as contaminant (toxicity). As a first approach, this wine industry waste product is being tested in zebrafish embryos (Fish Embryo Test).

Biological treatments by solid-state fermentation using white-rot fungi allowed the reduction of anti-nutritional factors such as total phenolics and lignin of substrates such as cowpea stovers, olive meal and vine stalks, indicating that these treated substrates have potential for animal feeding trials.

**Innovation and development of new added-value products**

It has been possible to demonstrate that wastes and co-products from vegetables and fruits can be used with accurate and simple but effective protocols, to produce pomaces with high content of bioactive compounds. These pomaces can be used by agro-food and pharmaceutical industry to extract bioactive compounds to be used in different type of applications.

Cowpea stover was successfully ensiled with discarded apples and the silage quality as well as its aerobic stability point out to a potential feed source for ruminant diets.

White-rot fungi treated cowpea stover was included in rabbits diets and performance data indicate that it could be utilized in their diets up to inclusion levels of 10%.

Grape stems from the winery industry have also demonstrated potential to be used directly, minimally processed, in the production of spirits, namely a liquor based beverage

by the incorporation of this by-product, proving that this first approach allowed obtaining an added value product fitting a current market demand.

New biocomposites, based in agro-forestry wastes and fungi, were developed, allowing a useful destination for those wastes and contributing to the replacement of many petroleum-based polymers, such as the styrofoam and plastics, in agriculture and other industries.

#### 2.5.2.2 Future Research

##### **Task 2.1 Innovative technologies and processes**

Smart agriculture-focused research will develop sensor-based assessment and quality evaluation in the following areas: databases for grape image and reference values; robust predictive models for oenological parameter estimation, including assessment for different varieties, growing conditions and harvest year; deep-learning robust predictive models for oenological parameter estimation; predictive models for water stress estimation and spatial-temporal statistical models for image data analysis obtained from land robots to monitor vineyards and crops.

Research on materials will study wood density variation through X-ray microdensitometry in *Quercus cerris* to estimate quality. We will develop methods to evaluate physical and anatomical wood properties regarding quality assessment and suitable uses including. We will develop new techniques to measure wood density profiles (softwoods) by analysing wood image RGB component and compute wood density components and growth traits (softwoods) using RGB component analysis. We aim to identify and quantify different hardwood tissues (fibres, vessels and parenchyma) by image analysis, based on the transverse dimensions of the cells.

Mechanical and fracture behaviour of bio-based materials and structures will evaluate the mechanical properties of cortical bone of animal models of breast cancer, human papilloma virus and chronic kidney disease. We will investigate identification methodologies of hyperelastic constitutive laws of soft tissues of animal models. We will study measurement methods of fracture cohesive laws of wood and wood bonded joints using local data (in the initial crack tip vicinity). We will develop identification methods of mechanical properties of cherry tissues. Experimental characterization and computational modelling of wood compression failure in the material symmetry directions, will be carried out at the mesomechanical scale.

The FTIR-ATR based approach, using multivariate analyses, has been successfully applied to distinct clones of the same species in our lab. This methodology will be applied as a tool

to assist clonal selection processes. Grape samples from 30 distinct 'Tempranillo' genotypes have been collected from two distinct sites, in three distinct harvests. The genotypes have been assessed to evaluate the performance of the distinct clones and the FTIR-ATR spectra have been concomitantly registered for these samples. The data collected will be used to calibrate and validate models to evaluate the samples through spectroscopical means. This will allow us to develop this work in a more efficient way and with fewer human resources over the next two years, representing an innovative approach to expand and divulge this kind of work. Since previous work has been already developed regarding beans and cowpea, while other legume species are being presently assessed through FTIR, this methodology will be also applied to construct generalized models. This will allow us to evaluate distinct contents and features of different legume species. Finally, faeces from distinct mammal species will be also assessed through FTIR, in both the NIR and MIR intervals, in order to evaluate their feasibility and performance in the indirect assessment of species feeding patterns.

## **Task 2.2. Valorization of bio-based products and co-products**

### **Structural characterization of bio-based products and co-products**

We will continue to study more and different residues and co-products from agro-food industry, in order to pursue the efforts to find a friendly and alternative solution for these undesirable materials. In addition, we will look for specific materials from agro-food industry with high negative impact in the environment and often neglected as natural source of bioactive compounds. We will obtain pomace extracts and determine their chemical composition with liquid chromatographic methods.

### **Biological and toxicological activities**

Identification and characterization of new plant extracts and other natural products with antimicrobial, antioxidant, anti-inflammatory and anti-genotoxic properties for human and animal health applications. Studies of anti-diabetic activities, including assays of anti- $\alpha$ -glycosidase, anti- $\alpha$ -amylase and anti-glutathione S-transferase enzymes will be performed.

Evaluation of therapeutic and toxicologic properties of natural substances from our region (*Lavandula pedunculata*, *Mentha cervina*, *Hypericum androsaemum*, *Tilia platyphyllos*, *Equisetum giganteum*) in animal models of cervical cancer K14HPV16.

Evaluation of the effects of black beans in the animal model of colorectal cancer

The study of algae as protective agents in carcinogenesis. It is intended to follow up the research with stillage aiming to identify oxidant/anti-oxidant activities and cell cycle

alterations (anti-age potential). Wastewaters from other agro-food sectors will also be tested for potential valorisation and toxicity.

White-rot fungi strains will continue to be tested in order to develop specific growth conditions for each strain according to the substrate. These will allow us to potentiate their detoxification capacities.

Furthermore, the assessment of the anti-bacterial activity of compounds isolated and identified from grape stems and pomaces will be also assessed, regarding distinct bacteriological strains, while a plethora of compounds obtained from distinct grape varieties, has been presently identifies.

### **Innovation and development of new added-value products**

Animal trials to support the utilization of cowpea stover and discarded apple silages in ruminant feeding will be planned. Higher levels of inclusion of white-rot fungi treated cowpea stover will be studied in feeding trials with rabbits. Other co-products treated with white-rot fungi will be tested in animal feeding trials.

Bioactive compounds of different extracts will be recovered to be used as nutraceutical, natural food additives/ingredients, therefore showing potential to be used in pharmaceutical, cosmetics and food industries.

The collaboration between our research team and agro-food companies will continue in the search for environmentally friendly solutions for agro-food industrial co-products. We expect to conduct outreach activities with actual and new private companies to demonstrate that is possible to find effective and environmental friendly solutions for agro-food wastes and, still, valorize them economically.

## **2.6 Outreach activities**

CITAB researchers organized or took part in over 100 outreach activities over 2017. In a year marked by some of the worst wildfires for over a decade, prominent CITAB researchers were constantly present in the media, answering question on the consequences of these extreme events.

Co-organized by members of the CITAB from 26<sup>th</sup> to 30<sup>th</sup> June about 300 young people (8 – 16 years old) participated in the fifth edition of “UTAD Junior University”, with the theme “Develop yourself” and under the aegis of the UNESCO's International Year of Tourism for Sustainable Development. Also, on 29<sup>th</sup> March took place the 16<sup>th</sup> edition of the “UTAD Open Day”, involving about 800 secondary school students, as well as the “Science and Technology Week” (21<sup>th</sup>-24<sup>th</sup> November), the “Portuguese Biology Olympiads” (5<sup>th</sup>-7<sup>th</sup>



May), the “Earth Hour” (25<sup>th</sup> March) at UTAD, and the “Open weekend - A future as a Biologist / Biochemist” at Minho University (24<sup>th</sup>-25<sup>th</sup> March). These CITAB outreach activities offered a wide range of activities (exhibitions, films, guided tours, lectures, laboratory experiments, workshops, and interactive demonstrations) and gave to secondary school students a first “hands-on” contact with research, to generate interest and enthusiasm that may help them decide on their future vocation.

The CITAB pole at the University of Minho participated in the European Researchers’ Night (NEI) in Braga on 29<sup>th</sup> September 2017. Promoted every year as part of the European Commission’s Marie Skłodowska-Curie programme, this event brings citizens closer to scientists and the work they do in an informal setting. For the sixth consecutive year, the Science Faculty at University of Minho organized integrated activities. NEI17 was organized as part of the SCILIFE project - Science in Everyday life 2016 - 2017 (H2020-MSCA-NIGHT-2016).

The creation of the UNESCO Chair “Geoparks, Sustainable Regional Development and Healthy Lifestyles” was approved in 2016 by the United Nations Organization area for Education, Science and Culture. Hosted by UTAD, this UNESCO chair oversees an international network for the socio-economic and environmental development of World Geoparks or Biosphere Reserves. The emerging paradigm of Healthy Lifestyles in natural spaces will drive integrated research, teaching, knowledge transfer and communication for sustainable resource optimization in agro-food and forestry territories, as well as health services of their respective ecosystems. This new educational area uses mobility and practical research to develop concepts and instruments that support research projects, outreach activities and advanced training for students based at UTAD who can study and investigate the economic, environmental and social aspects of the territories.

The first International Summer University on Geoparks, Sustainable Regional Development and Healthy Lifestyles took place at UTAD (3<sup>rd</sup> – 14<sup>th</sup> July 2017). Partners collaborated from 10 countries and 57 participants enrolled in the event. [The summer university](#) was highly multidisciplinary, using theory and practical approaches. This project is coordinated by CITAB researcher Ronaldo Gabriel.

Organized by members of the CITAB, 7 activities in the scope of "Living Science in the Laboratory - Scientific Occupation of Youth in the Holidays" were held from June 26 to July 7, involving 13 students from different regions of the country and archipelagos:

- The scientific journey from the cell to the ecosystem (João Carrola);

- Evaluation of the Antioxidant Potential of Compounds Extracted from Aromatic and Medicinal Plants (Ana Barros);
- The Effect of Physical Exercise on Prostate Cancer (Bruno Colaço);
- In vivo evaluation of biocompatibility of biomaterials for bone regeneration (Paula Oliveira);
- Discovering the DNA of ancient varieties (Isaura Castro);
- Medical Ecology: Discover the role of the medical-veterinary diagnostic laboratory in the conservation of wild species and public health (Maria das Neves);
- Plant Extract and its Antimicrobial Potential: Alternative to antibiotics? (Maria José Saavedra).

### **Wildfire in Portugal: CITAB provides essential outreach in 2017**

The year 2017 was marked by devastating wildfire events in Portugal. The CITAB researcher and internationally renowned wildfire expert Paulo Fernandes was appointed member of an Independent Technical Commission that was proposed and approved by Parliament (Law no. 49-A / 2017) in July 2017. [The commission comprises 12 national experts in forest fires](#). The commission has carried out a fact-finding mission and drawn up a technical report on the fires that devastated central region of Portugal between 17<sup>th</sup> and 24<sup>th</sup> June 2017. Paulo has since participated in numerous debates and public discussion panels; he has given lectures, written or contributed to newspaper articles and been interviewed for radio and television. Some of these 2017 outreach activities are listed below:

1. Opinion article "[Fire of Pedrógão Grande - Ten proposals for Portugal not to burn](#)". "Observador" daily newspaper, 15<sup>th</sup> July.
2. Opinion article "Fire of Pedrógão Grande - Ten proposals for Portugal not to burn". "Expresso" weekly newspaper, 15<sup>th</sup> July.
3. Interview "Paulo Fernandes defends the need for forestry engineers". Radio "Renascença" national radio station, 19<sup>th</sup> July.
4. Interview "[Euro Wildfires](#)" at the "TRT World" international TV station, 27<sup>th</sup> July.
5. Interview "[The solution is to tackle the problem of accumulated biomass](#)". DN daily newspaper, 27<sup>th</sup> July.
6. Opinion article "A quarter of the fires start at night". "Expresso" weekly newspaper, 26<sup>th</sup> August.

7. Opinion article "Galicia has halved its burnt area". "Expresso" weekly newspaper, 29<sup>th</sup> August.
8. Opinion article "[Fires – Paulo Fernandes: The problem is not solved by changing people or from year to year](#)". "Observer" daily newspaper, 16<sup>th</sup> October.
9. Opinion article "[Expert says that it was known since Friday that the risk was maximum: It was necessary to act accordingly](#)". "Expresso" weekly newspaper, 16<sup>th</sup> October.
10. Interview "[Fires - Firefighters are Jack-of-all-trades](#)" at the "TSF" national radio station, 16<sup>th</sup> October.
11. Interview "[Forest Fires: The risk was known, but it burned. And no one prevented it](#)". "Público" daily newspaper, 17<sup>th</sup> October.
12. Interview "[Europe's hurricane-fueled wildfires might become a recurring nightmare](#)" at the "Grist" international daily newspaper, 19<sup>th</sup> October.
13. Interview "[CO<sub>2</sub> emissions level doubles with fires in September and October](#)". "Público" daily newspaper, 20<sup>th</sup> October.
14. Interview "[Fires – Experts: new measures are "the first concrete step towards the absolutely disastrous fire of 2030"](#)". "Observador" daily newspaper, 22<sup>nd</sup> October.
15. Interview "[How to avoid the tragedy: What to do in the forest and fire management?](#)" "País ao Minuto" daily newspaper, 25<sup>th</sup> October.
16. Invited expert on the radio programme "Prova oral" at the "Antena 3" national radio station, 25<sup>th</sup> October.
17. Written interview at the "Visão" magazine, 26<sup>th</sup> October.
18. Interview "[Fires - New "huge and fast" fires require investigation, experts argue](#)" at the "TSF" national radio station, 30<sup>th</sup> October.
19. Interview "[Fires - Pyrocumulonimbo. Rare phenomenon may have been repeated on October 15th](#)" at the "TSF" national radio station, 30<sup>th</sup> October.
20. Interview "[Fires – Pyrocumulonimbo, the monstrous and rare storm that was repeated on October 15th](#)". "Observador" daily newspaper, 30<sup>th</sup> October
21. Episode of scientific series "Ep. 245: Paulo Fernandes - Firefighting trees in firefighting: are there differences between species?" presented in the program "90 seconds of science" at the "Antena 1" national radio station, 31<sup>st</sup> October.
22. Interview for the News report "[Green and Black](#)" at the "SIC Notícias" TV station, 5<sup>th</sup> November
23. Interview "[What is the difference in fire fighting between Portugal and Spain?](#)" "Porto Canal" TV station, 24<sup>th</sup> November.
24. Interview "Seeds delivered by airplanes generate pasture after fires". "Público" daily newspaper, 17<sup>th</sup> December.

Ana Sofia Santos (CITAB senior research) has been President of Horse Commission since December 2014, one of eleven scientific commissions of the European Federation for Animal Science (EAAP <http://www.eaap.org>). EAAP is an international non-governmental organization that aims to improve knowledge and dissemination of research in animal science and production. The mission of the Federation is to "promote the improvement, organization and enlightened practice of animal production by scientific research, the application of science and cooperation between the national animal production organizations, scientists and practitioners of member countries". Ana Sofia participated in innumerable outreach activities on Management, Welfare, Health, Therapeutic riding and Equine education over 2017.

### **Other Outreach Activities**

25. Interview "Seeds delivered by airplanes generate pasture after fires". "Público" daily newspaper, 17<sup>th</sup> December.
26. Mini Conference: "Mitigation of fire risk in the forest of the future". Conference of Regional Strategy on Adaptation to Climate Change in Alentejo, Évora, 4<sup>th</sup> December.
27. Talk: "Forest management and fires, Fires in Portugal: the before, the during... and the after". University of Aveiro, 13<sup>th</sup> December.
28. Mini Conference: "Church of São Lourenço (Church of the Crickets) of Porto, history and conservation of plasters". 10<sup>th</sup> Anniversary of the Portuguese Association of History of Vine and Wine, Peso da Régua, 27<sup>th</sup> November.
29. Organization of the Science and Technology Week. This event aims to disseminate the science that develops within the School of Life and Environmental Sciences (ECAV)/UTAD, sharing information about the projects, and let know the researchers (mostly from CITAB) and students involved. 21<sup>th</sup>-24<sup>th</sup> November.
30. Mini Conference: "Prevention of forest fires: options and results". VIII Macaronesian Forest Conferences, Funchal, 20<sup>th</sup> November.
31. Mini Conference: "The evolution of large fires in Portugal: lessons learned". FIRECAMP Alto Minho 2017, International Conference on Forest Fires, Valença, 20<sup>th</sup> November.
32. Mini Conference: "Development and sustainability: cultural heritage, author wineries and wine tourism". II National Meeting of Wine Museums, Peso da Régua, 10<sup>th</sup> November.
33. Organization of the "VI Journey of the Equidae Research Working Group", Golegã, 8<sup>th</sup> November.

34. Mini Conference: “Dendrology”. BioBlitz - Landscape Lab Program, Braga, 23<sup>th</sup> September.
35. Talk: “Autochthonous Forest - Some Historical-Natural and Cultural Aspects”. Solar Festivals Seminar, Trancoso, 23<sup>th</sup> September.
36. Construction and dissemination of a natural engineering demonstration site: Pilot Station for the Study of the Recovery of Burnt Areas (Castanheira de Pêra, Figueiró dos Vinhos, Portugal). A technical outreach activity developed specifically a visit by the State Secretary for Forests and Rural Development (Eng. Miguel Freitas) and key sector stakeholders to see firsthand natural engineering techniques and devices for stabilizing slopes and mitigating erosion along watercourses. UTAD/CIFAP/CITAB, in collaboration with EcoSalix, 21<sup>th</sup>-22<sup>th</sup> September.
37. Mini Conference: “Coppice Conversion, a difficult and long-lasting process in Europe”. IUFRO 125th Anniversary Congress, Freiburg (Germany), 18-22<sup>th</sup> September.
38. Talk: “Is there a good/bad fire?” Workshop Good Fire, Bad Fire, EUROPARC Conference – New Voices, New Visions, New Values, Secondary School of Arouca, 7<sup>th</sup> September.
39. Talk: “Techniques for monitoring concentrations of ammonia in poultry”. Back to knowledge 2017, 4<sup>th</sup>-15<sup>th</sup> August.
40. Talk: Ecosystem services and well-being under different scenarios of land use and climate change. Invited lecturer: First Summer University on Geoparks, Sustainable Regional Development and Healthy Lifestyles, University of Trás-os-Montes e Alto Douro, Portugal. An initiative of the UNESCO Chair on Geoparks, Sustainable Regional Development and Healthy Lifestyles, 4<sup>th</sup> July.
41. Mini Conference: “The state of the scientific knowledge on fire: What contributions and mechanisms for risk management and forest fire prevention?” Meeting with Science and Technology in Portugal – Science’17, Lisbon, 3-5<sup>th</sup> July.
42. Video Interview “[Science Meeting’17](#)” at the “Meeting with Science and Technology in Portugal - #Science2017PT”, 3<sup>th</sup> July.
43. Mini Conference: “Evaluation of biological activities of propolis from Gerês (Portugal)”. Trends in Natural Product Research - PSE Young Scientists’ Meeting Lille 2017 - Natural Products in Health, Agro-Food and Cosmetics. Polytech Lille, Villeneuve d’Ascq, France, 28<sup>th</sup> June – 1<sup>st</sup> July.
44. The theme of the 5<sup>th</sup> edition of “[UTAD Junior University](#)” was “Self development” under the UNESCO International Year of Tourism for Sustainable Development. This edition promoted science, technology and culture for young people in a fun environment. CITAB researchers distributed across the 5 UTAD Schools organized 80

activities for approximately 300 participants aged between 8 and 16 years over one week. UTAD, 26-30<sup>th</sup> June.

45. Interview "Portugal on fire". "Isto É" daily newspaper, 23<sup>th</sup> June (<http://istoe.com.br/portugal-em-chamas/>)
46. Invited orator: "Research and Development for Forest Fire Protection". VII Conference New Paradigms of Civil Protection, Municipal Library of Santo Tirso, 20<sup>th</sup> June.
47. Interview "[Portugal's prime minister calls on emergency services to explain wildfire response](#)". "The Guardian" daily newspaper, 20<sup>th</sup> June.)
48. TV debate in the program "Pros and Cons on Forest Fires" presented at the "RTP 1" TV station, 19<sup>th</sup> June.
49. Interview "[Portugal, a country helplessly prone to forest fires](#)". "Washington Post" daily newspaper, 19<sup>th</sup> June.
50. Interview "[Portugal, a country helplessly prone to forest fires](#)". "Phys.org" daily newspaper, 19<sup>th</sup> June.
51. Opinion article "Kamov on the floor, sparks in the air". "Expresso" weekly newspaper, 10<sup>th</sup> June.
52. Conference: "Resistance of the pine forest to fire: how to do?" Congress of Resins, Environment and Industry, S. Pedro do Sul, 8<sup>th</sup> June.
53. First International Meeting for Prescribed Burning Operational Training Exchanges, Mafra, 4-8<sup>th</sup> June. Invited speaker.
54. Talk: "The Routes of Innovation of the Sea sector - relations between Universities and Companies". Business2Sea 2017 - Sea Forum, 7<sup>th</sup> Edition, "Ocean Technologies and Industries". Oporto, 5<sup>th</sup> June.
55. Participation in the evaluation panels "Biology and Environmental Sciences" at the XI National Science Showcase of the 25<sup>th</sup> Competition Young Scientists and Researchers of the "Fundação da Juventude" and "Ciência Viva", Oporto, 1<sup>st</sup>-3<sup>rd</sup> June.
56. Presentation of the state of the art and moderation of the debate. Workshop on Forest Fires - Fuel Management Bands, IV International Congress of Risks, University of Coimbra, 24<sup>th</sup> May.
57. Talk: "Efficiency and effectiveness of fire treatments". Technical Journeys- Use of Fire: Prevention of Rural Fires Fighting. Civil Protection Week of Guarda District, Seia, 20<sup>th</sup> May.
58. Field practical class (Ribeira das Toirinhas) on eutrophication in aquatic systems. Actions for secondary school students (12<sup>th</sup> grade), School of Morgado de Mateus, Vila Real, 8<sup>th</sup> May.

59. Organization of the “Portuguese Biology Olympiads–Senior”, Microbial Biochemistry. UTAD, 5<sup>th</sup>-7<sup>th</sup> May.
60. Putting the pieces together: dynamic modelling of river restoration measures. Journal Club of the Applied Ecology Laboratory, University of Trás-os-Montes e Alto Douro, Portugal, 26<sup>th</sup> April.
61. Mini Conference: “White and colorful plasters from the 18th and 19th centuries of the Church of S. Lourenço (Church of the Crickets), Oporto: materials and techniques employed”. International Day of Monuments and Sites, 18<sup>th</sup> April.
62. Mini Conference: “The role of oak forest on the fire defense”. Iberian Meeting of oak forest - valuation of multifunctionality, Sabugal, 7<sup>th</sup> April.
63. “5th Golden Grape Contest” approved by the Institute of Vine and Wine. Estoril Hotel School, 4-5<sup>th</sup> April (Chairman of the Selection Board)
64. Mini Conference: “What fire management policy for Portugal?” Forest Fires Seminar - A culture of prevention and firefighting, Sátão, 1<sup>st</sup> April.
65. Mini Conference: “Increased fire activity under climate change: mitigation and adaptation”, for Planning and Environmental Management students of the Manchester University, UTAD, 30<sup>th</sup> March.
66. The 16<sup>th</sup> [“UTAD Open Day”](#) disseminated teaching and research activities through 51 activities (exhibitions, films, guided tours, lectures, experiences, workshops, and interactive demonstrations) for approximately 800 secondary school students. This initiative involved a large number of CITAB researchers. UTAD, 29<sup>th</sup> March.
67. Mini Conference: “Controlled fire in Portugal: opportunities and constraints”. Forest Journeys - The Forest and the Fires, Arouca, 25<sup>th</sup> March.
68. Organization of the “Earth Hour”, involving Lectures, Thematic Workshops, and Cultural Activities. Executive Commission: UTAD/CITAB, Municipality of Vila Real, QUERCUS, Alter Ibi. 25<sup>th</sup> March.
69. A challenge for the future: Natural Engineering Techniques and Fluvial Biodiversity. A two-day workshop organized in collaboration with EcoSalix Ltd and Santarém Municipal Council. The workshop was for professionals and students in the areas of Engineering, Landscape Architecture, Ecology, Urbanism, Forest, Environment and Biology, 24-25<sup>th</sup> March
70. Talk: “Fire or Flame: Will the forest survive? Knowledge and decisions. Panel I "Before the Fire" - Prevention, is it justified? University of Lisbon, 10<sup>th</sup> March.
71. Episode of scientific series [“Ep. 6: Forest Fires” presented in the program “Biosfera”](#) at the “RTP 2” TV station, 18<sup>th</sup> February.
72. Guide to "Fire Rides”, to MONTIS, Arouca, January.

## 2.7 Prizes, awards and distinctions

CITAB researchers have been elected to prestigious posts or received awards during 2017:

- **JOSÉ LARANJO**: elected **Chairman** of the **Chestnut Workgroup** of the International Society for Horticultural Science (ISHS), for the 2017-2021 term of office;
- **MARIA EMÍLIA SILVA**: elected **President** of the **Portuguese Society of Forestry Sciences**, for the 2018-2021 term of office;
- **PAULO FERNANDES**: appointed as **scientific expert** of the **Independent Technical Commissions** which analyzed the fires that devastated the Central Region of Portugal in June and October 2017;
- **ANTONIETA ALVARADO MUÑOZ**: distinguished with the **Lisandro Alvarado Annual Research Prize**, awarded by the Bolivarian Republic of Venezuela / Centroccidental Lisandro Alvarado University, under your PhD, on the prognostic factors in the animal model of breast cancer, supervised by Bruno Colaço and Paula A. Oliveira.

## 2.8 International Doctoral Programmes

The 4<sup>th</sup> edition of the CITAB doctoral programme “AgriChains – Agricultural Production Chains: from fork to farm” was successfully launched. AgriChains is a joint degree, conferred by the University of Trás-os-Montes e Alto Douro (UTAD) and the University of Minho (UMinho) in partnership of the University of Wageningen (WUR) and the Polytechnic University of València (UPV). AgriChains continues respond to consumer demands and concerns via focused training of doctoral students in each step of the agricultural production chain. Forty PhD students are now in the AgriChains programme. Students from different editions of AgriChains programme are carrying out their thesis research in different areas of agro-food chain science. The first student cohort will complete their studies in July 2018.

CITAB continues to be a cornerstone research institute in the “Do\*Mar” doctoral programme. Do\*Mar is a doctoral and research programme in Marine Sciences, Technology and Management, comprising a consortium of three Galician Universities (Vigo, which coordinates, La Coruña and Santiago de Compostela) and 4 universities in the north of Portugal (UTAD, Minho, Aveiro and Porto). Two Spanish public research organizations CSIC (Higher Council for Scientific Research) and IEO (Spanish Institute of Oceanography) joined the consortium in 2017. Two hundred and thirty PhD students, of



which 10 supervised by CITAB researchers, are enrolled in “Do\*Mar”, which is now in its 2<sup>nd</sup> edition.

The International PhD Programme on “Water, sustainability and development” was launched in late 2017. Based at the specially constructed “Water Campus” in Ourense (Region of Galicia, Spain) this doctoral programme is coordinated by the University of Vigo and run in collaboration with the Junta de Galicia, Porto Polytechnic Institute and the University of Trás-os-Montes and the Alto Douro. The UTAD team mostly comprises CITAB researchers. In the future, the PhD will become a joint PhD between U Vigo, UTAD and Porto Polytechnic.

## 2.9 International Funded Projects

CITAB has been coordinating the EUROLEGUME project (Enhancing of legumes growing in Europe through sustainable cropping for protein supply for food and feed - GA 613781) since 2014. The project is funded by the 7<sup>th</sup> Research Framework Programme of the European Union (4,993,592€; 18 institutions from 10 EU MS). This research project will deliver an updated biochemical, nutritional and morphological description of valuable genotypes, as well as biological methods to enhance the nutritive value of the residual biomass and the development of new feed and food products. The consortium comprises the Portuguese institutions CITAB-UTAD and National Agrarian and Veterinary Research Institute (INIAV), the enterprises Frescura Sublime and Estirpe D’honra, as well as others partner institutions of Spain, Greece, Austria, Czech Republic, Latvia, Estonia, Albany, Sweden and Norway.

TURBO SUDOE - development, validation and demonstration of a model based on a network of “Transference Brokers” for a direct technology transference between R&D centres and companies in the SUDOE territory. CITAB became part of a nine-partner consortium, including R&D institutions, from the SUDOE region. TURBO SUDOE kicked off in July 2016 and will end in June 2019. The consortium supports companies to improve their technical and scientific capacity via knowledge transfer in three main strategic areas (i) agrifood, (ii) automotive and (iii) energy/ICT. An innovative approach, using a dedicated Transference Broker to foster the transference process, will allow the consortium effectively exploit the knowledge generated from the strategic areas in the market. This will be done via a harmonized and coordinated effort between R&D (OFFER) and business activities (DEMAND). The consortium comprises 5 centres that OFFER knowledge (CITAB-UTAD, the University of Burgos, the University of Malaga, the University of Aveiro, and the Fundación Centro Tecnológico de Efficiency and Energy Sustainability) and 3 DEMAND Entrepreneurial Technology Clusters -(Agribusiness Business Federation of the Valencian

Community - FEDACOVA, Asociación Cluster de Automoción de Aragón - CAAR and Mecanic Vallée). The Barcelona Knowledge Innovation Market (KIMbcn), a world expert in Training in the area of Technology Transfer, is also a TuRBO project partner. The CITAB researchers involved in this project are senior researchers Professor Ana Barros, Professor Carla Amaral, and Professor Eduardo Rosa, who is also the project coordinator. TuRBO SUDOE is a 36 month with a global budget of 1.218,594 € project; CITAB-UTAD has been allocated 112 769 €.

The new EU Horizon 2020 programme Eurodairy - A Europe-wide Thematic Network on improving resource use efficiency in dairy farming - started in February 2016. The aim of this project is cooperation between institutions, knowledge transfer and organisation of demonstration techniques to address best practices across a wide range of conditions on pilot farms. This will stimulate the use of the project deliverables by commercial farmers. The EURODAIRY consortium includes researchers from 19 European institutions including from UTAD & CITAB (coordinated by the senior research Henrique Trindade; CITAB). Eurodairy will develop a Europe-wide thematic network for dairy farming to enhance economic, social and ecological performance. Regional multi-actor groups of farming organisations, dairy industry, extension services and research organisations will collaborate to ensure a continuous two-way flow of information between practice and science. Eurodairy is a 36 month 1. 997, 237 € project; CITAB-UTAD has been allocated 36 865 €.

H2020: BRESOV - Breeding for Resilient, Efficient and Sustainable Organic Vegetable production. This European Project is coordinated by UNICT (IT) and supervised in CITAB by the senior researcher Eduardo Rosa. The project deals with the urgent need to provide climate-resilient cultivars in organic vegetable production systems. These new cultivars will benefit organic growers, and the organic seed industry, providing much needed security both under current and future scenarios of climate change. In this project, we will exploit the genetic variation of broccoli, kohlrabi, bean and tomato for enhanced productivity, by exploiting up-to-date knowledge of genome structure and function. This work will be enhanced by the active involvement of farmers, advisory services, research institutes, breeding companies and food processors from diverse geographical/climatic contexts in Europe and Non-EU countries. The selection of pre-breeding/ breeding lines for the three species will be undertaken in organic vegetable farming systems, utilizing an annual crop rotation scheme. New cultivars will be selected for efficiency when grown under water, temperature, and nitrogen stress, for resistance to some pests and diseases, for desirable product quality traits such as taste, visual appearance, and post-harvest

performance. The Stakeholder Board will contribute to the expected outcomes of the project. Crop genetic diversity will be broad as we will be utilizing several landraces (LRs) and crops wild relatives (CWRs) provided by partners for the foreseen pre-breeding and breeding activities. We will adopt an innovative approach, where plant traits related to the roots-zone, and to root-growth, and architecture that enable a better interaction with organic soil and its microbiome, are sought to benefit the end-users. This approach will ensure that the available genetic resources and bred-germplasm, combined with the best onfarm management practices will enhance resource use efficiency and productivity. The germplasm from this project will act to pump-prime the production of new seed for the organic growing sector and will also serve as a model for the enhancement of other crops. BRESOV is a 48 month with a global budget of 5.962,020 € project; CITAB-UTAD has been allocated 125 000 €.

H2020 Project - MSCA-NIGHT-2016 Ref. 723006: SCILIFE - Science in everyday life 2016-2017. Marie Skłodowska-Curie Actions - European Researchers' Night. Interaction project with the society that proposed to organize the European Researchers Night during 2016 and 2017 at the University of Minho. Participating Institutions: University of Lisbon (coordination), University of Minho (Coord UM Estelita Vaz, Coord. CITAB Ana Cunha), University of Oporto, Nova ID FCT, Lisbon University Institute, and Municipality of Lisbon. Supervised in CITAB by Estelita Vaz. Global budget: 159 750 €.

CITAB also participates in the project “Integrative conservation strategies for the critically endangered freshwater mussels in Tunisia before their dramatic extinction”, financed by the Mohamed bin Zayed Species Conservation Fund (Tunisia). The main objective is to protect and restore the Tunisian freshwater mussel biodiversity and the use of planning and sustainable management practices to prevent species extinction and repair damage to their habitats. The consortium is coordinated by Najoua Trigui Elmenief (Bizerte-Carthage University, Tunisia), includes partners from Tunisia, France, Spain and Portugal, and in CITAB is coordinated by Simone Varandas.

Sino-Portuguese Programme for Cooperation in Science & Technology; “The Cooperative Study on Prevention and treatment of neurological disorders by medicinal plants”; FCT-MOST bilateral cooperation, 2016-2019; participants: UMinho, Southwest Medical University, (Louzhou, China), Chinese Academy of Medical Sciences (Beijing, China); (PI: Alberto Dias); CITAB budget: 16 200 €.

Improving the management of Atlantic Landscapes: accounting for biodiversity and eCcosystem sErVICES (ALICE). This INTERREG Project aims to develop a set of new tools and methodologies in order to enhance the characterization of biodiversity (habitats and

species, sensu Habitats Directive) and the valuation of ecosystem services in a set of case studies within the Atlantic Region. ALICE will pay special attention to the demonstrative and participatory character of these case studies by enhancing the participation of different stakeholder and policy developers within the selected regions. This will help illustrate how biodiversity characterization and ecosystem service valuation can be incorporated on integrated landscape management and socioeconomic planning. The consortium is coordinated by the University of Cantabria, includes partners from Spain, France, Ireland and Portugal, and in CITAB is coordinated by Samantha Hughes (CITAB). CITAB-UTAD has been allocated 264 483€ and is responsible for Work Package 5: *Improving biophysical models to link terrestrial, riverine and coastal interfaces*.

INTERREG V-A ESPAÑA/PORTUGAL (POCTEP) nº 0050: UNI+I - Cooperación transfronteriza Norte de Portugal- Castilla y León para el impulso al emprendimiento innovador y la competitividad de las empresas (UNI+I - Transboundary Cooperation Northern of Portugal-Castilla and León for the promotion of innovative entrepreneurship and business competitiveness). The primary goal of UNI + i is to strengthen cooperation between the institutions responsible for R & D & I in Castilla and Leon - Northern Portugal to create and develop innovative companies in the common strategic sectors of the Cooperation Area. Likewise, the project will look for: 1) Promote the entrepreneurial culture and support entrepreneurship among young researchers or highly qualified; 2) Increase the competitiveness of the business network of both regions and encourage specialisation in strategic sectors with high added value; 3) Create an ecosystem of innovative entrepreneurship in the Cooperation Area. The consortium comprises the Portuguese institutions CITAB-UTAD (coord: Maria Helena Moreira), the University of Porto and the Association for the Development of Regia Douro Park and the Spanish institutions Salamanca University, Science Park of Salamanca and Iberian Association of Riverside Municipalities of the Duero. UNI+I is a 36 month project with a global budget of 932 372,63 €; CITAB-UTAD has been allocated 126 375 €.

Transnational Promotion and Cooperation of the Atlantic Geoparks for sustainable development (Atlantic-Geoparks) is a project partner in the EU-funded Interreg project (EAPA\_250/2016). The project is funded through the Atlantic Area section of the European Regional Development Fund. The project aims to promote and disseminate the geological and cultural heritage of the Atlantic Geoparks to attract tourist flows and generate new economic activity. Atlantic Geoparks will produce cutting-edge tools to promote Geotourism, support the labelling process of "UNESCO Global Geoparks" in Atlantic natural areas without this distinction and carry out educational activities and environmental

awareness around the geological heritage. The Atlantic Geoparks Project is a 30 month programme (2017 – 2019) with UTAD as Lead Partner (coordinated by Artur Sá) and supervised in CITAB by Ronaldo Dias Gabriel. CITAB-UTAD has been allocated 207 037,50€. The project partners are: • UTAD-University of Trás-os-Montes and Alto Douro (Portugal) • Arouca Geopark (Portugal) • Azores Geopark (Portugal) • Forest Fawr Geopark (UK) • Marble Arch Geopark (Ireland) • Basque Coast Geopark (Spain) • Lanzarote Geopark (Spain) • Sustainable Municipalities Community of Cantabria Aspiring Geopark (Spain) • PNR Armorique Aspiring Geopark (France) • North Pennines AONB Geopark (UK) • Burren and Cliffs of Moher Geopark (Ireland) • Copper Coast Geopark (Ireland) • GeoMon Geopark (UK)

INTERREG V - España/Portugal (POCTEP) nº 1326: Network of Rural Landscapes in the Borders of the Douro River: A Strategic Map of the Iberian Plateau). The main objective is to promote eco-efficiency of cultural and heritage landscape resources as well as the protection of agroecosystems in the vicinity of the Douro river border (Cross-border Biosphere Reserve: Iberian Plateau). The consortium includes researchers from Spain (Valladolid University (coordination) and Castilla y León Natural Heritage Foundation) and Portugal (CITAB-UTAD supervised by Domingos Lopes and Polytechnic Institute of Bragança). This INTERREG project is a 36 month 290 710,45 € project; CITAB-UTAD has been allocated 71 992,05 €.

INTERREG V - España/Portugal (POCTEP): Iberphenol - Red cooperativa de investigación en el ámbito de polifenoles y sus aplicaciones industriales (Iberphenol - Research cooperation network in polyphenols and its industrial applications). The project will establish a thematic research network on polyphenols, through the following main areas: 1. Promote the interaction and integration of research and development capacities; 2. Promote the training and mobility of researchers between academic centers and companies; 3. To develop collaborative R & D projects (involving research centers and companies) in order to produce results capable of creating added value, mainly applicable to the food, pharmaceutical and cosmetic industry; 4. Promote the technology transfer between public institutions and the business framework. The consortium comprises the Portuguese institutions CITAB-UTAD, University of Coimbra, University of Porto (Faculty of Sciences and Faculty of Pharmacy) and Polytechnic Institute of Bragança, the Spanish Institutions University of Salamanca, University of Valladolid and University of Vigo, and the wine cellar Matarromera, S.L. This Project is coordinated by UNICT (IT) and supervised in CITAB this project is supervised by the senior researchers Eduardo Rosa and Ana Barros. CITAB-UTAD has been allocated 18 888€.

INTERREG V-A ESPAÑA/PORTUGAL (POCTEP) nº 0067: FLUMEN DURIUS - Promoción y valorización de los recursos turísticos del río Duero (FLUMEN DURIUS - Promotion and valorization of the tourist resources of Douro river). The cross-border cooperation project "Flumen Durius" aimed to protect and enhance the cultural and natural heritage of the area of the Douro river axis as well as to promote and value the natural and cultural heritage around the river to attract new visitors and tourists. Thus, it is intended 1) Propose sustainable models to conserve the material and immaterial heritage of the Douro; 2) Strengthen the joint image and the tourism services around the river, using ICT and social networks; 3) Promote a sustainable and quality tourism based on the cultural and landscape heritage of riverside municipalities. The consortium comprises the Spanish partners Municipality of Zamora (coordination), Iberian Association of Riverside Municipalities of the Duero (AIMRD), Innovative Business Grouping for Efficient Building (AEICE), Santa María la Real Foundation of Historical Heritage, and the Portuguese partners UTAD/CITAB (supervised by Maria Helena Moreira) and the Municipality of Miranda do Douro. CITAB-UTAD has been allocated 140 062,50€.

INTERREG V-A ESPAÑA/PORTUGAL (POCTEP) nº 0366: ResValHum - Valorization of organic waste: production of humic substances. Axis: Sustainable growth through cross-border cooperation for risk prevention and better management of natural resources.. Coordination: Fernanda Proença, University of Minho. Supervised in CITAB by Ana Cunha e Rui Oliveira. Global budget: 471 143,53 €.

Two more international projects were approved in 2017, but will start in 2018:

- Interreg V - Atlantic Area (EAPA\_304/2016): Dairy-4-Future - Propagating innovations for more resilient dairy farming in the Atlantic area (CITAB coordination: Henrique Trindade; 281 975€)
- Interreg V - Atlantic Area: NASPA - Natural fungicides against air & soil borne pathogens in the Atlantic Area (CITAB coordination: Berta Gonçalves; 274 029,64€)

Green Growth (Crescimento Verde): CITAB (Professor Domingos Lopes) is participating in the "Agriculture and Forestry (GTT AGF)" thematic network. Network actions started in April 2016 with the principal objective of outlining a framework to help meet objectives and Green Growth Group strands in the agro-food sector. The network is part of the Green Growth Group ("Crescimento verde"), created by the EU to endorse a long-term aim towards a better, green and a sustainable economy. This is based on a circular economic paradigm that embraces higher productivity, the production of less residues and wastes,

higher recycling rates and lower CO2 emission levels. The Green Growth Group will support green activities to promote environment protection, to create and promote employment, to stimulate sustainable management tools with a maximum respect for natural resources, water quality and biodiversity.

### 3 Productivity metrics

#### 3.1 SCI/JCR articles

A total of 197 SCI/JCR articles were published within the thematic strands of Sustainability of Agri-food and Forestry Ecosystems in a changing environment and Technology & innovation in Agri-food and Forestry chains for a more competitive bioeconomy in 2017.

1. Afonso, S, Ribeiro, C, Bacelar, E, Ferreira, H, Oliveir, I, Silva, AP, Goncalves, B. (2017). Influence of training system on physiological performance, biochemical composition and antioxidant parameters in apple tree (*Malus domestica* Borkh.). *SCIENTIA HORTICULTURAE* 225: 394-398. ISSN: 0304-4238. doi: 10.1016/j.scienta.2017.07.037 (Impact factor, Quartil: 1.624, Q1).
2. Aires, A, Carvalho, R. (2017). Rapid Separation of Indole Glucosinolates in Roots of Chinese Cabbage (*Brassica rapa* Subsp *Pekinensis*) by High-Performance Liquid Chromatography with Diode Array Detection. *INTERNATIONAL JOURNAL OF ANALYTICAL CHEMISTRY* 2017: Article ID 5125329. ISSN: 1687-8760. doi: 10.1155/2017/5125329 (Impact factor, Quartil: 0.901, Q4).
3. Aires, A, Carvalho, R, Matos, M, Carnide, V, Silva, AP, Goncalves, B. (2017). Variation of chemical constituents, antioxidant activity, and endogenous plant hormones throughout different ripening stages of highbush blueberry (*Vaccinium corymbosum* L.) cultivars produced in centre of Portugal. *JOURNAL OF FOOD BIOCHEMISTRY* 41: e12414. ISSN: 0145-8884. doi: 10.1111/jfbc.12414 (Impact factor, Quartil: 1.000, Q3).
4. Aires, A, Carvalho, R, Saavedra, MJ. (2017). Reuse potential of vegetable wastes (broccoli, green bean and tomato) for the recovery of antioxidant phenolic acids and flavonoids. *INTERNATIONAL JOURNAL OF FOOD SCIENCE AND TECHNOLOGY* 52: 98-107. ISSN: 0950-5423. doi: 10.1111/ijfs.13256 (Impact factor, Quartil: 1.640, Q2).
5. Aires, A, Dias, C, Carvalho, R, Saavedra, MJ. (2017). Analysis of glycosylated flavonoids extracted from sweet-cherry stems, as antibacterial agents against pathogenic *Escherichia coli* isolates. *ACTA BIOCHIMICA POLONICA* 64: 265-271. ISSN: 0001-527X. doi: 10.18388/abp.2016\_1374 (Impact factor, Quartil: 1.105, Q4).
6. Alvarado, A, da Costa, RMG, Faustino-Rocha, AI, Ferreira, R, Lopes, C, Oliveira, PA, Colaco, B. (2017). Effects of exercise training on breast cancer metastasis in a rat model. *INTERNATIONAL JOURNAL OF EXPERIMENTAL PATHOLOGY* 98: 40-46. ISSN: 0959-9673. doi: 10.1111/iep.12225 (Impact factor, Quartil: 1.780, Q3).
7. Alvarado, A, Faustino-Rocha, AI, Colaco, B, Oliveira, PA. (2017). Experimental mammary carcinogenesis - Rat models. *LIFE SCIENCES* 173: 116-134. ISSN: 0024-3205. doi: 10.1016/j.lfs.2017.02.004 (Impact factor, Quartil: 2.963, Q2).
8. Alvarado, A, Lopes, AC, Faustino-Rocha, AI, Cabrita, AMS, Ferreira, R, Oliveira, PA, Colaco, B. (2017). Prognostic factors in MNU and DMBA-induced mammary tumors in female rats. *PATHOLOGY RESEARCH AND PRACTICE* 213: 441-446. ISSN: 0344-0338. doi: 10.1016/j.prp.2017.02.014 (Impact factor, Quartil: 1.543, Q3).
9. Álvarez X, Valero E, Santos RMB, Varandas SGP, Sanches Fernandes LF, Pacheco FAL. (2017). Anthropogenic nutrients and eutrophication in multiple land use watersheds: best management practices and policies for the protection of water resources. *LAND USE*



- POLICY 69: 1 a 11. ISSN: 0264-8377. doi: <https://doi.org/10.1016/j.landusepol.2017.08.028> (Impact factor, Quartil: 3.089, Q1).
10. Alves-Pimenta, S, Ginja, MM, Fernandes, AM, Ferreira, AJ, Melo-Pinto, P, Colaca, B. (2017). Computed tomography and radiographic assessment of congruity between the ulnar trochlear notch and humeral trochlea in large breed dogs. VETERINARY AND COMPARATIVE ORTHOPAEDICS AND TRAUMATOLOGY 30: 8-14. ISSN: 0932-0814. doi: 10.3415/VCOT-16-03-0045 (Impact factor, Quartil: 0.917, Q2).
  11. Alves-Pinnenta, S, Colaco, B, Fernandes, AM, Goncalves, L, Colaco, J, Melo-Pinto, P, Ginja, MM. (2017). Radiographic assessment of humeroulnar congruity in a medium and a large breed of dog. VETERINARY RADIOLOGY & ULTRASOUND 58: 627-633. ISSN: 1058-8183. doi: 10.1111/vru.12521 (Impact factor, Quartil: 1.137, Q2).
  12. Andrade, C, Corte-Real, J. (2017). Assessment of the spatial distribution of continental-oceanic climate indices in the Iberian Peninsula. INTERNATIONAL JOURNAL OF CLIMATOLOGY 37: 36-45. ISSN: 0899-8418. doi: 10.1002/joc.4685 (Impact factor, Quartil: 3.760, Q1).
  13. Andrade, E, Goncalves, A, Mendes-Ferreira, A, Silva, V, Pinheiro, V, Rodrigues, M, Ferreira, L. (2017). A novel feedstuff: ensiling of cowpea (*Vigna unguiculata* L.) stover and apple (*Malus domestica* Borkh.) mixtures. Evaluation of the nutritive value, fermentation quality and aerobic stability. JOURNAL OF THE SCIENCE OF FOOD AND AGRICULTURE 97: 4306-4313. ISSN: 0022-5142. doi: 10.1002/jsfa.8307 (Impact factor, Quartil: 2.463, Q1).
  14. Andrade, E., Pinheiro, V., Gonçalves, A., Cone, J.W., Marques, G., Silva, V., Ferreira, L., Rodrigues, M. 2017 Potential use of cowpea (*Vigna unguiculata* (L.) Walp.) stover treated with white-rot fungi as rabbit feed JOURNAL OF THE SCIENCE OF FOOD AND AGRICULTURE 97: 4386–4390. ISSN: 0899-8418. doi: 10.1002/jsfa.8395 (Impact factor, Quartil: 3.760, Q1).
  15. Andrade, SC, Guine, RPF, Goncalves, FJA. (2017). Evaluation of phenolic compounds, antioxidant activity and bioaccessibility in white crowberry (*Corema album*). JOURNAL OF FOOD MEASUREMENT AND CHARACTERIZATION 11: 1936-1946. ISSN: 2193-4126. doi: 10.1007/s11694-017-9576-4 (Impact factor, Quartil: 0.536, Q4).
  16. Andreani, T, Nogueira, V, Pinto, VV, Ferreira, MJ, Rasteiro, MG, Silva, AM, Pereira, R, Pereira, CM. (2017). Influence of the stabilizers on the toxicity of metallic nanomaterials in aquatic organisms and human cell lines. SCIENCE OF THE TOTAL ENVIRONMENT 607: 1264-1277. ISSN: 0048-9697. doi: 10.1016/j.scitotenv.2017.07.098 (Impact factor, Quartil: 4.900, Q1).
  17. Arosa, ML, Bastos, R, Cabral, JA, Freitas, H, Costa, SR, Santos, M. (2017). Long-term sustainability of cork oak agro-forests in the Iberian Peninsula: A model-based approach aimed at supporting the best management options for the montado conservation. ECOLOGICAL MODELLING 343: 68-79. ISSN: 0304-3800. doi: 10.1016/j.ecolmodel.2016.10.008 (Impact factor, Quartil: 2.363, Q2).
  18. Arteiro, A, Catalanotti, G, Xavier, J, Linde, P, Camanho, PP. (2017). Effect of tow thickness on the structural response of aerospace-grade spread-tow fabrics. COMPOSITE STRUCTURES 179: 208-223. ISSN: 0263-8223. doi: 10.1016/j.compstruct.2017.06.047 (Impact factor, Quartil: 3,858, Q1).
  19. Azevedo, S, Cunha, LM, Oliveira, JC, Mahajan, PV, Fonseca, SC. (2017). Modelling the influence of time, temperature and relative humidity conditions on the mass loss rate

- of fresh oyster mushrooms. *JOURNAL OF FOOD ENGINEERING* 212: 108-112. ISSN: 0260-8774. doi: 10.1016/j.jfoodeng.2017.05.026 (Impact factor, Quartil: 3.099, Q1).
20. Barbosa, S, Pauperio, J, Herman, JS, Ferreira, CM, Pita, R, Vale-Goncalves, HM, Cabral, JA, Garrido-Garcia, JA, Soriguer, RC, Beja, P, Mira, A, Alves, PC, Searle, JB. (2017). Endemic species may have complex histories: within-refugium phylogeography of an endangered Iberian vole. *MOLECULAR ECOLOGY* 26: 951-967. ISSN: 0962-1083. doi: 10.1111/mec.13994 (Impact factor, Quartil: 6.086, Q1).
21. Barroca, MJ, Guine, RPF, Calado, ARP, Correia, PMR, Mendes, M. (2017). Artificial neural network modelling of the chemical composition of carrots submitted to different pre-drying treatments. *JOURNAL OF FOOD MEASUREMENT AND CHARACTERIZATION* 11: 1815-1826. ISSN: 2193-4126. doi: 10.1007/s11694-017-9563-9 (Impact factor, Quartil: 0.536, Q4).
22. Belo-Pereira, M, Andrade, C, Pinto, P. (2017). A long-lived tornado on 7 December 2010 in mainland Portugal. *ATMOSPHERIC RESEARCH* 185: 202-215. ISSN: 0169-8095. doi: 10.1016/j.atmosres.2016.11.002 (Impact factor, Quartil: 3.778, Q1).
23. Bernardo, S, Dinis, LT, Luzio, A, Pinto, G, Meijon, M, Valledor, L, Conde, A, Geros, H, Correia, CM, Moutinho-Pereira, J. (2017). Kaolin particle film application lowers oxidative damage and DNA methylation on grapevine (*Vitis vinifera* L.). *ENVIRONMENTAL AND EXPERIMENTAL BOTANY* 139: 39-47. ISSN: 0098-8472. doi: 10.1016/j.envexpbot.2017.04.002 (Impact factor, Quartil: 4.369, Q1).
24. Botequim, B, Fernandes, PM, Garcia-Gonzalo, J, Silva, A, Borges, JG. (2017). Coupling fire behaviour modelling and stand characteristics to assess and mitigate fire hazard in a maritime pine landscape in Portugal. *EUROPEAN JOURNAL OF FOREST RESEARCH* 136: 527-542. ISSN: 1612-4669. doi: 10.1007/s10342-017-1050-7 (Impact factor, Quartil: 2.017, Q1).
25. Branco-Neves, S, Soares, C, de Sousa, A, Martins, V, Azenha, M, Geros, H, Fidalgo, F. (2017). An efficient antioxidant system and heavy metal exclusion from leaves make *Solanum cheesmaniae* more tolerant to Cu than its cultivated counterpart. *FOOD AND ENERGY SECURITY* 6: 123-133. ISSN: 2048-3694. doi: 10.1002/fes3.114 (Impact factor, Quartil: 2.286, Q2).
26. Buchadas, A, Vaz, AS, Honrado, JP, Alagador, D, Bastos, R, Cabral, JA, Santos, M, Vicente, JR. (2017). Dynamic models in research and management of biological invasions. *JOURNAL OF ENVIRONMENTAL MANAGEMENT* 196: 594-606. ISSN: 0301-4797. doi: 10.1016/j.jenvman.2017.03.060 (Impact factor, Quartil: 4.010, Q1).
27. Cabral, D, de Almeida, MDV, Cunha, LM. (2017). Food Choice Questionnaire in an African country - Application and validation in Cape Verde. *FOOD QUALITY AND PREFERENCE* 62: 90-95. ISSN: 0950-3293. doi: 10.1016/j.foodqual.2017.06.020 (Impact factor, Quartil: 3.199, Q1).
28. Cajaiba, RL, Périco, E, Silva, WB, Santos, M. (2017). Seasonal patterns in the diversity of histerid beetles (Histeridae) are ecosystem specific' A case in para state, northern Brazil. *APPLIED ECOLOGY AND ENVIRONMENTAL RESEARCH* 15: 1227-1237. ISSN: 1589-1623. URL: [http://www.aloki.hu/indvol15\\_4.htm](http://www.aloki.hu/indvol15_4.htm) ( Impact factor, Quartil: 0.681, Q4).
29. Cajaiba, RL, Perico, E, Caron, E, Dalzochio, MS, Silva, WB, Santos, M. (2017). Are disturbance gradients in neotropical ecosystems detected using rove beetles? A case

- study in the Brazilian Amazon. *FOREST ECOLOGY AND MANAGEMENT* 405: 319-327. ISSN: 0378-1127. doi: 10.1016/j.foreco.2017.09.058 (Impact factor, Quartil: 3.064, Q1).
30. Cajuiba, RL, Perico, E, da Silva, WB, Santos, M. (2017). Can dung beetles (Scarabaeinae) indicate the status of Amazonia's ecosystems? Insights integrating anthropogenic disturbance with seasonal patterns. *ANIMAL BIOLOGY* 67: 301-318. ISSN: 1570-7555. doi: 10.1163/15707563-00002538 (Impact factor, Quartil: 0.574, Q4).
31. Cajuiba, RL, Perico, E, da Silva, WB, Santos, M. (2017). Attraction of Scarabaeinae (Coleoptera: Scarabaeidae) to different baits in the Brazilian Amazon region. *REVISTA DE BIOLOGIA TROPICAL* 65: 917-924. ISSN: 0034-7744. doi: 10.15517/rbt.v65i3.29433 (Impact factor, Quartil: 0.495, Q4).
32. Cajuiba, RL, Perico, E, Dalzochio, MS, da Silva, WB, Bastos, R, Cabral, JA, Santos, M (2017). Does the composition of Scarabaeidae (Coleoptera) communities reflect the extent of land use changes in the Brazilian Amazon? *ECOLOGICAL INDICATORS* 74: 285-294. ISSN: 1470-160X. doi: 10.1016/j.ecolind.2016.11.018 (Impact factor, Quartil: 3.898, Q1).
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### 3.2 Book Chapters

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11. Vilela, A., Pinto, T., Rosário, A. Cosme, F. (2017). Chemical and Sensorial Characteristics of Red Fruits Imprinted by Organic Farming Production. *In: Agricultural Research Updates*. Prathamesh Gorawala and Srushti Mandhatri (Eds.), Nova Science Publishers, ISBN: 978-1-53611-016-6. URL: [https://www.novapublishers.com/catalog/product\\_info.php?products\\_id=61253](https://www.novapublishers.com/catalog/product_info.php?products_id=61253)
12. Vilela, A., Pinto, T., Gonçalves, B., Bacelar, E., Correia, A.C., Jordão, A.M., Cosme, F. (2017). Food analysis: From structure, chemistry and flavour to foodomics. *In: Science within Food: Up-to-date Advances on Research and Educational Ideas* (95-105). A. Méndez-Vilas (Eds). ISBN: 978-84-947512-1-9. URL: <http://www.foodscience1.org/>; <http://www.formatex.info/foodscience1/book/contents.pdf>
13. Carvalho, J., Viana, H., Rodrigues, A. (2017). Portugal Coppices. In: *National Perspectives on Coppice from 35 EuroCoppice Member Countries* (58-59). Nicolescu, V.-N., Bartlett, D., Buckley, P., Rossney, D., Pyttel, P., Unrau, A. (Eds). Albert Ludwig Univ Freiburg, Freiburg, Germany. ISBN: 978-3-9817340-1-0. URL: <https://www.eurocoppice.uni-freiburg.de/intern/pdf/deliverables/national-perspectives>

### 3.3 Books

1. Bento-Gonçalves, A., Vieira, A.A.B., Costa, M.R.M., Aranha, J.T.M. (2017). Wildfires. Perspectives, Issues and Challenges of the 21st Century. Editors. Natural Disaster Research, Prediction and Mitigation, 2017, NOVA Science Publishers, New York - ISBN 978-1-53612-891-8 (eBook). 331 Pages.
2. Cabecinha, E., Monteiro, S.M., Coimbra, A.M., Alenção, A. (2017). Ciência e cidadania, UTAD 2017 - Livro de Resumos. UTAD - Universidade de Trás-os-Montes e Alto Douro(Ed). UTAD - Universidade de Trás-os-Montes e Alto Douro. ISBN:978-989-704-252-2. URL: [https://eventos.utad.pt/cienciacidadania/wp-content/uploads/sites/14/2017/11/Livro-de-Resumos-Ci%C3%aancia-e-Cidadania\\_2.pdf](https://eventos.utad.pt/cienciacidadania/wp-content/uploads/sites/14/2017/11/Livro-de-Resumos-Ci%C3%aancia-e-Cidadania_2.pdf)
3. Marques D., Fachada M., Viana H. (2017) Synergies Between Goat Grazing and Shrub Biomass in Mountain Areas. In: Simões J., Gutiérrez C. (eds) Sustainable Goat Production in Adverse Environments: Volume I. Springer, Cham

4. Martins, L.M., C.A. Silva, H. Sousa, A. Mariano, S. Madeira, A.P. Sintra, F. Leal, J. Ferreira-Cardoso, T. Pinto. (2017) O Freixo Duarte de Armas. A história e recuperação da árvore. Câmara Municipal de Freixo de Espada à Cinta, Universidade Trás-os-Montes e Alto Douro, Instituto da Conservação da Natureza e das Florestas, Universidade Algarve. EXOTERRA, Lda., Torre de Moncorvo; Luís M Martins (Eds). ISBN: 978-989-704-234-8
5. Nicolescu, V., Carvalho, J., Hochbichler, E., Bruckman, V., Piqué-Nicolau, M., Hernea, C., Viana, H., Stochlová, P., Ertekin, M., Tijardovic, M., Dubravac, T., Vandekerhove, K., Kofman, P., Rossney, D., Unrau, A. (2017). Silvicultural Guidelines for European Coppice Forests. Albert Ludwig Univ Freiburg, Freiburg, Germany.

The distribution of papers published in 2017 by quartile is listed in Table 3.

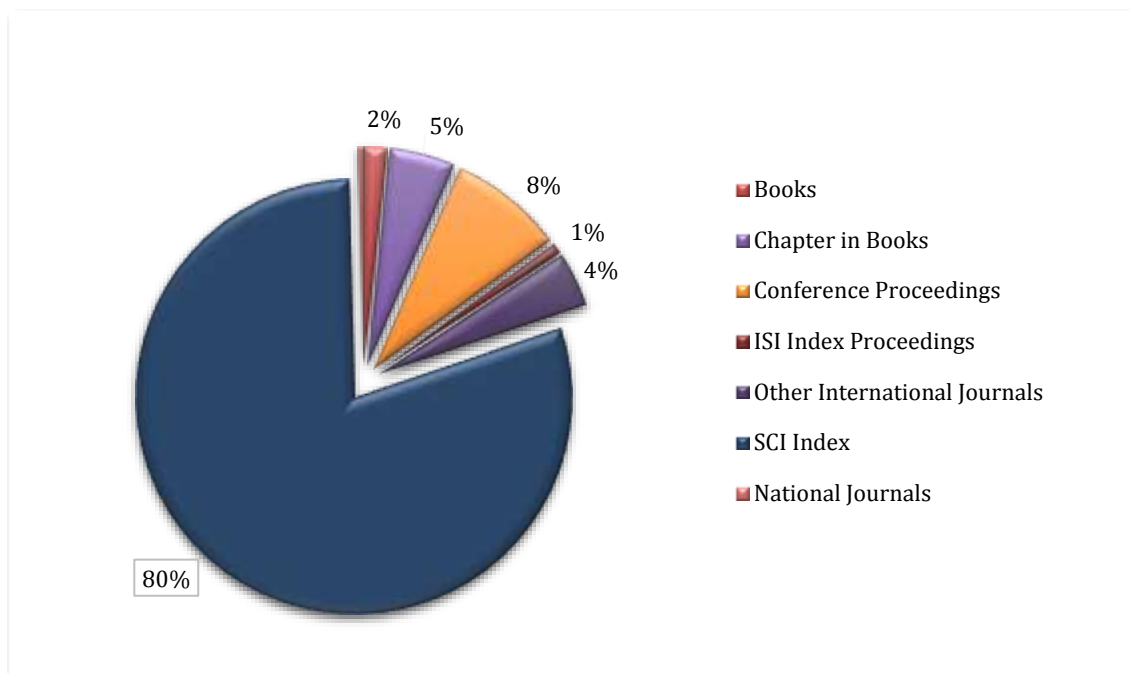
**Table 3. A summary of quartiles of 2017 published papers for CITAB**

| Quartile           | Number of papers |
|--------------------|------------------|
| Q1                 | 113              |
| Q2                 | 38               |
| Q3                 | 29               |
| Q4                 | 17               |
| <b>Total Geral</b> | <b>197</b>       |

In addition to the 197 papers in JCR Journals, the Research Centre published several other type of manuscripts, including in international journals, ISI proceedings, and international and national conference meetings as abstracts, national journals, books and chapters in books (Table 4 and Figure 2).

**Table 4. Summary of all indicators of the Research Centre during 2017**

|                              |            |
|------------------------------|------------|
| Books                        | 5          |
| Chapter in Books             | 13         |
| Conference Proceedings       | 21         |
| ISI Index Proceedings        | 2          |
| Other International Journals | 10         |
| National Journals            | 1          |
| SCI Index                    | 197        |
| <b>Total Geral</b>           | <b>249</b> |

*Figure 2. Percentage of each type of publication in 2017*

### 3.4 Patents

Two patents were granted to CITAB researchers during 2017:

1. Rebelo, E., Ginja, M. Dog Femur Positioner. National patent N.º 108 485 from October 2017..
2. Ginja, M. Hip distractor for dogs. National patent N.º 107 372 from February 2017.

### 3.5 Masters and Doctoral theses

A total of 49 Masters and 11 Doctoral theses were completed in 2017.

#### **Masters theses**

1. MSc Afonso, A.L. 2017. Influência da aplicação de ácido salicílico no comportamento fisiológico de oliveiras submetidas a défice hídrico. Master in Agronomic Engineering. Supervisors: Carlos Correia (CITAB-UTAD) and José Moutinho-Pereira (CITAB-UTAD).
2. MSc Almeida, F.A.G. 2017. Ferramenta para gerar automaticamente perguntas de matemática. Master in in Electrical and Computing Engineering. Supervisors: Carlos Serôdio (CITAB-UTAD) and João Matias (UTAD).
3. MSc Aragão, R.V.M.A. 2017. Viabilidade económica, ambiental e social da gaseificação de resíduos sólidos urbanos. Master in Environmental Engineering. Supervisors: Abel Rouboa (UTAD) and Carlos Teixeira (CITAB-UTAD).
4. MSc Araújo, C.S. 2017. Exploring the biomedical potential of Portuguese propolis. Master in Applied Biochemistry. Supervisors: Cristina Almeida Aguiar (CITAB-UMinho) and Filipa Pinto Ribeiro (EMed-UMinho).
5. MSc Barreiro, J.L.S. 2017. matUTAD, Reestruturação dos serviços de suport (Web e Business Tier). Master in Electrical and Computing Engineering. Supervisors: Pedro Mestre (CITAB-UTAD) and João Matias (UTAD).
6. MSc Barros, A.M.S. 2017. Estudo do potencial adaptativo de diferentes espécies florestais em resposta às alterações climáticas. Master in Forest Engineering. Supervisors: Maria João Gaspar (BioISI-UTAD) and Rosário Anjos (CITAB-UTAD).



7. MSc Barros, P.M.N. 2017. A influência da composição corporal na aptidão física funcional em mulheres pós-menopáusicas. Master in Gerontology: Physical Activity and Health in the Elderly. Supervisor: Helena Moreira (CITAB-UTAD).
8. MSc Barroso, L.C. 2017. Analysis of the effects of propolis extracts on DNA damage and mutagenicity. Master in Applied Biochemistry. Supervisors: Cristina Almeida Aguiar (CITAB-UMinho) and Rui Oliveira (CITAB-UMinho).
9. MSc Beires, F.A.A. 2017. Aplicação android para monitorização e processamento de dados de pressão arterial. Master in Electrical and Computing Engineering. Supervisors: Pedro Mestre (CITAB-UTAD) and José Ribeiro (UTAD).
10. MSc Carvalho, P. 2017. Imunoexpressão de marcadores de multiresistência a fármacos em oncologia. Integrated Master in Veterinary Sciences. Supervisors: Felisbina Queiroga (CITAB-UTAD) and Bruno Cogliati (USP-São Paulo, Brasil).
11. MSc Dinis, T.A.F. 2017. Efeito de dois fármacos antineoplásicos (Cisplatina e Dimetilaminopartenolídeo) a nível dos parâmetros de stresse oxidativo no fígado de murganhos com cancro da bexiga induzido com N-butil-N-(4-hidroxibutil)-nitrosamina. Master in Biochemistry. Supervisors: Carlos Venâncio (CITAB-UTAD) and Maria Manuel Oliveira (CQ-UTAD).
12. MSc Duarte, F.A.V. 2017. Riscos ambientais associados ao setor das pedreiras no território - o cerne do entre-norte-e-centro. Master in Environmental Engineering. Supervisors: Margarida Marques (CITAB-UTAD).
13. MSc Duarte, P.M. 2017. Caracterização da rigidez à flexão da madeira através do método dos campos virtuais: optimização e identificabilidade. Master in Mechanical Engineering. Supervisions: José Xavier (CITAB-UTAD) and José Morais (CITAB-UTAD).
14. MSc Faria, S.S.A. 2017. The influence of prey availability on the seasonal patterns of bat richness and activity in autochthonous deciduous forests. Master in Natural Resources Management. Supervisors: João Alexandre Cabral (CITAB-UTAD) and Paulo Barros (CITAB).
15. MSc Ferreira, S.M.V. 2017. Incremento da agrobiodiversidade funcional do amendoal na protecção contra pragas. Master in Agronomic Engineering, Supervisors: Laura Torres (CITAB-UTAD) and Antonio Crespi (CITAB-UTAD).
16. MSc Forno, B.C.B. 2017. Influence of kaolin application on physiological behavior of olive trees (*Olea europaea* L.) submitted to water deficit. Master in Biology. Supervisors: Carlos Correia (CITAB-UTAD) and José Moutinho-Pereira (CITAB-UTAD).

17. MSc Gomes, C.A.M. 2017. Correlation between chemical composition and bioactivity of *Thymus carnosus* Boiss. extracts. Master in Biochemistry. Supervisors: Amélia M. Lopes Dias da Silva (CITAB-UTAD) and Fernando M. Nunes (UTAD).
18. MSc Gomes, S.R.C. 2017. Estratégia para a validação de um método alternativo de monitorização de emissões pontuais em fontes fixas. Master in Environmental Engineering. Supervisors: Margarida Marques (CITAB-UTAD).
19. MSc Leite, A. (2017). Monitorização do impacte microclimático do Aproveitamento Hidroelétrico do Baixo Sabor. Master in Environmental Engineering. Supervisor: João Santos (CITAB-UTAD).
20. MSc Lino, M. 2017. Prognostic Factors for Cats with Squamous Cell Carcinoma of the Nasal Planum following High-Dose Rate Brachytherapy. Integrated Master in Veterinary Medicine. Supervisor: Felisbina Queiroga (CITAB-UTAD).
21. MSc Lopes, A. 2017. Influência da distância entre parafusos bicorticais no comportamento mecânico evidenciado por uma fratura transversa de fémur imobilizada com placa de osteossíntese interna. Supervisors: Fábio Pereira (CITAB-UTAD) and Nuno Dourado (CMEMS-UMinho).
22. MSc Maldonado, B. 2017. Matriz de indicadores de sustentabilidade na avaliação da gestão de resíduos sólidos em município de Pernambuco, Brasil. Master in Environmental Engineering. Supervisors: Carlos Teixeira (CITAB-UTAD).
23. MSc Martins, C. 2017. Respiratory diseases induced by *Bordetella bronchiseptica* in Internal Medicine of Companion Animals. Integrated Master in Veterinary Medicine. Supervisor: Felisbina Queiroga (CITAB-UTAD).
24. MSc Monteiro, E.M.R. 2017. Genetic diversity and phylogenetic relationships in cowpea revealed by chloroplast DNA analysis. Master in Molecular Comparative and Technological Genetics. Supervisors: Valdemar Carnide (CITAB-UTAD) and Isaura Castro (CITAB-UTAD).
25. MSc Moreira, A.B.S. 2017. Desenvolvimento de uma linha de cosmética à base de própolis português. Master in Molecular Biology, Biotechnology and Bioentrepreneurship in Plants. Supervisors: Cristina Almeida Aguiar (CITAB-UMinho) and Elisabete Sampaio Sá (EEG-UMinho).
26. MSc Mouta, F. 2017. Estudo do efeito da orientação de uma ligação roscada em tecido ósseo cortical através de um ensaio de arrancamento. Supervisors: Fábio Pereira (CITAB-UTAD) and Nuno Dourado (CMEMS-UMinho).

27. MSc Oliveira, L. 2017. Proteinúria em Gatos com linfoma. Integrated Master in Veterinary Medicine. Supervisor: Felisbina Queiroga (CITAB-UTAD) and Hugo Vilhena.
28. MSc Olmos, A. 2017. Caracterização numérico-experimental de uma ligação roscada em tecido ósseo cortical. Supervisors: Fábio Pereira (CITAB-UTAD) and Nuno Dourado (CMEMS-UMinho).
29. MSc Peçanha, L. 2017. Caracterização da Região de Trás-os-Montes em termos de potencial turístico. Master in Geographical Information Systems. Supervisor: José Aranha (CITAB-UTAD).
30. MSc Peixoto, A.P.R. 2017. Avaliação do efeito antimicrobiano de nanomateriais mono e bimetalúricos baseados em zeólitos. Master in Applied Biochemistry. Supervisors: Cristina Almeida Aguiar (CITAB-UMinho) and Isabel Correia Neves (EC-UMinho).
31. MSc Pereira, A.J.F. 2017. matUTAD, implementação da lógica de jogo e interface com o utilizador (Client Tier). Master in Electrical and Computing Engineering. Supervisors: João Matias (UTAD) and Pedro Mestre (CITAB-UTAD).
32. MSc Pereira, C.V.F. 2017. Effect of isothiocyanates on growth, morpho-physiology and ultrastructure in *Candida albicans* isolates. Master in Biology. Supervisors: Ana Sampaio (CITAB-UTAD) and Ana Margarida Calado (UTAD).
33. MSc Pereira, E.C.S. 2017. Efeito de fenólicos do extrato de casca de tangerina na viabilidade celular e na modulação dos níveis de proteínas reguladoras da apoptose. Master in Clinical and Laboratorial Biology. Supervisors: Amélia M. Lopes Dias da Silva (CITAB-UTAD) and Fernando Hermínio Milheiro Nunes (UTAD).
34. MSc Pinto, R.M.G. 2017. Técnicas de localização em ambientes exteriores. Master in Electrical and Computing Engineering. Supervisors: Pedro Mestre (CITAB-UTAD) and Carlos Serôdio (CITAB-UTAD).
35. MSc Pires, C.M.Q. 2017. Desenvolvimento de Ferramentas SIG para a Gestão do Empreendimento Hidroagrícola do Vale da Vilarça. Master in Geographical Information Systems. Supervisor: José Aranha (CITAB-UTAD).
36. MSc Pires, J.M.G. 2017. Caracterização da actividade apícola na Europa Mediterrânea e em Portugal. Master in Geographical Information Systems. Supervisor: José Aranha (CITAB-UTAD).
37. MSc Queiroz, M.F.J. 2017. Evaluation of grape stems extracts from cultivar 'Sousão' as a source of compounds inhibitors of oxidative stress in vitro using keratinocytes. Master in

- Biochemistry. Supervisors: Amélia M. Lopes Dias da Silva (CITAB-UTAD) and Raul Dominguez-Perles (CITAB-UTAD).
38. MSc Quintas, A.C.V.P. 2017. Resource efficiency in the built environment: trend analysis of CDW management in Portugal and Europe. Master in Environmental Engineering. Supervisors: Carlos Teixeira (CITAB-UTAD).
  39. MSc Rodrigues, V.F.S. 2017. Vocalization repertoires variation of Red-billed Cough (Pyrhacorax pyrrhacorax) populations in Portugal. Master in Applied Ecology, Aveiro University. Supervisors: António Luís (UA) and João Alexandre Cabral (CITAB-UTAD).
  40. MSc Sario, S.J.P. 2017. In vitro and in vivo evaluation of the biological effects of Celuvein® and its components. Master in Biotechnology for Health Sciences. Supervisors: Isabel O'Neill de Mascarenhas Gaivão (CITAB-UTAD) and Amélia Maria Lopes Dias da Silva (CITAB-UTAD).
  41. MSc Serafim, C.M.M. 2017. Análise de efeitos da Cetamina no desenvolvimento do sistema nervoso de peixe-zebra por avaliação da expressão génica. Master in Biotechnology for Health Sciences Supervisors: Ana Maria Coimbra (CITAB-UTAD) and Manuela Matos (UTAD).
  42. MSc Silva, M.R.T.M. 2017. Comunidade de nemátodes do solo associada a Quercus suber em declínio. Master in Agronomic Engineering. Supervisors: Ana Maria Nazaré Pereira (CITAB-UTAD) and Maria Teresa Martins de Almeida (CBMA-Centro de Biologia Molecular e Ambiental –Univ. Minho).
  43. MSc Silva, R. 2017. Predicting Oenological Attributes Using Machine Learning Models. Master in Informatic Engineering. Supervisor: Pedro Melo-Pinto (CITAB-UTAD).
  44. MSc Siopa, J.R.R. 2017. Mecanismos celulares subjacentes à potencial ação fototerapêutica induzida por corantes escurílicos”. Master in Biochemistry. Supervisors: Amélia Maria Lopes Dias da Silva (CITAB-UTAD) and Lucinda Vaz Reis (UTAD).
  45. MSc Sousa, C.C. 2017. Propriedades mecânicas do tecido ósseo cortical de modelos animais de cancro da bexiga e do colo do útero. Master in Biomedical Engineering. Supervisors: José Morais (CITAB-UTAD) and Bruno Colaço (CITAB-UTAD).
  46. MSc Sousa, J.L.S. 2017. Comportamento à fratura viscoelástica em modo I e modo II de ligações coladas em madeira. Master in Mechanical Engineering. Supervisors: José Morais (CITAB-UTAD) and Fábio Pereira (CITAB-UTAD).

47. MSc Tuna, J.F.T. 2017. Desenvolvimento de um UAV para aplicações de monitorização ambiental. Master in Electrical and Computing Engineering. Supervisors: Pedro Mestre (CITAB-UTAD) and Carlos Serôdio (CITAB-UTAD).
48. MSc Vaz, A.S.P. 2017. A problemática do cancro bacteriano da Actinidea na região de Entre Douro e Minho. Master in Agronomic Engineering. Supervisors: Ana Maria Nazaré Pereira (CITAB-UTAD) and Luisa Roldão Moura (CIMO - Centro de Investigação de Montanha-ESA/IPB / ESA/IPVC).
49. MSc Vieira, Z. 2017. Comportamento mecânico da cereja. Master in Mechanical Engineering. Supervisors: Fábio Pereira (CITAB-UTAD) and José Xavier (CITAB-UTAD).

### Doctoral theses

1. PhD Alvarado, M.A. (2017). Histopathology and immunohistochemistry characterization of mammary lesions chemically-induced by 7,12-dimethylbenz(a)anthracene and 1-methyl-1-nitrosourea in female Sprague-Dawley rats. PhD in Veterinary Sciences. Supervisors: Bruno Colaço (CITAB-UTAD), Paula Oliveira (CITAB-UTAD) and António Cabrita.
2. PhD Alves-Pimenta, M.S.R. (2017). Anatomical and imaging studies of the humeroulnar congruity in dogs'. PhD in Veterinary Sciences. Supervisors: Bruno Colaço (CITAB-UTAD) and Mário Ginja (CITAB-UTAD).
3. PhD Carvalho, M.I. (2017). Advances in Canine Mammary Cancer: A Role for Inflammatory Infiltrate in Tumor Microenvironment. PhD in Veterinary Sciences. Supervisors: Felisbina Queiroga (CITAB-UTAD) and Isabel Pires (CECAV-UTAD).
4. PhD Faustino, A.I.R. (2017). Mammary carcinogenesis in female rats: contribution to monitoring and treatment. PhD in Veterinary Sciences. Supervisors: Mário Ginja (CITAB-UTAD), Rita Ferreira (UA) and Adelina Quaresma (CECAV-UTAD).
5. PhD Gomes, T. (2017). A sensor node SoC architecture for extremely autonomous WSNs. PhD programme in Electrical and Computing Engineering. Supervisors: Jorge Cabral (UM) and Pedro Mestre (CITAB-UTAD).
6. PhD Gregorio, A.H. (2017). Dog cancer: an approach to owners' expectations and Cox-2 role in prognosis and therapy. PhD in Veterinary Sciences. Supervisor: Felisbina Queiroga (CITAB-UTAD); Isabel Pires (CECAV-UTAD) and Justina Prada (CECAV-UTAD).
7. PhD Morinha, F.J.G. 2017. Landscape genetic structure and ecological constraints of the endangered Red-billed Chough (*Pyrrhocorax pyrrhocorax*) populations in Iberian

- Peninsula: an innovative approach for conservation and management. PhD in Comparative Molecular and Technological Genetics. Supervisors: João Alexandre Cabral (CITAB-UTAD) and Estela Bastos (CITAB-UTAD).
8. PhD Nogueira, A.J.M. (2017). Contribution to the study of the rat model of renal mass reduction: the effect of chaetomelic acid A. PhD in Veterinary Sciences. Supervisors: Maria João Pires (CITAB-UTAD) and Paula Oliveira (CITAB-UTAD).
  9. PhD Oliveira, J.M.Q. (2017). Mechanical behavior of wood under mixed-mode loading. PhD programme in Mechanical Engineering. Supervisors: Marcelo Moura (FEUP), José Morais (CITAB-UTAD) and Paulo Fael (UBI).
  10. PhD Páscoa, M.I.A. (2017). Ammonia toxicity in zebrafish (*Danio rerio*). PhD in Chemical and Biological Sciences. Supervisors: António Fontainhas-Fernandes (CITAB-UTAD) and Jonathan Mark Wilson (CIIMAR).

### 3.6 International projects

CITAB researchers participated in 18 international projects over 2017.

|   | Project   | Funding      |
|---|---|--------------|
| 1 | "EUROLEGUME - Enhancing of legumes growing in Europe through sustainable cropping for protein supply for food and feed". Consortium coordinator: Eduardo Rosa. Starting date: January 2014, duration: 48 months (FP7-KBBE-2013-7 – GA 613781). <a href="http://www.eurolegume.eu/">http://www.eurolegume.eu/</a>  | € 742.816,34 |
| 2 | "EURODAIRY - A Europe-wide Thematic Network on improving resource use efficiency in dairy farming". CITAB/UTAD Coordinator: Henrique Trindade. Starting date: February 2016, duration: 36 months (H2020 - ISIB-2015-1 GA 696364). <a href="http://www.eurodairy.eu">http://www.eurodairy.eu</a>   | €36.865,00   |
| 3 | "SCILIFE - Science in everyday life 2016-2017". CITAB coordinator: Ana Cunha. Starting date: May 2016, duration: 19 months (H2020-MSCA-NIGHT-2016)  | €22.250,00   |
| 4 | "IB Project - Production of new bioactive compounds by plants and bacteria using new and improved halogenases". CITAB coordinator: Alfredo Aires. Starting date: May 2014, duration: 36 months (Era-net CA EIB.13.008 NBCPBH)   | € 100.000,00 |
| 5 | "MedWildFireLab - Global Change Impacts on Wildland Fire Behaviour and Uses in Mediterranean Forest Ecosystems, towards a « wall less » Mediterranean Wildland Fire Laboratory". CITAB Coordinator: Paulo Fernandes. Starting Date: October 2014, duration 30 months (Era-net).   | € 10.000,00  |
| 6 | "TurboSudoe - Development, validation and demonstration of a model based on a network of 'Transference BrOkers' for a direct technology transference between R&D centres and companies in the SUDOE territory". CITAB coordinator: Eduardo Rosa. Starting date: July 2016, duration: 36 months (INTERREG SOE1/P1/E0136) <a href="https://www.turbo-sudoe.eu/">https://www.turbo-sudoe.eu/</a> | €150.358,92  |
| 7 | "ALICE - Improving the management of Atlantic Landscapes: accounting for biodiversity and eCosystem sErVICES". CITAB coordinator: Samantha Hughes. Starting date: November 2017, duration: 36 months (INTERREG)   | €264.483,38  |
| 8 | "IBERPHENOL- Research cooperation network in polyphenols and its industrial applications". CITAB coordinator: Eduardo Rosa. Starting date: October 2015, duration: 51 months (INTERREG 0377_Iberphenol_6_E)   | €181.888,00  |

|    | Project   | Funding     |
|----|---|-------------|
| 9  | “UNI+i - Transboundary Cooperation Northern of Portugal- Castilla and León for the promotion of innovative entrepreneurship and business competitiveness”. Consortium coordinator: Helena Moreira. Starting date: May 2017, duration: 20 months (INTERREG)  | €126.375,00 |
| 10 | “Atlantic-Geoparks - Transnational Promotion and Cooperation of the Atlantic Geoparks for sustainable development”. CITAB coordinator: Ronaldo Gabriel. Starting date: June 2017, duration: 30 months (INTERREG ref - EAPA_250/2016)  | €207.037,50 |
| 11 | “FLUMEN DURIUS - Promotion and valorization of the tourist resources of Douro river”. CITAB coordinator: Helena Moreira. Starting date: May 2017, duration: 20 months (INTERREG)  | 140.062,50  |
| 12 | “ECOMAR – Valuation and Monitoring of Marine and Coastal Ecosystem Services in Iberoamerican countries”. CITAB participant: Edna Cabecinha. Starting date: January 2017, duration: 46 months (CYTED). <a href="https://futureoceanslab.org/ecomar/">https://futureoceanslab.org/ecomar/</a>   | N/A         |
| 13 | “PAIRED - Magnetically and photochemically actuated bioactive nanowires for remotely controlled drug delivery”. CITAB participant: Amélia Silva. Starting date: October 2016, duration: 36 months (ERA-NET/0004/2015)   | N/A         |
| 14 | “Temperatures, ash and soil hydrology: predicting fire impact from plant traits - Ko-Tsah-To”. CITAB coordinator: Paulo Fernandes. Starting date: September 2016, duration: 24 months (H2020-MSCA-IF-2015)  | N/A         |
| 15 | “A New Tool for Intelligent Computing: Autoadapted Aggregation Functions for Classification and Decision Making Problems”. CITAB coordinator: Pedro Melo Pinto. Starting date: November 2014, duration: 36 months. Promotor: UPNa (Spain)   | N/A         |
| 16 | “Urban Allotment Gardens in European Cities - Future, Challenges and Lessons Learned”. CITAB coordinator: Frederico Meireles. Starting date: September 2012, duration: 62 months. (COST Action) <a href="http://www.urbanallotments.eu/">http://www.urbanallotments.eu/</a>   | N/A         |
| 17 | “EuroCoppice - Innovative management and multifunctional utilization of traditional coppice forests - an answer to future ecological, economic and social challenges in the European forestry sector”. CITAB coordinator: João Paulo Carvalho. Starting date: January 2015, duration: 36 months. (COST Action FP1301) <a href="https://www.eurocoppice.uni-freiburg.de/">https://www.eurocoppice.uni-freiburg.de/</a> | N/A         |



|    | Project   | Funding |
|----|---|---------|
| 18 | “Land Surface Analysis Satellite Applications Facility”. CITAB coordinator: Malik Amraoui. Starting date: January 2007, duration: 11 years. (EUMETSAT). <a href="https://www.eumetsat.int/website/home/Satellites/GroundSegment/Safs/LandSurfaceAnalysis/index.html">https://www.eumetsat.int/website/home/Satellites/GroundSegment/Safs/LandSurfaceAnalysis/index.html</a> | N/A     |

### 3.7 National projects

CITAB researchers participated in or coordinated 32 national projects over 2017.

|   | Project  | Funding     |
|---|--|-------------|
| 1 | “+PrevCRP - Development of integrated strategies for the prevention of pine pitch canker”. CITAB coordinator: Luís Martins. Starting date: April 2017, duration: 48 months (Grupo Operacional)   | €62.506,27  |
| 2 | “BioPest - Integrated strategies to fight against key pests in nut species”. CITAB coordinator: Luís Martins. Starting date: April 2017, duration: 45 months (Grupo Operacional)   | €30.226,65  |
| 3 | “Preserve the quality of Arouquesa meat”. CITAB coordinator: Carlos Venâncio. Starting date: 2017-04-01, duration: 48 months (Grupo Operacional)   | €227.178,66 |
| 4 | “GOEfluentes - Livestock effluents: strategic approach towards agronomic and energetic valorization of flows in the farming activity.”. CITAB coordinator: Henrique Trindade. Starting date: 2017-06-01, duration: 48 months (Grupo Operacional) | €48.725,73  |
| 5 | “VITISHIDRI – Strategies for the management of water stress of the Douro Superior vineyards”. CITAB coordinator: Aureliano Malheiro. Starting date: 2017-03-01, duration: 48 months (Grupo Operacional)  | €100.603,83 |
| 6 | “Control and minimization of damages caused by invasive species <i>Vespa velutina nigrithorax</i> ( <i>Vespa velutina</i> ) in beekeeping”. CITAB coordinator: José Aranha. Starting date: 2017-05-01, duration: 48 months (Grupo Operacional)   | €98.021,09  |
| 7 | “New management practices in rainfed olive orchards - strategies for mitigation and adaptation to climate change”. CITAB coordinator: Carlos Correia. Starting date: 2017-01-02, duration: 48 months (Grupo Operacional)                         | €103.513,41 |

|    | Project  | Funding       |
|----|--|---------------|
| 8  | "ClimCast - The new challenges for the chestnut orchards in the context of climate change". CITAB coordinator: Mário Pereira. Starting date: 2017-09-01, duration: 43 months (Grupo Operacional)   | €74.650,85    |
| 9  | "Valorization of the Resende cherry production and market positioning of the chain". CITAB coordinator: Berta Gonçalves. Starting date: 2017-03-01, duration: 43 months (Grupo Operacional)  | €166.850,59   |
| 10 | "SustentOlive - Improvement of irrigation and fertilization practices at olive farms in Trás-os-Montes for its sustainability". CITAB coordinator: Anabela Silva. Starting date: April 2017, duration: 48 months (Grupo Operacional)                         | €193.496,98   |
| 11 | "INTERACT - Integrative Research in Environment, Agro-Chains and Technology". CITAB coordinator: Rui Cortes. Starting date: May 2016, duration: 36 months (ON.2 – NORTE-01-0145-FEDER-000017)  | €3.508.607,48 |
| 12 | "TEAMING - Promoting Agri-food and Forestry Stakeholder Engagement for Knowledge Transfer and SMARTAgriFor partnerships". Consortium coordinator: Eduardo Rosa. Starting date: June 2016, duration: 19 months (ON.2 – NORTE- 01-0246-FEDER-000023)           | €235.714,00   |
| 13 | "INNOVINE&WINE – Vineyard and Wine Innovation Platform". CITAB coordinators: João Santos & Aureliano Malheiro. Starting date: April 2016, duration: 36 months. (NORTE-01-0145-FEDER-000038)  | €1.124.971,76 |
| 14 | "RUNaway - Running away from prostate cancer: Walking through the molecular basis of physical activity". Project coordinator: Paula A. Oliveira. Starting date: July 2016, duration: 36 months (PTDC/DTP-DES/6077/2014)                                      | €85.968,00    |
| 15 | "LEGSeedCOAT - Legume seed coating with beneficial microorganisms for increased productivity and resilience under climate change conditions". CITAB coordinator: Guilhermina Marques. Starting date: July 2016, duration: 36 months (PTDC/AGR-TEC/1140/2014) | €82.800,00    |
| 16 | "BONFIRE – gloBal-scale analysis and mOdelliNg of FIRE behaviour potential". Project coordinator: Paulo Fernandes. Starting date: July 2016, duration: 30 months (PTDC/AAG-MAA/2656/2014)  | €68.859,00    |
| 17 | "Cherry cracking & mitigation strategies: towards their understanding using a functional metabolomic approach". Project coordinator: Berta Gonçalves. Starting date: June 2016, duration: 36 months (PTDC/AGR-PRO/7028/2014)                                 | €164.002,00   |

|    | Project  | Funding      |
|----|--|--------------|
| 18 | "FIREXTR - Prevent and prepare society for extreme fire events: the challenge of seeing the forest and not just the trees". CITAB coordinator: Mário Gonzalez Pereira. Starting date: May 2016, duration: 36 months (PTDC/ATP-GEO/0462/2014)   | €54.960,00   |
| 19 | "SOLAR - Earth System Modelling of the Eastern Atlantic Region". CITAB coordinator: João Santos. Starting date: September 2016, duration: 36 months (PTDC/GEO-MET/7078/2014)   | 3.120,00€    |
| 20 | "SPLICETHER - Application of splicing approaches to exploit alternative therapies for Lysosomal Storage Diseases: in vitro and in vivo studies". CITAB coordinator: Paula A. Oliveira. Starting date: May 2016, duration: 36 months. (PTDC/BBB-BMD/6301/2014)  | €14.400,00   |
| 21 | "FRESHCO - <u>Multiple implications of invasive species on Freshwater Mussel coextinction processes.</u> " CITAB coordinator: Simone Varandas. Starting date: April 2016, duration: 36 months (PTDC/AGR-FOR/1627/2014)   | €19.500,00€  |
| 22 | "ALIEN - An integrated approach to unravel Lasiodiplodia-grapevine Interaction". CITAB coordinator: J. Moutinho Pereira. Starting date: June 2016, duration: 36 months. (PTDC/AGR-PRO/2183/2014)   | €16.920,00   |
| 23 | "AMONIAVE - Techniques for reducing ammonia concentrations in poultry houses". CITAB coordinator: Henrique Trindade. Starting date: March 2016, duration: 32 months. (08/SI/2015). Promotor: Lusiaves  | €157.714,12  |
| 24 | "VITINOV – Innovation in Harvesting Systems for Steep Slope Viticulture". CITAB coordinator: Eduardo Rosa. Starting date: September 2014, duration: 36 months (PRODER 52306). Promotor: Symington Vinho SA   | € 107.695,92 |
| 25 | "ModelVitiDouro - Prediction model for grapevine development and production in the Douro Demarcated Region". CITAB coordinator: João Santos. Starting date: June 2014, duration: 36 months (PRODER 53774). Promotors: Adegas representativas da RDD: Mesão Frio (Baixo Corgo), Favaios (Cima Corgo) e Freixo de Espada à Cinta (Douro Superior). | € 100.130,04 |
| 26 | "Ergofito - Evaluation of the impact of the use of Ergofito in chestnut". CITAB coordinator: José Laranjo. Starting date: May 2014, duration: 36 months. Promotor: AgroRioBom. (ProDer 52428).   | 129.265,37 € |
| 27 | "Introduction of anti-hail screens in apple trees evaluation of side effects and economic impact". Mallus, Cagest, Instituto Politécnico de Bragança. CITAB coordinator: C. Correia. Starting date: April 2015, duration: 33 months. Promotors: Mallus. (ProDer PA 54824)  | € 112.946,35 |

|    | Project  | Funding      |
|----|--|--------------|
| 28 | “Chave In - Conceptualization, development and dissemination of an interactive system for identifying the Portuguese vascular flora, with emphasis in the North, based on an illustrated dichotomous key”. CITAB Coordinator: António Crespi. Starting Date: March 2014, duration 36 months (ProDer 52751) | € 32.190,82  |
| 29 | “DEUS EX MACHINA - Symbiotic technology for societal efficiency gains”. CITAB Coordinator: Pedro Melo Pinto. Starting Date: January 2016. Duration: 36 months (NORTE-01-0145-FEDER-000026)   | €146.340,00  |
| 30 | “Development of production processes and pine resin extraction to improve efficiency, rationalization and expansion of the activity”. CITAB Coordinator: José Luís Lousada. Starting Date: January 2015. Duration: 36 months Promotor GIFF (PRODER 57059)  | €108.550,66€ |
| 31 | PARRA – “Plataforma integrAda de monitoRização e avaliação da doença da flavesccencia douRada na vinhA”. CITAB Coordinator: Irene Oliveira. Starting Date: April 2016. Duration: 36 months. Promotor: Tekever ASDS, Lda. (LISBOA-01-0247-FEDER-003447)   | €25.000      |
| 32 | “Common Forest - Promotion of native forests for products and ecosystem services”. CITAB Coordinator: João Paulo Carvalho. Starting Date: January 2016. Duration: 48 months  | N/A          |

### 3.8 Industry contract research

During 2017, CITAB provided expert consultation in 17 major research contracts with public and private clients.

|   | Designation  | Contractor                                | Value         |
|---|--|---|---------------|
| 1 | Aproveitamento Hidroeléctrico do Baixo Sabor (AHBS) – Programa Integrado de Monitorização Ambiental (PIMA), Fase de Exploração (75/17/DST) | EDP – Gestão da Produção de Energia, S.A. | €1.127.655,24 |
| 2 | Aproveitamento Hidroeléctrico da Foz do Tua (AHFT) – Programa Integrado de Monitorização Ambiental (PIMA), Fase de Exploração (86/17/DST)  | EDP – Gestão da Produção de Energia, S.A. | €320.688,89   |

|    | <b>Designation</b>  | <b>Contractor</b>                     | <b>Value</b> |
|----|---|---------------------------------------|--------------|
| 3  | Monitorização da atividade e prospeção da mortalidade de quirópteros e de avifauna no Parque Eólico de Gevancas II  | Parque Eólico de Gevancas             | €13.634,00   |
| 4  | Trabalhos de monitorização de avifauna e quirópteros no sobreequipamento do parque eólico de D. João e Feirão na fase prévia à construção   | Empreendimentos Eólicos do Douro, SA. | €11.176,13   |
| 5  | Trabalhos de monitorização de avifauna e quirópteros no sobreequipamento do parque eólico do Vale da Azinheira na fase prévia à construção.   | Parque Eólico do Vale do Abade        | €10.819,88   |
| 6  | Trabalhos de monitorização de avifauna e quirópteros no sobreequipamento do parque eólico de Alto do Marco na fase prévia à construção  | Parque Eólico de Gevancas             | €8.421,38    |
| 7  | Levantamento e Caracterização de Habitats e Biodiversidade do rio Almonda (REF. 2160/15 – DAES/AP)  | Câmara Municipal de Torres Novas      | €30.000,00   |
| 8  | Levantamento e Caracterização de Habitats e Biodiversidade do rio Almonda (REF. 2160/15 – DAES/AP)  | Câmara Municipal de Torres Novas      | € 30.000,00  |
| 9  | AGUIAR CIV - Protocolo de Cooperação estabelecido entre a UTAD, a Câmara de Aguiar da Beira, a União de Freguesias de Aguiar da Beira e Coruche e a ARVOFRITI-Produção de Árvores e Fruta Lda., para Instalação do Centro de Interpretação Vivo do Castanheiro e da Castanha de Aguiar da Beira |                                       | € 40.269,40  |
| 10 | TranCast - Protocolo de Cooperação entre a UTAD e a Câmara Municipal Trancoso visando a promoção e o reforço da cultura do castanheiro no concelho de Trancoso  | City Hall of Trancoso                 | € 43.184,73  |

|    | Designation   | Contractor                     | Value        |
|----|---|--------------------------------|--------------|
| 11 | Avaliação de Eficácia dos Regimes de Caudais Ecológicos das Barragens de Vilarinho das Furnas e Salamonde   | PROFICO AMBIENTE               | € 16.321,00  |
| 12 | Monitorização do estado das massas de água rios e albufeiras no âmbito da Diretiva Quadro da Água   | Agência Portuguesa de Ambiente | 125.483,61 € |
| 13 | Elaboração de planos de gestão de habitats naturais, da fauna e da flora selvagens, que incidem sobre Sítios de Importância Comunitária (SIC) no âmbito da diretiva habitats. | Agência Portuguesa de Ambiente | € 42.200     |
| 14 | Reduce the impact of water abstraction and unsustainable water infrastructure on river basins biodiversity and functioning.   | MAVA: Fondation pour la Natur  | 99.348,00 €  |
| 15 | Porto Ranges Park - preliminar studies and management plan (Paulo Fernandes)  |                                |              |
| 16 | Study Case about the Pedrogão Grande and Góis wildfires   |                                | 6.000,00 €   |
| 17 | Monitoring of lentic and highly modified water bodies (Water Framework Directive)   |                                |              |

### 3.9 Spin-off Companies

Two companies were created by CITAB members in 2017, based on knowledge and expertise resulting from funded research projects. Some the companies already bear the UTAD Spin-Off seal, while others are waiting this seal of recognition.

1. **SPAWNFOAM, Lda.** - the company was created in January 2017 to develop and commercialize novel biomaterials from agroforestry residues and fungi. The applications (i) aim to replace plastics and styrofoam in agriculture, forestry,

construction, and other industries, as well as (ii) produce biofertilizers to boost crop productivity and health.

2. **Ruralidade Verde** - is a consulting and services company that specializes in boosting capacity of innovation, the generation and transfer of technical and scientific knowledge in Agrarian Sciences and Rural Development. The strong complementarity between company partner knowledge, capacity and outlooks and a strong link with national and international stakeholders (research centers, universities, municipalities, associations of producers, producers, cooperatives, etc.) are important reference for the success of this project. The partners have considerable experience in scientific consulting and the organization of events and training programmes.

## **4 List of CITAB Members in 2017**

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Ana Isabel R. Novo Amorim de Barro

### **VICE-DIRECTOR**

Pedro Alexandre Mogadouro do Couto

### **VICE-DIRECTOR**

Luís Miguel Mendes Ferreira

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#### **PRESIDENT**

Samantha Jane Hughes

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Carlos Manuel Correia

Guilhermina Miguel da Silva Marques

Hernâni Varanda Gerós

José Luís Penetra Cerveira Lousada

José Manuel Cardoso Xavier

#### **SECRETARIAT**

Lídia Maria Vieira de Nóbrega

Lígia Azevedo Ribeiro Pinto



**FULL MEMBER RESEARCHERS**

|  |                                       |
|--|---------------------------------------|
| Alberto Carlos Pires Dias              | Domingos Manuel Mendes Lopes          |
| Alexandre Gonçalves                    | Dulcineia Maria de S. Ferreira Wessel |
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| Dario Joaquim Simões L. dos Santos     | José Manuel Moutinho Pereira          |
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|---|--|
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| Luís Filipe Sanches Fernandes               | Paulo Alexandre Martins Fernandes      |
| Luis Manuel Lourenço Felix                  | Pedro Alexandre Mogadouro do Couto     |
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| Maria João Miranda Pires                    | Sónia Alexandra de Almeida Martins     |
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| Nélson Filipe Lopes Machado                 | Viviana Maria Martins Varajão          |
| Olga Maria Fernandes Pereira Coutinho       |  |

**COLLABORATORS**

|   |                                      |
|---|--------------------------------------|
| Alexandra Luísa Ribeiro Dias            | Changhe Zhang                        |
| Amadeu Duarte da Silva Borges           | Chenyao Yang                         |
| Ana Cristina Santos Abraão              | Claudia Alexandra dos Reis Serra     |
| Ana Isabel Marques Monteiro             | Cristina da Conceição Ribeiro Carlos |
| Ana Lúcia Lopes Pinto e Sintra          | Cristina Isabel Amaro da Costa       |
| Ana Maria Araújo de N. Nazaré Pereira   | Cristóvão Lucas dos Santos           |
| Ana Maria Marques Valentim              | Daniel Filipe Martins A. C. de Sousa |
| Ana Paula Álvaro Santana                | Daniela dos Santos Oliveira          |
| Ana Sofia Andrade de Faria              | Daniela Patrícia Salgado Terêncio    |
| Ana Sofia de Sá Gil Rodrigues           | Darinka Costa Gonzalez               |
| Ana Sofia Lopes Mil-Homens              | Dário Lúcio Ferreira de Jesus        |
| Ana Sofia Pereira Carvalho Soares       | David das Neves Silva                |
| Ana Sofia Pereira de Freitas            | David Passos Morgado Franco Frazão   |
| Anabela C. Borges                       | Dércia Cabral dos Santos             |
| Anabela Cristina M. da Nave Rodrigues   | Diogo Filipe T. C. de Sousa Carvalho |
| André Daniel Mendes Lemos               | Edna Carla J. Cabecinha Sampaio      |
| Andreia Marilise Carneiro de Carvalho   | Emanuel Soares Peres Correia         |
| Andressa Ballem                         | Ermelinda Isabel Martins da Silva    |
| Andreia Raquel Martins Garrido          | Eunice Maria Rico Moreira dos Santos |
| Ângelo Filipe dos Reis P. Cortinhas Sil | Fabrcício Lopes de Macedo            |
| António Carlos Pinheiro Fernandes       | Fernanda Maria Lopes-Ferreira        |
| António de Fátima de Melo A. Pinto      | Fernando de Pablo Davila             |
| António José Madeira Nogueira           | Fernando Pedro Falcão Raimundo       |
| Aurora Carmen Monzón Capapé             | Francisco José Guedes Morinha        |
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| Bruna Filipa Camilo Carbas              | Helena Maria Fernandes Ferreira      |
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| Carla Sofia Pereira Dias                | Iva Prgomet                          |
| Carlos Alberto R. Loureiro da Silva     | Ivo Miguel Meneses Pavia             |
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| Carmen Hernández Gómez                  | Joana Margarida Costa Fernandes      |
| Catarina Isabel Guedes Teixeira         | Joana Raquel Mendes Cação Parente    |
| Catarina Manuela Almeida Coelho         | João Manuel Cardoso Martins          |
| Cátia Filipa Pinheiro dos Santos        | João Paulo Baptista Carneiro         |
| Cátia Sofia Pereira Braga Pontos        | João Paulo Coelho                    |
| Cátia Vanessa Queijo Brito              | João Paulo Fidalgo Carvalho          |
| Célia Ferreira Rocha                    | Joaquim João de Sousa                |

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|--|---|
| Joaquim José Barreira de Jesus         | Marslin Gregory                             |
| Jorge Marcelo Quintas de Oliveira      | Marta Alexandra Nunes da Silva              |
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| José Carlos Silva Cardoso              | Miguel Pedro Antunes de Oliveira            |
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| Leónia do Carmo Santos Nunes           | Nuno Manuel Lucas Vieira Lopes              |
| Leonor Caldeira Ferreira               | Nuno Miguel Franco Paula Santos             |
| Lisa Maria de Oliveira Martins         | Olinda da Conceição Pinto Carnide           |
| Luis Filipe Pires Braz                 | Paula Alexandra da C. S. B. P. Rodrigues    |
| Luis Filipe Ribeiro da Rocha           | Paula Cristina Ribeiro Coutinho de Oliveira |
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| Luis Jesus Rivas Soriano               | Paulo Alexandre Rodrigues de Barros         |
| Luis Miguel Ferreira Pontes Martins    | Paulo Barracosa Correia da Silva            |
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| Magda Sofia Soares de C. .Nobre Semedo | Paulo Gabriel Fernandes de Pinho            |
| Manuel João Teles de Oliveira          | Pedro Miguel Mestre Alves da Silva          |
| Manyou Yu                              | Rafaela Alcina Araújo dos Santos            |
| Marcelo Flávio Jesus Queiroz           | Raquel de Pinho Ferreira Guiné              |
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| Márcia Silva de Oliveira               | Raul Manuel Pereira Morais dos Santos       |
| Margarida Maria Correia Marques        | Regina Maria Bessa Santos                   |
| Maria Adelaide Homem Perdigão Pito     | Reinaldo Lucas Cajaiba                      |
| Maria da Conceição C. Rodrigues        | Ricardo Jorge Nunes da Costa                |
| Maria do Rosário A. Ferreira dos Anjos | Richard Maykel Gonçalves Breia              |
| Maria Elisabete T. da Silva Franco     | Rita Coelho Bastos                          |
| Maria Emília Calvão Moreira da Silva   | Rita de Melo Durão                          |
| Maria Eunice da Costa Salavessa        | Rui Cláudio Constantino Madureira           |
| Maria Helena Rodrigues Moreira         | Rui Miguel Gil da Costa Oliveira            |
| Maria Irene Fraga dos Santos           | Rui Pedro Soares de Oliveira                |
| Maria Isabel M. G. Marques Cortez      | Ruth Maria de Oliveira Pereira              |
| Maria Isabel Pinho Pessoa Marinho      | Sandra Cristina Santos do Cabo              |
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| Maria Lúcia de Jesus Pato              | Sandrine dos Santos Ferreira                |
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| Marisa de Oliveira Lopes               | Sílvia Martins Afonso                       |

Sofia Mendes Moreira Correia  
Susana Margarida da Silva Parra  
Sweta Singh  
Tatiana Andreani  
Teresa Maria dos Santos Pinto  
Teresa Raquel Duque Enes  
Valéria Reva

Vanessa Cristina Monteiro Ferreira  
Vânia Cristina Santos Sena Graça  
Vânia Cristina Teixeira Seixas  
Véronique Imperatriz Medeiros Gomes  
Vicente de Seixas e Sousa  
Vitor Rodrigues Pereira  
Weina Hou