

2014 Activities Report

CITAB

Compiled by
**CITAB Executive
Committee**

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

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Executive Summary

The 2014 Activity Report Plan marks the end of the first phase of CITABs development strategy and a transition towards a more streamlined structure in anticipation of the 2015-2020 Strategic Programme.

This is part of ongoing strategy to achieve an FCT classification of “Excellent” and develop cohesive, integrated research initiatives in accordance with key public and private sector stakeholder needs. Transition is built upon previous strategic planning based on consolidation of research strategies, internationalisation and improving critical mass. CITABs significant growth in scientific critical mass and integrated members highlights the qualitative scientific progress and the growing vitality of the unit which has attracted researchers from various national institutions that identify with CITABs strategy.

Objectives for 2014 focused on more specific tasks:

- Internationalization of the Unit via more focused links with anchor institutions and increased mobility of our members. One of the priorities of FCT funding is to increase the mobility, especially short stays in advanced laboratories. Other internationalisation efforts included procuring new contacts and strengthening existing international links, in particular with Brazil, China and India, as well as central European institutions.
- Development of syllabi for international doctoral programmes with national and international research centres, universities and stakeholders. The objective is that each CITAB group will coordinate an international doctoral program involving other national and international institutions.
- Continued efforts to increase interdisciplinarity between CITABs groups via regular meetings with working groups, joint conferences, workshops etc. Funded scholarships at CITAB in key tasks will also help to enhance group interaction.
- Increase scientific productivity in JCR Journals and other publications and promoting outreach activities. Communication of CITAB research and society to key stakeholders, the scientific community and the general public.

The CITAB strategic project will focus on two research 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.

Each thematic area will have a defined set of tasks specifically designed to meet a vision of innovative scientific and technological knowledge that answers stakeholder needs, making Agri-food and Forestry chains more competitive and sustainable. As well as our mission to create opportunities for stakeholders to innovate scientifically and technologically in agri-food and forestry chains, strategic project research will also contribute to environmental sustainability.

1 Objectives and achievements

1.1 Unit description

CITAB core activities focus on interdisciplinary research on agro-food, forestry and the environment, with input from engineering technologies to enhance development of agro-food and forestry production chains in Portugal.

CITAB's research activities have been organized into 6 multidisciplinary projects to optimise research group expertise via the development of integrated, multidisciplinary research (see organigram). This approach maximises participation of integrated members and collaborators. The Strategic project (SP) will herald a more streamlined approach. Research will be focused into two thematic areas in order to effectively contribute to resolving societal and private sector problems related with agriculture and forestry production chains and their impact on the natural environment. This will be done by balancing scientific excellence with benefits and consequences across multiple dimensions that embrace environmental sciences and socioeconomic needs.

CITAB's activities rely on the contribution of integrated members (members with a PhD) and collaborators (members without PhD) that are selected and assessed using international benchmarking criteria. Most CITAB members are primarily lecturers; therefore the Unit offers an international doctoral programme and supports post-graduate courses offered by the host institution and others centres of learning.

CITAB is managed using a bottom-up approach. The Directorate (1 Director and 2 Vice-Directors) is supported by the Executive Committee (ExCo; 6 members- 2 from each Working Group and headed by the ExCo president) to form a two-way link between CITAB members and the Directorate for policy and research development.

The ExCo is also responsible for compiling information and collaborating in actions that promote the visibility of the Unit. Both the Directorate and the ExCo meet approximately once a month. Research group members also hold regular meetings to evaluate group progress according to the Plan of Activities for the current year. The Scientific Council meets a minimum of 4 times a year, as stipulated by regulations. Given the considerable size of the Unit, a secretary was contracted to deal with all administrative and financial duties, provide support to the Directorate and the ExCo. A press officer has also been contracted to divulge the centre's activities at national and international level.

1.2 General objectives

The objectives for 2014 were based upon foundation planning and activities from previous years but focused on more specific tasks:

- Internationalization of the Unit via more focused links with anchor institutions and increased mobility of our members. One of the priorities of FCT funding is to increase the mobility, especially short stays in advanced laboratories. Other internationalisation efforts included procuring new contacts and strengthening existing international links, in particular with Brazil, China and India, as well as central European institutions.
- Development of syllabi for international doctoral programmes with national and international research centres, universities and stakeholders. The objective is that each CITAB group will coordinate an international doctoral program involving other national and international institutions.
- Continued efforts to increase interdisciplinarity between CITABs groups via regular meetings with working groups, joint conferences, workshops etc. Funded scholarships at CITAB in key tasks will also help to enhance group interaction.
- Increase scientific productivity in JCR Journals and other publications and promoting outreach activities. Communication of CITAB research and society to key stakeholders, the scientific community and the general public.

The FCT funded International PhD programme “PhD Agricultural Production Chains – From Fork to Farm (AgriChains) started in 2014. AgriChains covers issues related to the Agricultural production chains in order to assure competitiveness via the transfer of knowledge from high skilled and experienced teachers and researchers. A total of 8 FCT funded doctoral students were admitted to the programme. AgriChains has a joint diploma granted by the University of Trás-os-Montes e Alto Douro and the University of Minho with a partnership of the University of Wageningen and the Polytechnic University of València.

Two other International Doctoral Programme bids in “*Agro environmental Sustainability & Ecosystem Services*” and “*Advanced technologies applied to agriculture & forestry production chains*” will be improved and submitted in 2015.

External international funding was another successfully achieved objective with CITAB coordinating the EUROLEGUME project (*Enhancing of legumes growing in Europe through sustainable cropping for protein supply for food and feed*) funded by the 7th Research Framework Programme of the European Union (4,993,592€; 18 institutions from 10 EU MS), and the coordination of the Outreach Region of Portugal in the Climate-KIC (Knowledge and Innovation Community): “*Innovating for low carbon prosperity and climate resilience*”, allowing the participation of 68 Portuguese researchers/professionals in several initiatives in the areas of entrepreneurship, innovation, education, creative learning and professional mobility.

During 2014, CITAB’s press office divulged the centre’s activities at both national and international level. CITAB was cited in over 240 articles in the press and emitted 16 press releases covering various aspects of the centre’s activities.

One edition of the CITAB newsletter was published in 2014, divulging the centre's activities to actual and potential international partners. Outreach activities in 2014 comprised actions aimed towards the scientific community, the private sector, the general public but focusing in particular on capturing the interest of potential young scientists in the region's secondary schools. Organised by CITAB's ExCo, a one day seminar on "*Agroforestry Production and Sustainable Environment: an integrated approach*" divulged different aspects of the centre's activities to stakeholders, researchers, students and the public.

1.3 Scientific objectives

CITAB develops scientific activities and objectives within the 6 structural projects and their respective tasks (see organigram). Whenever possible, tasks develop novel approaches that involve interaction with and inputs from experts in areas of engineering and communication technology. The 2015- 2020 strategic project will be more streamlined.

These interactions give added value and advance science in CITABs key areas of agro-food, forestry and the environment, using innovative methods such as signal and image processing, biosensing and remote sensing to better understand how agricultural activities drive environmental change at different scales of the ecosystem and the organism. This unique and innovative approach sets CITAB apart from other UIs in the national system.

1.4 Main achievements during 2014

The main achievements of CITAB research for 2014 are summarised for each group.

1.4.1 Sustainable Agro-food Chains

The main achievements in 2014 attained by SAC group in each task are full described in *item 2.1.4*. Nonetheless, briefly the major achievements were the following. A climate change multi-model projections for temperature extremes in Portugal was achieved. Also, a stepwise methodology was applied to select ten regressors for logistic modelling of production classes. New weather regimes were developed to assess large-scale atmospheric forcing and cycles in production were isolated by a spectral analysis. Future viticultural zoning was achieved using data from 13 climate model transient experiments following the A1B emission scenario. An integrated analysis of climate, soil, topography and vegetative growth was performed for the Iberian Denomination of Origin regions. A Remote sensing was tested as an effective and practical monitoring tool, as data from on-board satellite sensors could measure vegetative growth. Another set of achievements from SAC researcher members were obtained at level of nutritional & nutraceutical aspects, & organoleptic properties. Full characterization of germplasm of some fruit species of temperate climate, with special attention to nutritional & nutraceutical aspects, & organoleptic properties. Selection & characterization of blueberry cultivars best adapted to the soil and climate of northern Portugal. Continuation of the Project INNOFOOD - INNOvation in the FOOD sector through the valorization of food and agro-food by-products, financed by “Programa Operacional Regional do Norte de Portugal (ON.2 - O Novo Norte), and National project “MYRTILLUS”-“Mirtilo com Inovação”. Programa QREN. Partners: Private company-MIRTILUSA-Sever do Vouga & CITAB/UTAD & Genetic and Biotechnology department of UTAD. Also, SAC achieved several advances in adaptation measures for Mediterranean crops under a changing environment through selection of genotypes, soil management and application of protective agents. The outcome of studies conducted to evaluate the effect of applying animal slurry fractions obtained after mechanical separation and slurry additives (nitrification inhibitor (DMPP) and acidification with sulphuric acid) on greenhouse gases emissions from soil and on oat forage yield and quality shows that, an increase in forage yield and quality may be achieved as the conventional treatments by applying slurry fractions obtained after mechanical separation and additive-treated liquid fraction in the North-West of Portugal under autumn conditions. In addition, those slurry treatments allow achieving important reductions on ammonia and greenhouse gas emissions from soils. Different analytical methods were properly validated, particularly, a specific method for epigallocatechin gallate (EGCG; a green tea catechin) stabilization in aqueous solution and quantification by RP-HPLC with UV-vis detection.

Encapsulation of EGCG into solid lipid nanoparticles for ocular application. Chemotypes of *Thymus vulgaris* L. and *Thymus mastichina* L. essential oils were obtained, and chemical composition of extracts were determined as well as their cytotoxicity. Chemical composition of extracts from *Geranium robertianum* and *Pterospartum tridentatum* as well as their cytotoxicity were also determined. During 2014, the SAC researchers also made important progresses in evaluation of plant composition, plant metabolism and bioactivity of plant compounds. Important achievement were made on were grape and grapevine by-products. Grapes (*Vitis vinifera* L.) have been pointed as a rich source of bioactive compounds. During 2014 we assessed the phenolic content of grape stems from red (n = 4) and white (n = 3) cultivars, which allowed to identify and quantify 17 phenolic compounds belonging to 5 distinct phenolic classes, nine of which were firstly in this material. The results obtained stressed the concentration of caftaric acid, quercetin-3-O-glucuronide, malvidin derivatives, and epicatechin as the major compounds. With respect to antioxidant capacity of hydro-methanolic extracts determined by a panel of radical scavenging tests. The rich (poly)phenolic content of hydro-methanolic extracts of grape stems prompted us to evaluate their capacity to inhibit the growth of digestive pathogens including the Gram+ strains *Listeria monocytogenes*, *Staphylococcus aureus* and *Enterococcus faecalis*, and the Gram- strains *Pseudomonas aeruginosa*, *Escherichia coli* and *Klebsiella pneumonia*, suggesting their potential as a functional ingredient that could act as canned food preservatives and/or preventing microbial disturbance. The analysis of correlation allowed to identify the individual phenolics mainly responsible for the antioxidant antimicrobial effect. Thus, the confirmation of the grape stems interest as a source of bioactive compounds prompted us to optimize the extraction conditions using solvents compatible with food/pharma industries using the Response Surface Methodology. Extraction of valuable compounds from cherry, sambus nigra and maize by-products were validated. Several phenolic acids and flavonoids were obtained. These residues and respective compounds were tested against human indicative pathogenic bacteria (*Pseudomonas aeruginosa*, *Escherichia coli* and *Enterococcus faecalis*) and antioxidant activity bioassays were performed. The results showed that these by-products are a rich source of hydroxycinnamic acids, hydroxybenzoic acids, catechin, quercetin and quercetin and quercetin isomers, kaempferol and kampferol isomers. Extraction of bioactive compounds from horticultural crops residues were also assed and the results showed that these type of residues are a rich of phenolics and isothiocyanates with important anti-bacterial activity. As consequence of their scientific activity the SAC research have established new partnerships with private companies namely "M&M Biotechnology". Also a New iSci project- Interface Ciência 2014/2015 between CITBA-UM researchers and NaturalConcepts, Lda. Was made. Different outreach activities between CITAB researchers, high schools students & and young researchers. Also, the researchers deciphered some important aspects of grape berry physiology in particular how its composition and quality are impacted by environmental conditions, like drought [1] and

heat [2] stresses, edaphoclimatic conditions [3], and exogenous application of Cu-based fungicides [4-6]. An International conference was organized: 62nd International Congress and Annual Meeting of the Society for Medicinal Plant and Natural Product Research (GA). Campus de Azurém da Universidade do Minho, Guimarães (Portugal), 31 ago to 4 sept 2014.

1.4.2 Eointegrity Group

Main achievements in 2014 in each of the EI tasks were:

Task #3.02 - Effect of water contamination in fish populations. Biomarkers for contamination assessment of fish were validated to detect the effects of xenobiotic compounds. These were tested to assess toxic effects of pharmaceutical and endocrine disrupting compounds in developmental and reproductive parameters of fish.

Task #3.03 - Dynamic and spatially dynamic modelling to predict ecological indicators associated with different impacts, functional biodiversity and the planning of endangered species conservation was the development of an innovative hierarchical modelling framework in order to address the influence of nested attributes of Land Use / Land Cover (LU/LC) on community-based ecological indicators. Founded in the principles of the spatially explicit Stochastic Dynamic Methodology (StDM), the proposed methodological advances are supported by the added value of integrating bottom-up interactions between multi-scaled drivers, such as relevant biophysical parameters (i.e. primary productivity, climate and habitat structure) that have clear implications in determining spatial and temporal patterns of biodiversity, landscape composition and ecosystem services.

Task #4.01 - Fire Ecology and fire management we established the scientific basis for prescribed burning in *Eucalyptus globulus* plantations through the development of models linking environmental factors (weather and fuel), low-intensity fire behavior, and corresponding effects on trees. The factors involved in post-fire plant regeneration and diversity in pine and eucalyptus forests have been identified and their relative importance assessed. A quantitative understanding of the drivers (fuel, weather, ignitions) and historic evolution of the area burned in Portuguese public forest has been reached.

Task #4.02 - Fire regime analysis and assessment of the influence of weather and climate in agro forested systems We showed that: (1) the inter-annual variability of total burnt area (BA) in the Iberian Peninsula is mainly controlled by meteorological conditions during the fire season and that certain specific meteorological backgrounds may enhance the risk for severe wildfire episodes in some areas; (2) developed statistical models able to reproduce about two thirds of the inter-annual variability of the BA, using

meteorological variables as predictors and testing their robustness for extrapolation under climate-change conditions; and, (3) use an ensemble of state-of-the-art RCM future climate scenarios to project future BA considering two alternative techniques of statistical correction of model bias often used in climate change impact studies. We also (4) test the robustness of space-time permutation scan statistics to assess both the existence and the statistical significance of clusters on aggregated datasets and (5) characterized the detected clusters. Finally, we (6) identified and characterized the spatial and temporal evolution of the fire incidence and of the vegetation types that are most affected by forest fires in Europe and (7) proposed a fire proneness index to assess and compare the fire selectivity of land cover classes and the propensity of European countries to fire.

Task #4.04 - Increasing functional biodiversity in olive groves to enhance conservation biological control of insect pests and maximizing ecosystem services provided by Demarked Douro Region vineyards identification of main groups of the flora and fauna that contribute for providing these services. Progress was also done in the development of habitat management strategies aimed at enhancing the impact of arthropod natural enemy on insect pests. Accordingly the establishment of ecological infrastructures on the properties of stakeholders was initiated.

1.4.3 Biosystems Engineering Group

Important major research achievement as a result of this strategy was knowledge transfer to society in the form of one granted patent for environmentally friendly identification of plant clones using spectroscopy, multivariate analysis or artificial intelligence methods. There is also a prototype for the industry, related to energy saving in public lighting.

Other major achievements, in cooperation with SAC Group and other research centres was the development of smart agriculture methodologies, related to image based non-intrusive methodologies; novel classification methodologies based on image segmentation techniques using FSs, IVFSs, A-IFSSs, machine learning and other computational intelligence techniques for application in agro-products quality assessment contexts. Some examples include clone identification in vines, anthocyanin concentration estimation in vinegrapes, and meat quality estimation.

Finally BE developed a novel hyperspectral image based methodology for intra growth ring measurement of wood density. This methodology includes computational intelligence techniques and may replace the more demanding technique of X-ray microdensitometry. In close collaboration with EI Group, a novel method for measuring bending stiffness parameters of MDF panels was developed, which combines full-field slope measurements by the deflectometry technique with the virtual fields method. This was applied to a new type of MDF panels, comprising a mixture of eucalyptus fibres and

recycled sugarcane particles, which represent an added value for the industry and contribute to environmental sustainability.

It was also developed a new method to evaluate the elastic properties of wood at the growth ring scale (early wood and latewood) by coupling digital image correlation with the virtual fields method, as well as a new method (the compliance based beam method) to evaluate the crack growth resistance curve of wood and wood bonded joints under mode I, mode II and mixed mode I/II loading, based only on the experimental load-displacement curve and a direct identification strategy of cohesive laws for wood and adhesively-bonded wood joints, under pure modes I and II, and mixed-mode I/II. This method is based on the loading-displacement curve and on the crack opening displacement, measured through the digital image correlation technique.

Advanced computational tools based on interface finite elements and cohesive zone modelling, to model the mechanical performance of wood dowel joints and repair solutions using carbon-fibre reinforced plastics and strengthening techniques of dowel type wood connections, based on metallic inserts and CFRP laminates were also developed.

Cohesive zone models have been developed to mimic damage onset and propagation in cortical bone in the vicinity of metal implants used to stabilize common femoral fractures. The numerical models have been calibrated with experimental data obtained in flexural tests that combined rigid internal metal plates and bicortical screws.

Based on specific stakeholders request and in collaboration of the EI Group, BE researchers carried out the identification of the patterns of the wood density components variation of several hardwood species, and developed methods to evaluate the physical, chemical, and anatomical properties of different species regarding quality assessment and suitable uses, of great impact in the wood industry. In close collaboration with SAC Group a new process of storage was designed for the chestnut industry resulting in savings of 1.5 million Euros.

1.5 Advanced Training and Courses

These initiatives improve cooperative links, develop involvement with stakeholders and help to CITAB disseminate research results. Just some examples of initiatives held over 2014 include an advanced course on Molecular Nutrition and workshop on “Comet Assay 2014 at the University of Minho. Technical seminars aimed at key stakeholders covered themes such as Almond farming and commercialisation and fatigue and fracture in different types of material. CITAB researchers also gave advanced training on statistics in ecology and environmental studies.

1.6 Outreach activities

CITAB continued to promote Conferences and workshops on transversal themes within CITAB and consortium member areas of expertise. Target audiences included the academic community, actual and potential key stakeholders, the private and public sector and schools.

1.6.1 Interacting with stakeholders

Research developed to meet stakeholder needs has become central to CITABs vision and underpins the centre's 2015-2020 strategic project. This essential shift implies regular meetings with stakeholders within the different scientific areas covered by CITAB in order to define and establish research priorities.

CITAB gives great importance to developing and maintaining ties with key regional and national stakeholders in order to develop innovative solutions to stakeholder problems. Outreach activities are versatile, including talks, poster presentations and research demonstrations that have direct applications to specific sectors. With over 100 participants from different stakeholder sectors and the general public, CITABs annual cycle of annual seminars started with the theme *"Agroforestry Production and Sustainable Environment: an integrated approach"*. Sponsored by ADVID and the CITAB, a seminar and debate between on the *"Touriga Nacional"* grape variety was attended by approximately 150 researchers and wine industry stakeholder in November 2014. A cream developed by CITAB researchers that helps in the treatment of deep wounds, burns and psoriasis was presented at *the 2014 International Medicinal Plant and Natural Product Research Congress*, which was organised by CITAB (UMinho) researchers. Continuing the cycle of conferences on the Douro, DAgro and CITAB organised a conference on *"Douro past present and future"* for winegrowers and producers. The *National Fruit Crops Symposium*, which took place between 4 and 5 December in UTAD, was jointly organized by CITAB and brought together experts from industry, producers, commerce and political representatives (Agriculture Minister Assunção Cristas, Secretary of State Nuno Brito, and member of the European Parliament José Manuel Fernandes). CITAB researchers hosted the GBIF Information Day - Global Biodiversity Information System in December 2014. This initiative formed part of a national roadmap to disseminate the possibilities of using the resources such as databases and analytical tools to address biodiversity issues.

1.6.2 CITAB and the community at large

CITAB continued its outreach programme in regional schools, divulging the Centre's areas of expertise and alerting young potential scientists to the world of research.

SAC researchers participated in the project "My School of Sciences", which is part of the UMinho School of Science initiative. Activities included a seminar on genetics at the Alcaides de Faria Secondary School on Barcelos and the João Paulo II College in Braga. There was also a guided tour of the Department of Biology laboratories for secondary school students. SAC researchers also gave seminars on genetics and molecular biology in secondary schools in Póvoa de Varzim and Vieira do Minho. A talk on the Project "DouroFix (sh) and Promoting Douro Natural Resources" was given at the Professor António da Natividade Secondary School complex. BE researchers gave a talk on Digital Image Processing and Computer Vision at several schools in the Trás-os-Montes region. EI researchers gave a training course on Dendrology at the São João da Pesqueira town hall and participated in the Open Day of the Alvão Natural Park. An olive oil tasting session organized by CITAB was held for olive farmers, olive oil producers, wine producers, students and olive oil connoisseurs and a workshop on historical climatology in March 2014. Organized by the CITABs Executive Committee, a one day seminar on "Sustainable Agroforestry Production and Environment: an integrated approach", attracted an audience of over 100 participants. CITAB researchers actively collaborated the 2014 "summer campus", organized every year by UTAD.

CITAB's Facebook page continued to post daily news and by the end of 2014 registered over 1.200 likes, from followers of several countries.

2 Funding

	2012	2013	2014	Subtotal
FCT Pluriannual	65.085,64€	96.606,26€	110.051,00€	271.742,90€
FCT Incentivo	----	12.019,00€	16.162,00€	28.181,00€
FCT Projects	886.153,71€	1.218.184,53€	440.267,94€	2.544.606,18€
Other (National)	2.091.093,01€	1.658.526,76€	2.641.877,84€	6.308.060,87€
Other (International)	219.746,77€	285.078,25€	374.114,75€	878.939,77€
Industry (National)	213.684,83€	364.418,32€	145.915,58€	724.018,72€
Industry (International)	0,00€	0,00€	400,00€	400,00€
Total	3.475.763,96€	3.745.268,83€	3.728.789,12€	10.839.386,19€

3 General indicators

	2010	2011	2012	2013	2014	Total
Contracted Researchers (Ciência Programme)	1	0	0	1	0	
Researchers (FTE)	66	73	74	77	87	
Masters degrees (Master theses completed)	15	38	29	48	62	
PhDs (PhD theses completed)	11	9	6	12	7	

4 Research Groups

Reference	Group Title
RG-Norte-4033-134	<u>Sustainable Agro-food Chains</u>
RG-Norte-4033-135	<u>Ecointegrity</u>
RG-Norte-4033-136	<u>Biosystems Engineering</u>

4.1 Sustainable Agro-food Chains

4.1.1 Group description

Principal Researcher	Francisco Manuel Pereira Peixoto
Research area	Agricultural Sciences
Home Institution	Universidade de Trás-os-Montes e Alto Douro

4.1.2 Funding

	2012	2013	2014
FCT Projects	361.944,00€	514.582,19€	217.458,40€
Other (National)	982.314,67€	1.185.107,42€	1.593.679,19€
Other (International)	93.922,77€	100.790,25€	293.736,42€
Industry/Gov. (National)	14.869,87€	0,00€	14.869,67€
Industry (International)	0,00€	0,00€	0,00€
Total	1.453.051,31€	1.800.479,86€	2.119.743,68€

4.1.3 Objectives

The main objective of Sustainable Agro-food Chains (SAC) group during the 2014 was to continue the previous scientific research activities from the previous years which comprises the development of effective, practical strategies to optimize sustainable food production. SAC research is organized in two complementary projects that both have 4 interconnected tasks which are described in more detail the next paragraphs.

Project #5 - Agronomy, climate change & environmental studies (ACES)

This project continues to develop mitigation measures to environmental and climate change in the agricultural sector, based on plant studies and numerical atmospheric modelling. This includes environmental impacts on Mediterranean agricultural production chains studies and design & improvement of cropping practices with innovative methods. This project is divided into 4 tasks: 5.01- Climate variability and environmental impacts; 5.02-Biodiversity as potential resource for sustainable development: Selection, characterization and conservation resources; 5.03-Environmental stresses. Improvement of cropping practices and mitigation measures, and 5.04- Nutrient cycles, soil and residues management.

Project #6 - Added-value plant products & co-products (APPC)

This project provide effective and sustainable solutions for "greening the food chain" and optimizing human and animal health. Research focuses mainly on Mediterranean crops, medicinal and aromatic plants (MAP), and other economically-important plants.

This project is divided in the following tasks: 6.01-Food composition and health effects; 6.02- Added value products derived from agro-food wastes; 6.03-MAP Biotechnology & bioactivities; and 6.0.4-Gravepine cultivation technologies and phsysiology. Major scientific activities include Food composition and health effects studies; Added value products derived from agro-food wastes studies; Studies of MAP Biotechnology & bioactivities; and Grape berry biochemistry & quality studies.

4.1.4 Main achievements

The main achievements in 2014 attained by SAC group in each task are described below.

Task #5.01-Climate variability and environmental impacts. This task aims assessing relationships between short-term climate variability (on a yearly basis) & crop parameters. Thus, within this scope the main achievements were:

i) A climate change multi-model projections for temperature extremes in Portugal was achieved. Clear shifts toward higher future seasonal mean temperatures in central tendency were found (2-4°C), particularly for summer and autumn maximum temperatures. Furthermore, frequencies of occurrence of daily extremes were projected to increase, particularly in summer maximum temperatures over inland Portugal. Wintertime changes were found to be weaker than in other seasons.

ii) A stepwise methodology was applied to select ten regressors for logistic modelling of production classes. New weather regimes were developed to assess large-scale atmospheric forcing and cycles in production were isolated by a spectral analysis. The analysis was enlarged to other Portuguese wine regions. Current bioclimatic zoning in Portugal (1950-2000) and its projected changes under future climate conditions (2041-2070) were assessed through the analysis of an aggregated, categorized bioclimatic index (CatI) at a very high spatial resolution (near 1 km).

iii) Future viticultural zoning was achieved using data from 13 climate model transient experiments following the A1B emission scenario. A downscaling approach allowed characterizing mesoclimatic influences on viticulture throughout Portugal. Results for the recent past depicted the current spatial variability of Portuguese viticultural regions. Under future climate conditions, the current viticultural zoning was projected to undergo significant changes, which may represent important challenges for the Portuguese winemaking sector. The changes were quite robust across the different climate models.

iv) A lower bioclimatic diversity was also projected, resulting from a more homogeneous warm and dry climate in most of the wine regions. This will lead to changes in varietal suitability and wine characteristics of each region.

v) An integrated analysis of climate, soil, topography and vegetative growth was performed for the Iberian Denomination of Origin regions. The results showed that the integrated climate-soil-topography influence on vine performance was evident. The present assessment of terroir characteristics allowed direct comparison among wine regions and may have great value to viticulturists, particularly under a changing climate.

vi) Remote sensing was tested as an effective and practical monitoring tool, as data from on-board satellite sensors could measure vegetative growth. Results showed statistically significant relationships between vegetation metrics and phenological timings and intervals. The study highlighted the applicability of remote sensing to monitor grapevine phenology in both retrospective and real-time, bringing an added-value to the winemaking sector.

vii) Finally, outreach activities were developed concerning the group activity in “Centro de Ciência Viva de Vila Real” and “Casa da Cultura Professor Doutor José Pinto Peixoto”.

Task #5.02 Biodiversity as a potential sustainable development resource: Selection, characterization and conservation of plant resources. This task aims, among others objectives the study of cultural practices for the implementation of an integrated agriculture plan with low environmental impact, with special attention to nutritional & nutraceutical aspects, & organoleptic properties. Following the achievements of 2013, in 2014 the achievements attained in 2014 were:

i) Full characterization of germplasm of some fruit species of temperate climate, with special attention to nutritional & nutraceutical aspects, & organoleptic properties. Selection & characterization of blueberry cultivars best adapted to the soil and climate of northern Portugal.

ii) Conclusion of previous research studies about hazelnut and almonds within the program on Genetic Resources in Agriculture, Regulation (EC) N°870/2004, AGRI GEN RES 2006, entitled: “Safeguard of hazelnut and almond genetic resources - SAFENUT” Participação de dez Instituições with a global financing 1100 000 €. Several communications and papers from these studies resulted.

iii) Continue of the Project INNOFOOD - INNovation in the FOOD sector through the valorization of food and agro-food by-products - NORTE-07-0124-FEDER-0000029, Financed by “Programa Operacional Regional do Norte de Portugal (ON.2 - O Novo Norte), through the European Regional Development Fund (FEDER) as well as Portuguese funds (PIDDAC), and Fundação para a Ciência e Português Tecnologia (FCT/MEC).

iv) Continuation of the National project “MYRTILLUS”-‘Mirtilo com Inovação”. Programa QREN. Partners: Private company-MIRTILUSA-Sever do Vouga & CITAB/UTAD & Genetic and Biotechnology department-UTAD. Global amount: 150 000€ (2010-2015).

Task #5.03 Environmental stress. Improving cropping practices and mitigation measures. The main objective of this task and therefore the major outcomes are assessment of environmental stresses using an integrative approach from molecular, cellular, biochemical & physiological levels to plant growth. Thus, this year the major achievements were continuation of previous studies about advances in adaptation measures for Mediterranean crops under a changing environment through selection of genotypes, soil management and application of protective agents.

Task #5.04 Nutrient cycles, soil and residues management. The outcome of studies conducted to evaluate the effect of applying animal slurry fractions obtained after mechanical separation and slurry additives (nitrification inhibitor (DMPP) and acidification with sulphuric acid) on greenhouse gases emissions from soil and on oat forage yield and quality shows that, an increase in forage yield and quality may be achieved as the conventional treatments by applying slurry fractions obtained after mechanical separation and additive-treated liquid fraction in the North-West of Portugal under autumn conditions. In addition, those slurry treatments allow achieving important reductions on ammonia and greenhouse gas emissions from soils.

Project #06 – Plant products and co-products (3P's)

Task #6.01 Food composition and health effects. During the year of 2014 our main achievements were: i) Validation of a method for epigallocatechin gallate (EGCG; a green tea catechin) stabilization in aqueous solution and quantification by RP-HPLC with UV-vis detection, as EGCG is susceptible for degradation we needed to validate a method for accurate and reproducible quantification (Fangueiro et al., (2014), Int. J. Pharm. 475: e181–e190; ii) Encapsulation of EGCG into solid lipid nanoparticles for ocular application: and physical (Fangueiro et al. (2014), Colloids and Surfaces B: Biointerfaces 123: 452–460) and *in vitro* toxicity (Fangueiro et al, (2014), Int. J. Pharm. 461: 64–73) characterization; iii) The chemotypes of *Thymus vulgaris* L. and *Thymus mastichina* L. essential oils were obtained, being thymol and 1,8-cineol respectively. Also the chemical composition of extracts were determined as well as their cytotoxicity (Master thesis in Biochemistry: Silva SDJ, 2014, UTAD)¹ (submitted manuscript). iv) The chemical composition of extracts from *Geranium robertianum* and *Pterospartum tridentatum* as well as their cytotoxicity were also determined (Master thesis in Biochemistry: Santos CES, 2014, UTAD)² (submitted manuscript).

¹SILVA, Sambrine Deolinda Jesus da. (2014). Caracterização química dos extratos aquosos e hidro-etanólicos de tomilho vulgar (*Thymus vulgaris* L.), tomilho bela-luz (*Thymus mastichina* L.) e tomilho limão (*Thymus x citriodorus* L.) e avaliação

da sua toxicidade usando modelos *in vitro*. Curso de Mestrado em Bioquímica, Universidade de Trás-os-Montes e Alto Douro, Vila Real. Orientadores: Amélia M. Lopes Dias da Silva & Fernando Hermínio Milheiro Nunes (DQ-UTAD).

²SANTOS, Constance Elise Silva dos. (2014) Caracterização química dos extratos de Carqueja (*Pterospartum tridentatum*, Willk) e de erva de S. Roberto (*Geranium robertianum*, L.) e avaliação da sua toxicidade usando modelos *in vitro*. Curso de Mestrado em Bioquímica, Universidade de Trás-os-Montes e Alto Douro, Vila Real. Orientação: Amélia M. Lopes Dias da Silva (orientadora) & Fernanda Maria Lopes Ferreira (coorientadora) (ESAC/IPC, Coimbra; CITAB-UTAD).

Task #6.02 Added value products derived from agro-food wastes. This task envisages the valorization of agro-food wastes into new products with improved biological potential and bioactivities. The achievement in 2014 for this task were:

i) Grape and grapevine studies. Grapes (*Vitis vinifera* L.) have been pointed as a rich source of bioactive compounds. From the 210 MTons of grapes produced annually, up to 15% are addressed to the wine-making industry, generating a large amount of solid waste. Winery wastes include biodegradable solids namely stems, skins, and seeds, which have disclosed a valuable content in bioactive phytochemicals with interesting health promoting activities, which was extensively reviewed in order to gain rational information on the suitability of improve the current knowledge on the value of winery industry by-products as a source of bioactive phytochemicals and the development of innovative procedures toward their valorisation. In this sense, since new resources of phytochemicals with biological activity are being claimed to substitute used drugs and synthetic protective compounds, during 2014 it was assessed the phenolic content of grape stems from red (n = 4) and white (n = 3) cultivars, which allowed to identify and quantify 17 phenolic compounds belonging to 5 distinct phenolic classes, nine of which were firstly in this material. The results obtained stressed the concentration of caftaric acid, quercetin-3-O-glucuronide, malvidin derivatives, and epicatechin as the major compounds. With respect to antioxidant capacity of hydro-methanolic extracts determined by a panel of radical scavenging tests. The rich (poly)phenolic content of hydro-methanolic extracts of grape stems prompted us to evaluate their capacity to inhibit the growth of digestive pathogens including the Gram+ strains *Listeria monocytogenes*, *Staphylococcus aureus* and *Enterococcus faecalis*, and the Gram- strains *Pseudomonas aeruginosa*, *Escherichia coli* and *Klebsiella pneumonia*, suggesting their potential as a functional ingredient that could act as canned food preservatives and/or preventing microbial disturbance. The analysis of correlation allowed to identify the individual phenolics mainly responsible for the antioxidant antimicrobial effect. Thus, the confirmation of the grape stems interest as a source of bioactive compounds prompted us to optimize the extraction conditions using solvents compatible with food/pharma industries using the Response Surface Methodology. As results of the information recorded concerning the interest of grape stems as a source of bioactive compounds, it was started the development of an added-value marketable liqueur performed by the maceration of this plant

material as well as the evaluation of its physicochemical, phytochemicals and sensory properties.

ii) Extraction of valuable compounds from cherry, sambus nigra and maize by-products. Several phenolic acids and flavonoids were obtained from cherry, sambus nigra and maize by-products, fruit peduncles, leaves, stems, peels and seeds. These residues were tested against human indicative pathogenic bacteria (*Pseudomonas aeruginosa*, *Escherichia coli* and *Enterococcus faecalis*) and antioxidant activity bioassays were performed. The results showed that these by-products are a rich source of hydroxycinnamic acids, hydroxybenzoic acids, catechin, quercetin and quercetin and quercetin isomers, kaempferol and kampferol isomers. They have an interesting antibacterial activities with minimum inhibitory concentration of below 100 mg.g⁻¹ of total phenolics dry weight.

iii) Extraction of bioactive compounds from horticultural crops residues. Different methods were used to extract valuable compound from tomato, green-beans and broccoli by products. The results showed different types of compounds with high antioxidant potential (average values above 75 % with DPPH, FRAP, and ABTS methods). HIGH levels of phenolics were found from these type of horticultural by-products. Showing the huge potential of the residues for extraction of bioactive compounds.

iv) Extraction of Tannins from chestnut residues. Comparative study between traditional extraction method and ultrasound assisted method (UAE) was performed with residues from chestnut fruits industry. The results showed that UAE can be an easy and fiable method to extract and produce powder with high level of tannins. These can be used by industry.

Task #6.03 MAP Biotechnology & bioactivities. This task aims to increase knowledge of plant composition, bioactivity and plant metabolism. This year the main achievements were:

i) Progress in scientific knowledge about metabolites, plant metabolism and bioactivity of plant compounds; ii) New partnerships between researchers and private companies: Scientific & Technical consultancy/advising protocol between “M&M Biotechnology” and “CITAB-UM”; iii) New iSci project- Interface Ciência 2014/2015 between CITAB-UM researchers and Natural Concepts, Ltd.; iv) 11 outreach activities between CITAB researchers, high schools students & and young researchers; v) Several papers in different SCI/JCR journals and National/International conferences; vi) One International conference was organized: 62nd International Congress and Annual Meeting of the Society for Medicinal Plant and Natural Product Research (GA). Campus de Azurém da

Universidade do Minho, Guimarães (Portugal), 31 August to 4 September 2014.
<http://ga2014.bio.uminho.pt/>.

Task #6.04 Grapevine cultivation technologies and physiology. We deciphered some important aspects of grape berry physiology in particular how its composition and quality are impacted by environmental conditions, like drought [1] and heat [2] stresses, edaphoclimatic conditions [3], and exogenous application of Cu-based fungicides [4-6]. Amongst these studies, one of pivotal importance unveiled a role of polyols in grapevine (*Tempranillo* cv (syn *Aragonez*)) water-deficit stress tolerance via modifications in polyol transport and metabolism that allow their accumulation particularly in the grape berry [1]. A multidisciplinary approach was adopted towards this finding, by combining an array of molecular biology, classic biochemical, recent metabolomic, and transcriptional analysis approaches. Also outreach activities divulging results of this activity were demonstrated to junior students and young researchers. In cooperation with task 6.03 an International conference was organized: 62nd International Congress and Annual Meeting of the Society for Medicinal Plant and Natural Product Research (GA). Campus de Azurém da Universidade do Minho, Guimarães (Portugal), 31 ago to 4 sept 2014. <http://ga2014.bio.uminho.pt/> . Six papers were published in JCR Journals.

4.1.5 Mobility

1. Cunha, A.C.G. (2014). Master class at Católica University-Porto, Portugal, entitled: “Fisiologia da videira no contexto das alterações climáticas” (4h), Escola Superior de Biotecnologia da Universidade Católica Portuguesa, Porto, 5 April, 2014.
2. Oliveira, R.P.S. (2014). Visit to University of Minho within Erasmus Program, 22 - 26 April, 2014. With this mobility activity it is intended to exchange scientific knowledge between both mobility exchange promoters: UTAD & UM. Both have similar research interests, regarding genome integrity and the protective activity of natural compounds. However, they use different experimental models in their research. Therefore, the main objective of this exchange is to provide the opportunity to discuss directly future joint research projects and complementary strategies for application to international research funding programmes. This mobility activity is intended to be reciprocal, which would potentiate the research collaboration and students exchange.

3. Oliveira, R.P.S. (2014). Visiting High School of Vieira do Minho, Colégio João Paulo II, Braga. Talk: "Admirável mundo novo" da biotecnologia", March 2014.
4. Oliveira, R.P.S. (2014). Visiting High High School of Póvoa de Lanhoso, Talks: "Admirável mundo novo" dos clones, dos transgénicos e da biologia sintética", March 2014.
5. Oliveira, R.P.S. (2014). Visiting High School Alcaides de Faria, Barcelos. Talk: "Manutenção da informação genética e sua manipulação", April 2014.
6. Oliveira, R.P.S. (2014). Visiting High School of school of Caldas das Taipas. Talks: "Admirável mundo novo" dos clones, dos transgénicos e da biologia sintética", High School of Caldas das Taipas, November 2014.

4.1.6 Group productivity

4.1.6.1 International Projects

SAC researchers participated in 6 international projects over 2014:

Project	Funding
"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). http://www.eurolegume.eu/	€742.816,34
"ReUseWaste - Recovery and Use of Nutrients, Energy and Organic Matter from Animal Waste". CITAB Coordinator: Henrique Trindade. Starting date: January 2012, duration: 48 months (FP7-PEOPLE-2011-ITN). http://www.reusewaste.eu/	€212.796,06
"Climate-KIC – Innovating for low carbon prosperity and climate resilience". Portuguese coordinator: Eduardo Rosa. Starting date: January 2014, duration: 12 months (eit/climate kic/fcvre/ssga2014/1). http://www.climate-kic.org/	€21.500,00
"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
"InnoVine- Combining innovation in vineyard management and exploration of genetic diversity for a sustainable European viticulture". CITAB Coordinator: Hernâni Gerós. Starting date: January 2013, duration: 48 months (FP7-KBBE-2012-6). http://www.innovine.eu/home.html	N/A
"Copper uptake and detoxification in grapevine" Bilateral Cooperation Portugal-Tunisia. CITAB Coordinator: Hernâni Gerós. Starting date: January 2013, duration: 24 months	N/A

4.1.6.2 National Projects

SAC researchers participated in 32 national projects over 2014:

Project	Funding
“INNOFOOD - INNOVation in the FOOD sector through the valorization of food and agro-food by-products”. CITAB coordinator: Ana Barros. Starting date: January 2014, duration: 18 months (NORTE-07-0124-FEDER-0000029)	€602.710,21
“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
“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
“Mais Proteína”. CITAB coordinator: Eduardo Rosa. Starting date: January 2014, duration: 36 months (PRODER 52506). Promotor: Frescura Sublime Lda	€91.242,47
“Gold Cherry – Improving the quality of cherry production”. CITAB coordinator: Berta Gonçalves. Starting date: April 2014, duration: 22 months. Promotor: Manuel Joaquim Ferrão Aires, Unipessoal (ProDer 53626).	€107.919,40
“Integrated strategies for increasing the productivity of almond in Trás-os-Montes”. CITAB coordinator: Ana Paula Silva. Starting date: January 2014, duration: 24 months. Promotor: Cooperativa Agrícola de Alfândega da Fé, CRL (ProDer 54609).	€56.449,97
“RegCast - Fertigation in chestnut - an innovative approach to grove management”. CITAB coordinator: José Laranjo. Starting date: November 2013, duration: 36 months. Promotor: Geosil – Empreendimentos Agrosilvícolas S.A. (ProDer 47451).	€6.790,97
“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).	84.022,49€

<p>“AlertCast - Implementation of a Network Information for promoting chestnut quality”. CITAB coordinator: Teresa Pinto. Starting date: January 2012, duration: 36 months. Promotor: Cooperativa Agrícola Penela da Beira, CRL (QREN Vale I&DT 23628).</p>	<p>€33.400,00</p>
<p>“2NEucBark - New Valorization Strategies for Eucalyptus spp. Bark Extracts.” CITAB coordinator: Cristóvão Lima. Starting date: June 2013, duration: 24 months (PTDC/AGR-FOR/3187/2012)</p>	<p>€33.659,00</p>
<p>“Animal slurry management: sustainable practices at field scale”. CITAB coordinator: Henrique Trindade. Starting date: January 2012, duration: 36 months (PTDC/AGR-PRO/119428/2010)</p>	<p>€45.000,00</p>
<p>“WineBioCode - Desenvolvimento de biossensores para rastreabilidade do vinho na Região Demarcada do Douro”. CITAB coordinator: Ana Barros. Starting date: March 2012, duration: 36 months (PTDC/AGR-ALI/117341/2010)</p>	<p>€17.749,20</p>
<p>“Caracterização funcional de novos transportadores ABC de planta com regulação diferencial em células especializadas na acumulação de alcalóides medicinais em <i>Catharanthus roseus</i> (L.) G. Don”. CITAB coordinator: Hernâni Gerós. Starting date: 2012. Duration: 36 months. (PTDC/BIA-BCM/119718/2010)</p>	<p>€10.000,00</p>
<p>“ClimVineSafe - Short-term climate change mitigation strategies for Mediterranean vineyards”. CITAB coordinator: José Moutinho Pereira. Starting date: April 2011, duration: 36 months. (PTDC/AGR-ALI/110877/2009)</p>	<p>€111.456,00</p>
<p>“CLIFE - Climate change of precipitation extreme episodes in the Iberian Peninsula and its forcing mechanisms”. CITAB coordinator: João Santos. Starting date: January 2011. Duration: 36 months (PTDC/AAC-CLI/111733/2009)</p>	<p>€37.409,00</p>
<p>“Developing processes and technologies aiming the production of ink disease resistant chestnut rootstocks, compatible with national varieties certified with molecular markers”. CITAB coordinator: José Laranjo. Starting date: January 2012, duration: 36 months. Promotor: Certifruteiras.com Lda. (ProDer PA 45967)</p>	<p>€15.791,75</p>
<p>“EcoDeep - Eco-efficiency and Eco-management in the Agro-Food sector”. CITAB coordinator: Henrique Trindade. Starting date: September 2011, duration: 36 months. (QREN - Sistema de Apoio a Ações Coletivas)</p>	<p>€114.625,00</p>

Good Agricultural practices for the Sustainable Use of Wastewater. CITAB coordinator: Henrique Trindade. Starting date: January 2012. Duration: 36 months (ProRede RuralNacional PA 0400238)	€83.805,69
“GreenVitis - Effects of soil management on productivity and sustainability of grape vineyards system”. CITAB coordinator: Armindo Afonso Martins. Starting date: January 2012, duration: 36 months. Promotor: Quinta do Vallado Lda. (ProDer PA 43879)	€413.397,29
“In-Nitro: conceptualizing the effects of increased nitrogen availability in a Mediterranean ecosystem”. CITAB coordinator: Henrique Trindade. Starting date: January 2012, duration: 36 months (PTDC/BIA-ECS/122214/2010)	€15.411,00
“IrrigOlive - Deficit irrigation on olive, in the region of "Terra Quente Transmonta", to optimization water resources, productivity and olive oil quality”. CITAB coordinator: Anabela Silva. Starting date: January 2012, duration: 36 months. Promotor: Viaz Produção e Comercialização de Vinhos e Azeites, Lda - (ProDer).	€202.257,88
“KlimHist - Reconstruction and model simulations of past climate in Portugal using documentary and early instrumental sources”. CITAB coordinator: João Santos. Starting date: March 2012, duration: 36 months (PTDC/AAC-CLI/119078/2010)	€19.678,00
“Molecular biology of grape berry phenolic maturation”. CITAB coordinator: Ana Alexandra Oliveira. Starting date: February 2012. Duration: 36 months (PTDC/AGR-PRO/120264/2010)	€118.742,00
“Molecular mechanisms of Agrobacterium recognition and defense activation in recalcitrant plant species. – How do recalcitrant plants avoid T-DNA transfer?” CITAB coordinator: Franklin Gregory. Starting date: December 2011. Duration: 36 months. (PTDC/AGR-GPL/119211/2010)	€153.000,00
“ <i>Myrtillus</i> with innovation”. CITAB coordinator: Ana Paula Silva. Starting date: December 2010, duration: 36 months. Promotor: Mirtilusa (QREN Co-Promoção 13736 - <i>Myrtillus</i>)	€158.393,00
“OlivaTMAD - Thematic Networks of Information and Dissemination of Olive Cultivation Line of Trás-os-Montes and Alto Douro”. CITAB coordinator: Eduardo Rosa. Starting date: January 2011, duration: 48 months. Promotor: AOTAD(ProDer PA 14346)	€241.791,00

<p>“Physical exercise role on Human lymphocyte DNA damage reduction: possible influence of oxidative stress and DNA repair capacity”. CITAB coordinator: Amélia Silva. Starting date: 2012, duration: 36 months (PTDC/DES/121575/2010)</p>	N/A
<p>“PromoAgro - Promotion of Agro-food Competitiveness”. CITAB coordinator: Eduardo Rosa. Starting date: October 2010, duration: 39 months (NORTE - 07 - 0162 - FEDER - 000042)</p>	€1.480.724,56
<p>“RAIDEN - Lightning activity in Portugal: variability patterns and socioeconomic impacts”. CITAB coordinator: João Santos. Starting date: June 2009, duration: 42 months. (PTDC/CTE-ATM/101931/2008). http://raiden-project.ul.pt/</p>	€72.356,00
<p>“SambucusFRESH - Improving productivity and quality in the production of elderberry in fresh, chilled and frozen”. CITAB coordinator: Eunice Bacelar. Starting date: June 2012, duration: 36 months. Promoter: Regiefrutas (QREN Co-promoção 23109)</p>	€248.242,96
<p>“Understanding Resistance to Pathogenic Fungi in <i>Castanea</i> sp.” CITAB coordinator: José Laranjo. Starting date: February 2010, duration: 42 months. (ResCast).</p>	€8.400,00
<p>“WUSSIAAME - Water use, survival strategies and impact of agrochemicals on water resources in agricultural Mediterranean ecosystems”. CITAB coordinator: Aureliano Malheiro. Starting date: February 2012, duration: 36 months (PTDC/AAC-AMB/100635/2008)</p>	€51.574,00

4.1.6.3 Publications in peer review Journals

During 2014 SAC research members published 75 SCI/JCR papers:

1. Andrade, C., Fraga, H., Santos, J.A. (2014). Climate change multi-model projections for temperature extremes in Portugal. *Atmospheric Science Letters*, 15(2), 149-156. <http://onlinelibrary.wiley.com/doi/10.1002/asl2.485/abstract>
2. Andreani, T., de Souza, A.L.R., Kiill, C.P., Lorenzon, E. N., Fanguero, J.F., Calpena, C.A., Chaud, M.V., Garcia, M.L., Gremião, M.P.D., Silva, A.M., & Souto, E.B. (2014). Preparation and characterization of PEG-coated silica nanoparticles for oral insulin delivery. *International Journal of Pharmaceutics*, 473(1-2), 627-635. <http://www.sciencedirect.com/science/article/pii/S0378517314005481>
3. Andreani, T., Kiill, C. P., de Souza, A.L.R., Fanguero, J F., Fernandes, L., Doktorovova, S., Santos, D.L., Garcia, M.L., Gremião, M.P.D., Souto, E.B., Silva, A.M. (2014). Surface

- engineering of silica nanoparticles for oral insulin delivery: Characterization and cell toxicity studies. *Colloids and Surfaces B-Biointerfaces*, 123, 916-923. <http://www.sciencedirect.com/science/article/pii/S0927776514005979>
4. Andrea-Silva, J., Cosme, F., Ribeiro, L F., Moreira, A.S.P., Malheiro, A.C., Coimbra, M.A., et al. (2014). Origin of the Pinking Phenomenon of White Wines. *Journal of Agricultural and Food Chemistry*, 62(24), 5651-5659. <http://pubs.acs.org/doi/abs/10.1021/jf500825h>
 5. Antunes, D., Padrão, A.I., Maciel, E., Santinha, D., Oliveira, P., Vitorino, R., Moreira-Gonçalves, D., Colaço, B., Pires, M.J., Nunes, C., Santos, L.L., Amado, F., Duarte, J.A., Domingues, M.R., & Ferreira, R. (2014). Molecular insights into mitochondrial dysfunction in cancer-related muscle wasting. *Biochim Biophys Acta*, 1841(6), 896-905. <http://www.sciencedirect.com/science/article/pii/S1388198114000456>
 6. Barros, A., Girones-Vilaplana, A., Teixeira, A., Collado-Gonzalez, J., Moreno, D. A., Gil-Izquierdo, A., et al. (2014). Evaluation of grape (*Vitis vinifera* L.) stems from Portuguese varieties as a resource of (poly)phenolic compounds: A comparative study. *Food Research International*, 65 (Part C) 375-384. <http://www.sciencedirect.com/science/article/pii/S0963996914004980>
 7. Botelho, M.C., Costa, C., Silva, S., Costa, S., Dhawan, A., Oliveira, P.A., & Teixeira, J.P. (2014). Effects of titanium dioxide nanoparticles in human gastric epithelial cells *in vitro*. *Biomed Pharmacother*, 68(1), 59-64. <http://www.sciencedirect.com/science/article/pii/S0753332213000954>
 8. Carneiro, M., Colaço, B., Brandão, R., Ferreira, C., Santos, N., Soeiro, V., Colaço, A., Pires, M.J., Oliveira, P.A. & Lavín, S. (2014). Biomonitoring of heavy metals (Cd, Hg, and Pb) and metalloid (As) with the Portuguese common buzzard (*Buteo buteo*). *Environmental Monitoring and Assessment*, 186(11), 7011-21. <http://link.springer.com/article/10.1007%2Fs10661-014-3906-3>
 9. Carvalho, A. C., Franklin, G., Dias, A. C. P., & Lima, C. F. (2014). Methanolic extract of *Hypericum perforatum* cells elicited with *Agrobacterium tumefaciens* provides protection against oxidative stress induced in human HepG2 cells. *Industrial Crops and Products*, 59, 177-183. <http://www.sciencedirect.com/science/article/pii/S0926669014002830>
 10. Carvalho, M., Matos, M., Carnide, V. (2014). Fingerprinting of *Vaccinium corymbosum* cultivars using DNA of fruits. *Horticultural Science* 41(4): 175-184. <http://www.agriculturejournals.cz/publicFiles/137758.pdf>
 11. Correia, I., Arantes-Rodrigues, R., Pinto-Leite, R., & Gaivão, I. (2014). Effects of naproxen on cell proliferation and genotoxicity in MG-63 osteosarcoma cell line. *Journal of Toxicology and Environmental Health-Part a-Current Issues*, 77(14-16), 916-923. <http://www.tandfonline.com/doi/abs/10.1080/15287394.2014.911131#.VNjcmZWzXIU>

12. Dalla Costa, L., Pinto-Sintra, A.L., Campa, M., Poletti, V., Martinelli, L., & Malnoy, M. (2014). Development of analytical tools for evaluating the effect of T-DNA chimeric integration on transgene expression in vegetatively propagated plants. *Plant Cell Tissue and Organ Culture*, 118(3), 471-484. <http://link.springer.com/article/10.1007%2Fs11240-014-0499-z>
13. De Sousa-Pereira, P., Abrantes, J., Pinheiro, A., Colaco, B., Vitorino, R., & Esteves, P.J. (2014). Evolution of C, D and S-type cystatins in mammals: an extensive gene duplication in primates. *PloS one*. 9(10) e109050. <http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0109050>
14. Dias, C., Aires, A., & Saavedra, M. J. (2014). Antimicrobial Activity of Isothiocyanates from Cruciferous Plants against Methicillin-Resistant *Staphylococcus aureus* (MRSA). *International Journal of Molecular Sciences*, 15(11), 19552-19561. <http://www.mdpi.com/1422-0067/15/11/19552>
15. Dias, M.C., Correia, C., Moutinho-Pereira, J., Oliveira, H., & Santos, C. (2014). Study of the effects of foliar application of ABA during acclimatization. *Plant Cell Tissue and Organ Culture*, 117(2), 213-224. <http://link.springer.com/article/10.1007%2Fs11240-014-0434-3>
16. Dinis, L.T., Correia, C.M., Ferreira, H.F., Goncalves, B., Goncalves, I., Coutinho, J.F., et al. (2014). Physiological and biochemical responses of Semillon and Muscat Blanc a Petits Grains wine grapes grown under Mediterranean climate. *Scientia Horticulturae*, 175, 128-138. <http://www.sciencedirect.com/science/article/pii/S0304423814003239>
17. Doktorovova, S., Santos, D.L., Costa, I., Andreani, T., Souto, E.B., & Silva, A.M. (2014). Cationic solid lipid nanoparticles interfere with the activity of antioxidant enzymes in hepatocellular carcinoma cells. *International Journal of Pharmaceutics*, 471(1-2), 18-27. <http://www.sciencedirect.com/science/article/pii/S0378517314003287>
18. Doktorovova, S., Shegokar, R., Fernandes, L., Martins-Lopes, P., Silva, A.M., Mueller, R.H., et al. (2014). Trehalose is not a universal solution for solid lipid nanoparticles freeze-drying. *Pharmaceutical Development and Technology*, 19(8), 922-929. <http://informahealthcare.com/doi/abs/10.3109/10837450.2013.840846>
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4.1.6.4 Other International publications

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- 19.** Gregory, M., Khandelwal, V. K. M., Mary, R. A., Kalaichelvan, V. K., & Palanivel, V. (2014). *Barringtonia acutangula* improves the biochemical parameters in diabetic rats. *Chinese*

Journal of Natural Medicines, 12(2), 126-130. <http://www.sciencedirect.com/science/article/pii/S1875536414600200>

20. Rebelo, A., Ribeiro, A., Costa, M.F.M., & Aguiar, C.A. (2014). Microbes: Where Are They? Are They Harmless? Are They Harmful? Booklet of the 11th International Conference on Hands-on-Science. 29. University of Aveiro, Portugal.
21. Sheeba, C.J., Marslin, G., Revina, A. M., & Franklin, G. (2014). Signalling pathways influencing tumor microenvironment and their exploitation for targeted drug delivery. *Nanotechnology Reviews*, 3(2), 123-151. <http://www.degruyter.com/view/j/ntrev.2014.3.issue-2/ntrev-2013-0032/ntrev-2013-0032.xml>
22. Silva-Carvalho, R., Miranda-Gonçalves, V., Ferreira, A.M., Cardoso, S.M., Sobral, A.J.F.N., Almeida-Aguiar, C., & Baltazar, F. (2014). Caracterização da actividade antitumoral e angiogénica do própolis português usando modelos *in vitro* e *in vivo*. Livro de resumos do III Congresso Ibérico de Apicultura. 86. Mirandela, Portugal
23. Silva, E., Moutinho-Pereira, J., Ferreira, H., Gonçalves, B., Bacelar, E., & Correia, C. (2014). Interactive Effects of Drought and Shade on Functional Traits of Cork Oak and Recovery after Re-Watering. Abstract book of "Plant Biology Europe FESPB/EPSO Congress", Dublin, Ireland, 22-26 June 2014. 61
24. Silva, J., Pinto-Leite, R., Fidalgo-Gonçalves, L., Gil da costa, R., Colaço, A., Arantes-Rodrigues, R., & Oliveira, P. (2014). Combination of carboplatin and piroxicam leads to a synergistic interaction on two human urinary bladder cancer cell lines. 1st Aspica International congress, 25-26 November Lisbon, Portugal.

4.1.6.5 Book Chapters

1. Botelho, M.C., Teixeira, J.P., Oliveira, P.A. (2014). Carcinogenesis. In Encyclopedia of toxicology. Elsevier. Volume: 1713-729.
2. Gil Da Costa, R., Lopes, C., Oliveira, P.A., Bastos, M.S.M.M. (2014). Illudane-type sesquiterpenes: challenges and opportunities for toxicology and chemotherapy. In New developments in terpenes research. Jinnan Hu(Ed). Nova Science Publishers, Inc. ISBN: 978-1-62948-760-1. 135-184.
3. Martins, L. M., J. P. Moura, J. V. Cardoso, M. R. Anjos, P. Oliveira, P. S. Arnaldo, T., & Pinto. (2014). Implementação de uma Rede de Avisos para Promoção da Qualidade da Castanha - AlertCast. In UTAD. 100 pp.

4.1.6.6 Books

N/A

4.1.6.7 Completed Master and PhD theses

During 2014 the SAC research members supervised 26 concluded MSc and 5 PhD theses

MSC theses

1. MSc: Almeida, T.D. (2014). *Dirofilariose canina: Determinação do NT-proBNP em cães infetados por *Dirofilaria immitis* – estudo preliminar*, Universidade de Trás-os-Montes e Alto Douro. Orientação de Maria João Miranda Pires (UTAD) e Maria Inês Fonseca (HVBV).
2. MSc: Brito, D. (2014). *Produção de novos porta-enxertos híbridos para castanheiro. Variação do teor de compostos fenólicos versus resistência à doença da tinta*". Mestrado em Bioquímica. Orientadores: Prof. Doutor José Gomes Laranjo e Doutora Rita Costa (INIAV).
3. MSc: Cepêda, R. (2013-2014). *Estudos de resistência à doença da tinta em progenies de ColUTAD*". Mestrado em Bioquímica. Orientadores: Prof. Doutor José Gomes Laranjo e Prof. Doutora Teresa Pinto (UTAD).
4. MSc: Costa, C.S. (2014). *Diabetes Mellitus em Gatos: um estudo retrospectivo*, Universidade de Trás-os-Montes. Orientação de Maria João Miranda Pires (UTAD) e Luís Montenegro (HVM).
5. MSc: Cunha, A-I. R. (2014). *Acompanhamento Analítico das Estações de Tratamento de Águas Residuais (ETAR) do Sousa (Lousada) e Serzedo (Guimarães)*. Mestrado em Ciências e Tecnologias do Ambiente. Orientação de Maria Teresa Borges (FCUP); Isabel Aguiar Pinto Mina (UM).
6. MSc: Cunha, M.M. (2014). *Avaliação do perfil fenólico e atividade antioxidante de suplementos baseados em frutas e legumes*, Mestrado em Biotecnologia e Qualidade Alimentar, Universidade de Trás-os-Montes e Alto Douro, Orientação de Ana Isabel Ramos Novo Amorim de Barros (UTAD).
7. MSc: Ferreira, S.S. (2014). *Avaliação do potencial efeito biológico de extratos de subprodutos de frutos e legumes, usando células animais em cultura*. Mestrado em Biologia Clínica Laboratorial, Universidade de Trás-os-Montes e Alto Douro. Orientação de Amélia M. Lopes Dias da Silva (UTAD) e de Fernando Hermínio Milheiro Nunes (UTAD).
8. MSc: Fonte, M.E. (2014). *Ação do ácido quetomélico nas alterações renais e hematológicas induzidas pela redução de 5/6 de massa renal em ratos*, Universidade de Trás-os-Montes e Alto Douro. Orientação de Maria João Miranda Pires (UTAD).

9. MSc: Gonçalves, E. (2014) Influence of the anatomical location of the harvest on the osteogenic differentiation of adipose-derived stromal cells. Mestrado em Engenharia Biomedica, FEUP Universidade do Porto. Orientação: Pedro Gomes (FMDUP) e Bruno Colaço (UTAD).
10. MSc: Gonçalves, I.M.N. (2014). Estudo comparativo de adaptabilidade em videiras 'Moscatel Galego' e 'Boal' na Região do Douro: respostas fisiológicas e bioquímicas. Mestrado em Engenharia do Ambiente, Universidade de Trás-os-Montes e Alto Douro. Orientação de Aureliano Malheiro (UTAD) e Carlos Correia (UTAD).
11. MSc: Lemos, M.W.B. (2014) - Up-scale orchid micropropagation: and entrepreneur approach. Mestrado em Biologia Molecular, Biotecnologia e Bioempreendedorismo em Plantas, Universidade do Minho. Co-orientação de Ana Cunha (UM) e Beatriz Casais (Escola de Economia-UM).
12. MSc: Linton, D. (2014) "Biomarcadores séricos em ratos osteoporóticos juvenis para a avaliação do metabolismo ósseo". Mestrado em Biologia Clínica Laboratorial. Universidade de Trás-os-Montes e Alto Douro. Orientação: Bruno Colaço (UTAD) e Pedro Gomes (FMDUP).
13. MSc: Machado, C.P.M. (2014). Morfologia e anatomia foliar comparada de *Buxus sempervirens* L. e *Buxus balearica* Lam. oriundos de diversas regiões da Península Ibérica. Mestrado em Engenharia do Ambiente. Universidade de Trás-os-Montes e Alto Douro. Orientação de Eunice Bacelar (UTAD) e Berta Gonçalves (UTAD).
14. MSc: Melo, M.C. (2014). Estudo da Adesão de *Chlorella vulgaris* (SAG211-12) a diferentes substratos e desenvolvimento de um reator de Biofilme Fotossintético. Mestrado em Ciências e Tecnologias do Ambiente. Orientação de Maria Teresa Borges (FCUP); Isabel Aguiar Pinto Mina (UM), arguente em 12 de dezembro de 2014.
15. MSc: Miranda, I.M. (2014). High Performance Liquid Chromatography analysis of anthocyanins for varietal differentiation of *Vitis vinifera* L. red grapes. Tese de Mestrado em Biotecnologia e Qualidade Alimentar, Universidade de Trás-os-Montes e Alto Douro. Orientação de Ana Isabel Ramos Novo Amorim Barros (UTAD).
16. MSc: Monteiro, A.I.M. (2014). Estudos anatómicos e bioquímicos em folhas de roseira desenvolvidas em diferentes condições de humidade relativa. Mestrado em Biologia Clínica Laboratorial, Universidade de Trás-os-Montes e Alto Douro. Orientação de Eunice Bacelar (UTAD) e Susana Carvalho (Universidade Católica).
17. MSc: Oliveira, M.I. (2014). Avaliação dos parâmetros ecocardiográficos de cães com excesso de peso - estudo preliminar, Universidade de Trás-os-Montes. Orientação de Maria João Miranda Pires (UTAD) e Ana Cristina Ferreira (UTAD).
18. MSc: Pinheiro, R. C. (2014). Efeito do caulino e da orientação das linhas de plantação no comportamento fisiológico da videira". Mestrado em Engenharia Agronómica,

Universidade de Trás-os-Montes e Alto Douro. Orientação de José Moutinho-Pereira (UTAD) e Carlos Correia (UTAD).

19. MSc: Pinto, A (2014). Influence of different captivity conditions in African and Asian elephants' behaviour. Mestrado Integrado em Medicina Veterinária, Universidade de Trás-os-Montes e Alto Douro, Orientação: Bruno Colaço (UTAD)
20. MSc: Reis, V. (2014). Resposta biológica à implantação de nanopartículas de hidroxiapatite em ratos diabéticos". Mestrado em Biologia Clínica Laboratorial. Universidade de Trás-os-Montes e Alto Douro. Orientação: Bruno Colaço (UTAD) e Pedro Gomes (FMDUP)
21. MSc: Rodrigues, T.R.D. (2014). Papel da adenosina na insuficiência cardíaca num modelo animal de hipertensão pulmonar. Mestrado em Biotecnologia para as Ciências da Saúde, Universidade de Trás-os-Montes e Alto Douro. Orientação de Ana Patrícia Fontes de Sousa (ICBAS-UP) e Amélia M. Lopes Dias da Silva (UTAD).
22. MSc: Santos, C.E.S. (2014). Avaliação do efeito de extratos aquosos de Carqueja (*Pterospartum tridentatum*, Willk) e de erva de S. Roberto (*Geranium robertianum*, L.) usando modelos *in vitro*. Mestrado em Bioquímica, Universidade de Trás-os-Montes e Alto Douro. Orientação de Amélia M. Lopes Dias da Silva (UTAD) e de Fernando Hermínio Milheiro Nunes (UTAD).
23. MSc: Santos, S.M.S. (2014). Quantificação do teor em metais em azeites e azeitonas da cv. cobraçosa. Mestrado em Qualidade e Tecnologia Alimentar, Instituto Politécnico de Viseu, Escola Superior Agrária de Viseu. Orientação de Ana Isabel Ramos Novo Amorim de Barros (UTAD)
24. MSc: Silva, S. D. J. (2014). Avaliação do efeito de extratos aquosos de tomilho vulgar (*Thymus vulgaris* L.) e tomilho bela-luz (*Thymus mastichina* Sibth. & Sm.) usando modelos *in vitro*. Mestrado em Bioquímica, Universidade de Trás-os-Montes e Alto Douro. Orientação de Amélia M. Lopes Dias da Silva (UTAD) e de Fernando Hermínio Milheiro Nunes (UTAD).
25. MSc: Teixeira, A. (2014). Caracterização Biológica da implantação subcutânea de Membrana de colagénio tipo I em ratos diabéticos". Mestrado em Biologia Clínica Laboratorial. Universidade de Trás-os-Montes e Alto Douro. Orientação: Bruno Colaço (UTAD) e Pedro Gomes (FMDUP)
26. MSc: Teixeira, A.I. (2014). Avaliação fitoquímica e da atividade biológica do engaço de castas (*Vitis vinifera* L.) brancas e tintas cultivadas em Portugal. Tese de Mestrado em Biotecnologia e Qualidade Alimentar, Universidade de Trás-os-Montes e Alto Douro. Orientação de Ana Isabel Ramos Novo Amorim Barros (UTAD) e Dr. Raúl Domínguez Perles (UTAD).

Ph.D. theses

1. PhD: Andreani, T. (2014). Silica nanoparticles in oral peptide delivery for Diabetes Mellitus control and treatment. Doutoramento em Ciências Químicas e Biológicas, Universidade de Trás-os-Montes e Alto Douro. Orientação de Eliana B. Souto (UFP) e de Amélia M. Lopes Dias da Silva (UTAD).
2. Phd: Fernández, M.G. (2014). Utilización de células troncales de tecido adiposo en la reparación de defectos condrales”, Doutoramento em Ciências Veterinárias, Universidade de León. Orientação: Maria Suarez (ULEON) e Bruno Colaço (UTAD)
3. PhD: Fraga, H. (2014). Viticultural zoning in Europe: climate change scenarios and adaptation measures. Supervisors: J. A. Santos, A. Malheiro and J. Moutinho-Pereira (UTAD). 3º Ciclo em Ciências Agrónomicas e Florestais da UTAD.
4. PhD: Pinto, K.M.S. (2014). Perfil fitoquímico de extractos vegetais de espécies de caatinga e potencial no controle da mancha marron de alternaria (*Alternaria alternata* sp. citri). Doutoramento em Agronomia, área de Agricultura Tropical, Universidade Federal da Paraíba, Centro de Ciências Agrárias, Brazil. Orientação de Prof^a. Luciana Cordeiro do Nascimento, D. Sc. (Universidade Federal da Paraíba, Centro de Ciências Agrárias, Brazil) e Professora Doutora Maria Isabel Mendes Guerra Marques Cortez, PhD. (UTAD/CITAB) e Doutor Alfredo Aires, PhD. (UTAD/CITAB).
5. PhD: Martins, V.M.V. (2014). Biotechnological, biochemical and molecular approaches towards the study of solutes accumulation (mineral and organic compounds) in the vacuole of grape berry cells. (Financiamento FCT - SFRH/BD/64587/2009). Viviana Maria Varajão Martins. Universidade do Minho/UCDavies - USA/ Centre de Biotechnologie de Borj-Cédria – Tunísia. Orientadores: H. Gerós & Eduardo Blumwald (USA) & Mohsen Hanana (Tunísia).

4.1.6.8 Patents/propotypes

N/A

4.1.6.9 Organization of conferences

Conferences and related activities organized (organizing committee or scientific committee) by SAC members during 2014:

1. 14th EMS Annual Meeting & 10th European Conference on Applied Climatology (ECAC), Prague, Czech Republic, 06-10 October 2014. Cristina Maria Mendes Andrade.
2. 18th Nitrogen Workshop. Instituto Nacional de Investigação Agrária e Veterinária, I.P. (INIAV), Quinta do Marquês, Oeiras, Portugal, 30 Junho a 3 Julho de 2014. Comissão Científica. José Luís da Silva Pereira.

3. 3rd International Conference on Ecohydrology, Soil and Climate Change, EcoHCC14, Polytechnic Institute of Tomar, Portugal, 10-12 September 2014. Cristina Maria Mendes Andrade.
4. 62nd International Congress and Annual Meeting of the Society for Medicinal Plant and Natural Product Research (GA). Campus de Azurém da Universidade do Minho, Guimarães (Portugal), 31 ago to 4 sept 2014. <http://ga2014.bio.uminho.pt/>. More than 650 participants. Host and Chair: Alberto Dias; Local Organization Committee (CITAB members): Alberto Dias, Ana Cunha, Cristina Aguiar, Cristina Pereira, Cristovão Lima, Franklin Gregory, Hernâni Gerós, Isabel Mina, Olga Coutinho, Rui Oliveira and several undergraduate and PG students. Ana Cristina Gomes da Cunha.
5. Douro: "Passado, Presente, Futuro" Palestra inserida no Ciclo de Conferências DAgro/CITAB. 12 de Fevereiro 2014. UTAD. Ana Alexandra Ribeiro Coutinho de Oliveira.
6. II Encontro Internacional da Casa das Ciências, Porto, Portugal, 14-16 Julho. Membro da Comissão Científica. Cristina Alexandra de Almeida Aguiar.
7. III Congresso Ibérico de Apicultura, Mirandela, Portugal, 13-15 Abril 2014. Membro da Comissão Científica. Cristina Alexandra de Almeida Aguiar.
8. III Encontro HVUTAD: "Patologia renal nos animais de companhia", UTAD, Vila Real, 22 de junho de 2014. Oradores: Maria Luísa Suárez Rey e Gérman Santamarina (Faculdade Veterinária de Lugo da Universidade de Santiago de Compostela). Organization: Maria João Pires, Felisbina Queiroga, Maria Isabel Dias, Carlos Viegas, Teresa Sargo. . Maria João Miranda Pires.
9. International Conference MEME'2014-Mathematics and Engineering in Marine and Earth Problems-The relevance of Mathematics in Meteorology Aveiro University, 22-25 July 2014. Cristina Maria Mendes Andrade.
10. International Conference on Numerical Analysis and Applied Mathematics, ICNAAM2014, Greece, 22-28 September 2014. Cristina Maria Mendes Andrade.
11. National Seminar: "Doenças Cardíacas Congénitas", UTAD, Vila Real, 5 January 2014. Organized by: Maria João Pires, Felisbina Queiroga & Maria João Miranda Pires.
12. V Fórum de Investigação Farmacológica: "O uso clínico dos fármacos anti-inflamatórios e anti-infecciosos". UTAD, Vila Real, 23 October 2014. Organization: Alexandre Gonçalves, Ana Faustino, Antonieta Alvarado, Catarina Marinho, Luís Pinto, Margarida Sousa, Nuno Silva, Sónia Ramos, Susana Correia, Tiago Santos. Ana Isabel Rocha Faustino.
13. V-Fórum de Investigação Farmacológica, Vila Real, 23 October 2014. Organization: Paula A. Oliveira e Patrícia Poeta, Paula Alexandra Martins de Oliveira.
14. Workshop presentation of the results of the Innofood project with the presence of the Evaluation Panel. UTAD, 15 December 2014. Ana Isabel Ramos Novo Amorim de Barros.

15.XV Jornadas Biologia Aplicada, Braga, Portugal, 19-22 February 2014. Member of the Scientific Committee: Cristina Alexandra de Almeida Aguiar.

16.3º Simpósio Nacional de Fruticultura, UTAD, Vila Real, 4-5 December 2014. Organizing Committee: Ana Paula Silva, Berta Gonçalves, Eduardo Rosa, Ana Alexandra Oliveira.

4.1.6.10 Industry contract research

N/A

4.1.6.11 Internationalization

SAC researchers participated in different types of internationalization initiatives such as participation in international meetings, admission into to the Editorial board of scientific peer reviewed Journals and scientific networks.

1. Aguiar, C.A., Ferreira, A.M., Oliveira, R., Baltazar, F., Cunha, A. (2014). Characterization of Portuguese Propolis: Unravelling Biological Properties. 62nd International Congress and Annual Meeting of the Society for Medicinal Plant and Natural Product Research (GA2014). University of Minho, Guimarães, Portugal, 31 Agosto - 4 Setembro 2014.
2. Aires, A. (2014) - Speaker of the 8th International Conference on Polyphenols Applications - ISANH Polyphenols 2014, June 4-6, 2014 – Lisbon, Portugal.
3. Andrade, C.M.M. (2014) – Speaker at 12th International Conference of Numerical Analysis and Applied Mathematics, ICNAAM 2014, 22-28 September 2014, Rodos Palace Hotel, Rhodes, Greece.
4. Andrade, C.M.M. (2014) – Speaker at 14th EMS Annual Meeting & 10th European Conference on Applied Climatology (ECAC) | 06 – 10 October 2014 | Prague, Czech Republic.
5. Andrade, C.M.M. (2014). Chair of the Organizing Committee, 3rd International Conference on Ecohydrology, Soil and Climate Change EcoHCC14, Tomar - Portugal, 10 to 12 September 2014.
6. Antunes, L.M. (2014). SEB Main Meeting, 1- 4 July, Manchester, UK.
7. Carvalho, A.C., Franklin, G., Dias, A.C.P., & Lima, C.F. (2014). Protection of human HepG2 cells against oxidative stress by a methanolic extract of *Hypericum perforatum* elicited with *Agrobacterium tumefaciens*. 62nd International Congress and Annual Meeting of the Society for Medicinal Plant and Natural Product Research (GA). August 31 - September 4, 2014. Guimarães, Portugal.
8. Carvalho, A.C., Gomes, A.C., Pereira-Wilson, C., & Lima, C.F. (2014). - Hormetic induction of antioxidant defences by phenolic diterpenes possess anti-aging effects in normal

human skin fibroblasts. 8th International Conference on Polyphenols Applications - ISANH Polyphenols 2014. June 4-6, 2014. Lisboa, Portugal.

9. Correia, C.M. (2014) – Speaker in the Second International Conference of Agriculture & Food 2014 Elenite, Bulgária, with the communication entitled: "Climate change and adaptation strategies for viticulture".
10. Dunck, B., Lima-Fernandes, E., Cássio, F., Cunha, A., Rodrigues, L., & Pascoal, C. (2014). Effects of stream eutrophication on primary production, litter decomposition and the associated communities of periphytic algae, fungi and macroinvertebrates. XVII Meeting of the Iberian Limnological Association. Santander, Spain, 6-11 July 2014 (oral).
11. Figueiro, J.F., Andreani, T., Parra, A., Silva, A.M., Calpena, A.C., Egea, M.A., Garcia, M.L., & Souto, E.B. (2014). Cationic Lipid Nanoparticles for ocular delivery of epigallocatechin gallate. In NanoPT, Nanoscience and Nanotechnology International Conference. 13 – 15 February, Porto, Portugal.
12. Figueiro, J.F., Andreani, T., Parra, A., Silva, A.M., Calpena, A.C., Egea, M.A., Garcia, M.L. & Souto, E.B. (2014). Epigallocatechin gallate-loaded lipid nanoparticles as novel ocular delivery systems. 9th World Meeting on Pharmaceuticals, Biopharmaceuticals and Pharmaceutical Technology. 31st March – 3rd April, Lisbon, Portugal.
13. Faustino-Rocha, A.I., Pinto, C., Gama, A., & Oliveira, P.A. (2014). Effects of Ketotifen on mammary tumors volume and weight. 9th International Conference of Anticancer Research, Porto Carras, Sithonia, Grécia.
14. Ferreira, M.F. (2014) - Associate Editor of BMC, Complementary & Alternative Medicine.
15. Ferreira, M.F. (2014) - Member of Editorial Board of Chemistry: An Indian Journal (Phytochemistry Section).
16. Ferreira, M.F. (2014) - Member of the GP-TCM Research Association (Good Practice in Traditional Chinese Medicine Research Association).
17. Freitas, A.S., Pintado, C., Antunes, P., Cunha, A., Aguiar, C.A., Oliveira, R. (2014). Evaluation of bioactivities of a propolis sample of Portuguese origin. 62nd International Congress and Annual Meeting of the Society for Medicinal Plant and Natural Product Research (GA2014). University of Minho, Guimarães, Portugal, 31 Agosto - 4 Setembro 2014.
18. Freitas, A.S., Pintado, C., Antunes, P., Cunha, A., Almeida-Aguiar, C., & Oliveira, R. (2014). Avaliação de bioactividades de uma amostra de própolis de origem portuguesa. III Congresso Ibérico de Apicultura. Mirandela, Portugal, 13 a 15 Abril 2014.
19. Lourenço, T., Ferreira, A.M., Bento, F., Geraldo, D., Oliveira, R., Almeida-Aguiar, C., & Cunha, A. (2014). Preparação de extratos de própolis dos Açores e avaliação das suas

atividades antimicrobiana e antioxidante. III Congresso Ibérico de Apicultura. Mirandela, Portugal, 13 a 15 Abril 2014.

20. Lourenço, T., Oliveira, T., Ferreira, A.M., Oliveira, R., Bento, F., Geraldo, D., Aguiar, C.A., A. (2014). Antimicrobial and antioxidant properties of propolis ethanol extracts from Terceira Island (Azores, Portugal). 62nd International Congress and Annual Meeting of the Society for Medicinal Plant and Natural Product Research (GA2014). University of Minho, Guimarães, Portugal, 31 Agosto - 4 Setembro 2014
21. Marques, R., Baltazar, F., Cunha, A., Oliveira, R., & Almeida-Aguiar, C. (2014). Análise dos mecanismos de actividade biológica do própolis do Pereiro. III Congresso Ibérico de Apicultura. Mirandela, Portugal, 13 a 15 Abril 2014.
22. Marques, R.A., Baltazar, F., Cunha, A., Oliveira, R., & Aguiar, C. A. (2014). Antimicrobial activity of propolis from Beira Alta (Portugal) and analysis of the toxicity mechanism in fungi. 62nd International Congress and Annual Meeting of the Society for Medicinal Plant and Natural Product Research (GA2014). University of Minho, Guimarães, Portugal, 31 Agosto - 4 Setembro 2014.
23. Pereira H, Ferreira AM, Almeida Aguiar C, Oliveira R, & Cunha A. (2014). Portuguese propolis: genotoxic, phytotoxic and protective effects against oxidative stress. 62nd International Congress and Annual Meeting of the Society for Medicinal Plant and Natural Product Research (GA2014). University of Minho, Guimarães, Portugal, 31 Agosto - 4 Setembro 2014.
24. Pinto, T.M.S. (2014). Encuentro europeo de la Castaña - V European Chestnut Meeting, 11 -13 de Sept. 2014, Castilla y León, Spain
25. Rosa, E.A.S. (2014). Coordinator of the Outreach Region of Portugal in the Climate-KIC. Funding to CITAB: 21.500€.
26. Santos, S. L., Silva, A. M., Fernandes, A, Marques, T., Monteiro, S.M., & Álvaro, A.R. (2014). Apoptotic potential of copper in Caco-2 and Hep-G2 cells. Expression of Caspases 3, 8 and 9, AIF and p53. In SEB (Society for Experimental Biology) Annual Meeting 2014, 1st – 4th July. Manchester, UK. C3.15. pp. 98.
27. Silva, J., Pinto-Leite, R., Faustino-Rocha, A.I., Colaço, A., Arantes-Rodrigues, R., & Oliveira, P.A. (2014). Autophagy and apoptosis analysis on T24 and 5637 cells induced by carboplatin and piroxicam. 9th International Conference of Anticancer Research, Porto Carras, Sithonia, Grécia.
28. Silva, J., Pinto-Leite, R., Faustino-Rocha, A.I., Colaço, A., Arantes-Rodrigues, R., & Oliveira, P.A. (2014). Carboplatin and piroxicam effects on human urinary bladder cancer cell lines. 9th International Conference of Anticancer Research, Porto Carras, Sithonia, Greece.
29. Sousa, R.M., Rosa, J.S., Cunha, A., & Fernandes-Ferreira, M. (2014) Activity of *Anethum graveolens*, *Foeniculum vulgare*, *Petroselinum crispum* and *Cuminum cyminum* essential oils and volatile compounds against the freshwater snail *Radix peregra* (Lymnaeae).

Planta Med, Vol. 80 (16) P2B49. DOI: 10.1055/s-0034-1394926. Manuel Fernandes Ferreira.

30. Vazzana, M., Santini, A., Veiga, F.J., Silva, A.M., Faggio, C., & Souto, E.B. (2014). Formulating polyphenols in hydrophilic polymeric solid dosage forms and pharmacokinetic characterization by mathematical modeling. In 87th Meeting of Societa Italiana di Biologia Sperimentale (SIBS) 2014, dezembro 5-6. Italy.
31. Vazzana, M., Santini, A., Veiga, F.J., Silva, A.M., Souto, E.B., & Faggio, C. (2014). Functionalized nanostructures derived from self-assembled polyphenols for targeted delivery against cancer. In 87th Meeting of Societa Italiana di Biologia Sperimentale (SIBS) 2014, dezembro 5-6. Italy.

4.1.6.12 Other Publications National

1. Almeida Aguiar C. (2014). Ensinar e Aprender com Podcasts. *Revista de Ciência Elementar*, 2(3), 17-20. <http://pt.calameo.com/read/001175227db6927354cb7>
2. Machado, M., Machado, N., Dominguez-Perles, R., & Barros, A. (2014). Análise imediata de açúcares e acidez titulável em mirtilos através de espectroscopia de infravermelho. *Actas Portuguesas de Horticultura*, 23, 419-423.
3. Cunha, M., Machado, N., Gouvinhas, I., Dominguez-Perles, R., & Barros, A. (2014). Avaliação do conteúdo e atividade antioxidante de suplementos alimentares baseados em frutas e frutos vermelhos. *Actas Portuguesas de Horticultura*, 23, 508-515.
4. Pinto, A., Vilela, A., Cosme, F., Nunes, F., Anjos, R., & Pinto, T. (2014). Agricultura biológica vs convencional: avaliação de parâmetros bioquímicos e qualidade sensorial da variedade de Amora Chester Thornless. *Actas Portuguesas de Horticultura* 23, 405-410.
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6. Correia, S., Vilela, A., Queirós, F., Oliveira, I., Silva, A.P., & Gonçalves, B. (2014). Efeito da aplicação de um bioestimulante em duas cultivares de cerejeira (Sweetheart e Skeena): I) no perfil sensorial dos frutos. *Actas Portuguesas de Horticultura*, 23, 141-148.
7. Correia, S., Queirós, F., Ribeiro, C., Oliveira, I., Luzio, A., Silva, A.P., & Gonçalves, B. (2014). Efeito da aplicação de um bioestimulante em duas cultivares de cerejeira (Sweetheart e Skeena): II) produção, calibre, índice de rachamento e características químicas dos frutos. *Actas Portuguesas de Horticultura*, 23, 389-396.

8. Pinto, A., Vilela, A., Cosme, F., Nunes, F., Anjos, R., & Pinto, T. (2014). Agricultura biológica vs agricultura convencional: avaliação de parâmetros bioquímicos e qualidade sensorial de amora Chester Thornless. *Actas Portuguesas de Horticultura*, 23, 405-410.
9. Gonçalves, A., Vilela, A., Cosme, F., Nunes, F., Pinto, T., & Anjos, R. (2014). Agricultura biológica vs agricultura convencional: avaliação de parâmetros bioquímicos e qualidade sensorial de framboesa Tulameen. *Actas Portuguesas de Horticultura*, 23, 411-418.
10. Mota, M., Pinto, T., Marques, T., Borges, A., Raimundo, F., Veiga, V., Caço, J., Martins, A.E., Gomes-Laranjo, J. (2014). Efeito da rega na produtividade fotossintética dos castanheiros. *Actas Portuguesas de Horticultura*, 23, 166-173.
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12. Aires, A., Carvalho, R.P.M., Rosa, E., Gonçalves, B., & Silva, A.P. (2014). Estudo comparativo do teor em fitoquímicos de pequenos frutos produzidos em Portugal e provenientes de mercados longínquos. *Actas Portuguesas de Horticultura*, 23, 359-371.
13. Fernandes, H., Carlos Ribeiro, C., & Rosa, E. (2014). Melão Casca de Carvalho (*Cucumis melo* L.) - a cultura de um fruto promissor. *Actas Portuguesas de Horticultura*, 23, 198-205.
14. Ferreira, S., Gonçalves, B., Aires, A., Carvalho, R.P., Correia, S., Oliveira, I., Ferreira, H., Bacelar, E., & Silva, A.P. (2014). Composição química de frutos de quatro cultivares de mirtilo em modo de produção biológico. *Actas Portuguesas de Horticultura*, 23, 432-438.
15. Ferreira, S., Gonçalves, B., Ferreira, H., Correia, C., Oliveira, I., Ferreira, R., Ana Paula Silva, A.P., & Bacelar, E. (2014). Composição química de folhas de quatro cultivares de mirtilo em modo de produção biológico. *Actas Portuguesas de Horticultura*, 23, 125-132.
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17. Queirós, F., Moutinho-Pereira, J., Correia, C., Bacelar, E., Ferreira, H., Paula Silva, A.P., Santos, A., Ana Barros, A., & Berta Gonçalves (2014). Comportamento biológico de folhas expostas versus folhas de sombra em cerejeira. *Actas Portuguesas de Horticultura*, 23, 117-124.
18. Oliveira, I., Moutinho-Pereira, J., Correia, C., Bacelar, E., Ferreira, H., Santos, A., Silva, A.P., & Gonçalves, B. (2014). Efeito da forma de condução nas cultivares de aveleira “Butler” e “Segorbe” (I): características morfo-anatómicas e químicas de folhas. *Actas Portuguesas de Horticultura*, 23, 149-157.

19. Oliveira, I., Moutinho-Pereira, J.M., Correia, C., Bacelar, E., Ferreira, H., Santos, A., Silva, A.P., & Gonçalves, B. (2014). Efeito da forma de condução nas cultivares de aveleira “Butler” e “Segorbe” (II): características fisiológicas de folhas. *Actas Portuguesas de Horticultura*, 23, 158-165.
20. Duarte, J., Forjaz, M.A., Almeida, M.J., Maciel, M.J.M, Aguiar, C.A., & Nobre, A. (2014). A biologia e a matemática vistas com as mãos e com os olhos através do croché. Livro de Resumos, Comunicação de Ciência para o desenvolvimento. Universidade do Porto, 3 e 4 de Junho, Porto, Portugal, **B5**, http://scicom.up.pt/resumos/SciComPT2014_Livro_de_Resumos_V1.1.pdf
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22. Nobre, A. Almeida Aguiar, C.A., Forjaz, M.A., Maciel, M., Braga, I.A., Araújo, H.C., & Almeida, M.J. (2014). STOL-A construção de um projeto de divulgação de ciência, Science Through Our Lives. Livro de Resumos, Comunicação de Ciência para o desenvolvimento. Universidade do Porto, 3 e 4 de Junho, Porto, Portugal, **C9**, http://scicom.up.pt/resumos/SciComPT2014_Livro_de_Resumos_V1.1.pdf
23. Forjaz, M.A., Nobre, A., Aguiar, C.A., Maciel, M., & Almeida, M.J. (2014). *Homo numericus*: O homem numa abordagem facetada e interdisciplinar. Livro de Resumos, Comunicação de Ciência para o desenvolvimento. Universidade do Porto, 3 e 4 de Junho, Porto, Portugal, **C12**, http://scicom.up.pt/resumos/SciComPT2014_Livro_de_Resumos_V1.1.pdf
24. Maciel, M., Nobre, A., Aguiar, C.A., Forjaz, M.A., Lobo, D., & Almeida, M.J. (2014). Da rua para o jornal: envolver a comunidade local nas estratégias de comunicação de ciência. Universidade do Porto, 3 e 4 de Junho, Porto, Portugal, **D6**, http://scicom.up.pt/resumos/SciComPT2014_Livro_de_Resumos_V1.1.pdf
25. Carvalho, R. A., T. Pinto, J. Gomes-Laranjo. (2014). A importância do sílicio no aumento da resistência das plantas de castanheiro à *Phytophthora cinnamomi*. Livro de resumos das 8^{as} Jornadas de Biologia, 22 e 23 de Outubro, Universidade de Trás-os-Montes e Alto Douro, Vila Real, Portugal.
26. Figueiredo, N., Carranca, C., Coutinho, J., Trindade, H., Pereira, J., Pereira, A., et al. (2014). A alteração climática na “fixação” do amónio em solos cultivados com arroz (*Oryza sativa*) por alagamento (J. Casimiro Martins T. B. R. M. da Conceição Gonçalves, Eds.). Oeiras, Portugal: Instituto Nacional de Investigação Agrária e Veterinária, I.P.
27. Oliveira, R. (2014). Aplicação de “audience response systems” em aulas de biologia molecular como ferramenta de incentivo à participação activa nas aulas. Atas do 2.º

Encontro sobre Jogos e Mobile Learning. Braga: CIEd, 9 de Maio de 2014, Universidade de Coimbra, Portugal, 444-451. (Vol. ISBN 978-989-8525-30-7).

4.1.6.13 Government/Organization contract research

SerCast- Reinforce of chestnut productivity in Sernancelhe municipality. CITAB coordinator: José Laranjo. Starting date: May 2012, duration: 36 months (Protocol with Sernancelhe Municipality). Value: €44.609,00.

4.1.6.14 Awards

Cristina Alexandra de Almeida Aguiar (2014). Menção Honrosa no âmbito dos Prémios Casa das Ciências 2014 ao objeto educativo Diversidade Microbiana.

4.1.7 Future research

4.1.7.1 Objectives

CITAB is undergoing transition and restructuring as the new R&D strategic plan for the next 5 years (2015-2020) is implemented. SAC objectives are strongly committed to the global CITAB Strategic Project (SP) which has been planned in coordination with the other 2 research Groups (BE and EI), and also complies with key Horizon 2020 research funding areas. The SAC research Group will focus on applied research to agri-food production chains and their sustainability, taking into account the influence of climate change effects and guaranteeing added-value to plant residues and co-products. These objectives will be allied with stakeholder demands met via strong cooperative bonds and a commitment to outreach activities to increase the impact of findings on the regional and national economy.

SAC also intends to increase the number of integrated members by providing scholarships to carry out full-time research, increase the number of financed projects with an industrial focus, carry out internationally recognized high quality scientific work and increase the number of registered patents and spin-offs. SAC will reinforce participation in several international networks (e.g. COST actions, ERA-NETS). SAC will develop strategies to reinforce its position and become a leader in some key areas in Portugal. This is based on the fact that several researchers from other Research Units in Portugal have requested to join CITAB, in particular to work in the SAC Group.

Our main ambitions are:

- To lead in the development of crop models adapted to Mediterranean environments to yield reliable climate change projections; the production of



biosensors in collaboration with BE group to monitor different crops with economic relevance in real time;

- Produce reliable methods to evaluate the quality of crops and food products and biodiversity in collaboration with BE and EI members. SAC is committed to developing reliable and practical methods using metabolomic, transcriptomic and biochemical/molecular techniques with sensory analysis to provide vital information for the crop optimization and adaptation.
- Develop continuous and efficient strategies to decrease GHG emissions impacts from dairy cattle building, animal slurries, and paddy rice production;
- Develop continuous and effective methods to evaluate the bioactivities of various PAMs and agri-food by making better use of the regions considerable regional biodiversity;
- Valorisation of by-products produced in agro-industry.

Taking advantage of recent facilities, SAC will develop more *In vitro* studies with cell lines complemented with *In vivo* studies with animal models. This will allow SAC to present solutions and validation processes of bio based materials and functional foods to future stakeholders.

4.2 Ecointegrity

4.2.1 Group description

Principal Researcher	Mário Gabriel Santiago dos Santos
Research area	Environment
Home Institution	Universidade de Trás-os-Montes e Alto Douro

4.2.2 Funding

	2012	2013	2014
FCT Projects	347.873,00€	431.761,83€	89.858,83€
Other (National)	747.159,20€	195.524,67€	801.820,89€
Other (International)	0,00€	6.250,00€	3.633,33€
Industry (National)	198.814,96€	364.418,00€	126.601,00€
Industry (International)	0,00€	0,00€	400,00€
Total	1.293.847,16€	997.954,82€	1.022.313,97€

4.2.3 Objectives

Ecointegrity (EI) research focuses on characterization of natural and altered ecosystems at different scales of observation. Results are used to select appropriate ecological indicators or ecosystem processes and develop predictive models of change. Output is used to set guidelines for ecosystem management and restoration namely the conservation of natural resources, biodiversity and the restoration of disturbed areas or conservation of target species.

EI research is grouped into two main projects:

Project #03 - Biodiversity, Environmental Assessment and Biotechnology

Researchers working in tasks within this project study the effects of large scale environmental change on the sustainability, resilience and diversity of disturbed and natural ecosystems and agrosystems. Research aims include:

- creating appropriate tools for characterising and predicting the spatial and temporal dynamics, structure and function of terrestrial and aquatic ecosystems affected by human disturbance;
- Developing and implementing typologically appropriate management plans, based on the ecological assessment of different components of the environment, in order to rehabilitate or restore degraded systems.
- Bioremediation of systems affected by anthropogenic disturbance.
- Conservation of threatened species of terrestrial and aquatic ecosystems.

Project #04 – Disturbance of forest and agro-forested ecosystems

This project includes studies on abiotic and biotic agents of disturbance that act on forests, woodlands, agricultural agroforestry systems. Research aims:

- To characterize spatial and temporal patterns of abiotic disturbance regimes and to develop management guidelines for disturbance mitigation and adaptation measures.
- The ecology of endangered arthropods and their role in the functioning of ecosystems.
- Integration of ecosystem services in agriculture to decrease the use of pesticides and associated costs.

4.2.4 Main achievements

A summary of EI main achievements for 2014 is listed below

- New applications using StDM models for the conservation of wildlife populations.
- New information concerning aggressive diseases on bat populations and the genetics of endangered corvids.

- Development of a multi-model integrative framework for ecosystem management, where the ecological indicator response can be predicted under different socio-economic scenarios and site-specific management actions.
- Identification of main groups of the flora and fauna that contribute for providing ecosystem services in “Douro Demarcated Region” vineyards.
- Development of habitat management strategies aimed at enhancing conservation biological control of insect pests of vineyards.
- Assessment of impact of climate change, human interference, scale and modelling uncertainties on the estimation of aquifer properties and river flow components in Northern Portugal.
- Impacts of climate change and land-use scenarios on *Margaritifera margaritifera*, an environmental indicator and endangered species, in the Beça River.
- Assessment of the recent and future changes in the extreme precipitation regime and the impacts of climate change on the Intensity-Duration-Frequency (IDF) curves used in Portugal to design building storm-water drainage systems.
- Assessment of climate change impacts in maximum precipitation intensity in Portugal and the need to revise precipitation classification and the sizing of retention basins.
- Association of soil losses in rural watersheds with environmental land use conflicts.
- The use of Multi Criteria Analysis for monitoring aquifer vulnerability in environmental policy.
- Establishment of a connection between exposures to endocrine disruptors during embryogenesis and developmental toxicity.
- Apoptosis pathways were identified as target of endocrine disruption action, in zebrafish.
- Identification of new NMDA receptor independent mechanism of Ketamine toxicity in zebrafish embryos.
- Identification of three potential sex related genomic sequences in zebrafish.
- Development of a scientific, quantitative basis for prescribed burning planning in eucalyptus plantations.
- Identification of the drivers of post-fire plant regeneration in pine and eucalyptus stands;
- Identification of the dynamics and drivers of wildfire extent in the Portuguese public forest;

- Identification and characterization of the spatial and temporal evolution of the fire incidence and of the vegetation types most affected by forest fires in Europe;
- Propose a fire proneness index to assess the fire selectivity of land cover classes, to quantify and compare the propensity of vegetation classes and countries to fire;
- Test and use different approaches to model future burnt area in the Iberian Peninsula;
- Testing and use of space-time permutation scan statistics to detect and characterize clusters of fire in the Portuguese Rural Fire Database.

4.2.5 Mobility

1. Carvalho, J. (2014). *Oaks – Importance and valuation in the Douro region and Portugal*. Workshop ‘The Douro in Cambridge’. University Cambridge. McDonald Institute for Archaeological Research, 8 Nov 2014.
2. Carvalho, J. (2014). People and Coppice. COST Action FP1301 - Innovative management and multifunctional utilization of traditional coppice forests. University of Greenwich, England, 5 Nov 2014.
3. Hughes SJ (2014). Pioneers into Practise Programme. Climate-KIC professional mobility programme. Low Carbon Economy join and put into practice their expertise to create new products and services in the field of the climate change.
4. Santos, M. (2014). Socio-ecology of Acacia. SESYNC meeting. (<http://www.sesync.org/project/socioecology-of-acacia>) Halle, Germany, 31 August-5 September.
5. Viana, H.F.S. (2014). 5th Advanced Training Course in Land Remote Sensing. European Space Agency. University of Valencia, Spain, 8 a 12 de September de 2014.

4.2.6 Group productivity

4.2.6.1 International Projects

El researchers participated in 4 international project during 2014:

Project	Funding
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 (Eranet).	€10.000,00
Evolution and endemism in a morphologically cryptic group of aquatic insects (Ephemeroptera, Baetidae) on the islands of northeastern Macaronesia. CITAB Coordinator: Samantha Hughes. Starting Date: 2013, duration 24 months	€600,00
IMPACT - Developing an Integrated Model to Predict Abiotic habitat Conditions and biota of rivers for application in climate change research and water management. CITAB Coordinators: Samantha Hughes and Simone Varandas. Starting Date: February 2013, duration 30 months.	N/A
European Initiative on Natural Water Retention Measures (NWRM). CITAB Coordinator: Samantha Hughes. Starting Date: January 2014, duration 12 months.	N/A

4.2.6.2 National Projects

El researchers participated in 15 national projects during 2014:

Project	Funding
“SUSTAINSYS - Environmental Sustainable Agro-Forestry Systems”. CITAB Coordinator: Rui Cortes. Starting Date: January 2014, duration 18 months (NORTE-07-0124-FEDER-0000044)	€600.863,65
“Biobase. Thematic Networks of Information and Dissemination” CITAB Coordinator: António Crespi. Starting Date: March 2014, duration 24 months (ProDer 52986)	€75.500,22

<p>“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)</p>	€32.190,82
<p>“Zebrafish (<i>Danio rerio</i>) anaesthesia and potential implications in research – reduction, replacement and refining”. CITAB Coordinator: Sandra Mariza Monteiro. Starting Date: July 2013, duration 24 months (PTDC/CVT-WEL/4672/2012)</p>	€159.965,00
<p>“Paeloris: characterization and protection of native species of molluscs in coastal lagoons of Barrinha Mira, Mira Lagoon, Lake Vela and Braças Lagoon”. CITAB Coordinator: Simone Varandas. Starting Date: March 2013, duration 12 months. Promotors: Oceanário de Lisboa and National Geographic Channel.</p>	€15.000,00
<p>“Conbi - Biodiversity and Conservation Bivalves - ecogeographic, genetic and physiological information”. CITAB Coordinator: Simone Varandas. Starting Date: 2011, duration: 36 months (PTDC/AAC-AMB/117688/2010)</p>	€15.000,00
<p>“<i>Cryptococcus gattii</i> environmental survey: Europe and Mediterranean area”. CITAB Coordinator: Ana Sampaio. Starting Date: 2013, duration: 36 months (ISHAM <i>Cryptococcus</i> working group).</p>	N/A
<p>“Economountain, Economy of biodiversity in the Vila Pouca de Aguiar mountains”. CITAB Coordinator: Aurora Capapé. Starting Date: July 2012, duration: 36 months. (Fundo EDP Biodiversidade)</p>	€50.000
<p>“FIRE-ENGINE - Flexible Design of Forest Fire Management Systems”. CITAB Coordinator: Paulo Fernandes. (MIT/FSE/0064/2009). Starting date: March 2011. Duration: 36 months. http://feup.azul.net/fe/</p>	€30.935,00
<p>“FIREGLOBULUS - Prescribed fire use in blue gum plantations”. CITAB Coordinator: Paulo Fernandes. (nº 2011/021555). Starting date: September 2011. Duration: 36 months (QREN Co-promoção)</p>	€189.427,00
<p>“IND_CHANGE - INDicator-based modelling tools to predict landscape CHANGE and to improve the application of social-ecological research in adaptive land management”. CITAB</p>	€14.629,00

Coordinator: João Cabral. Starting Date: July 2013. Duration: 36 months (PTDC/AAG-MAA/4539/2012)

“EcoVitis - Maximizing Eco-services into Douro Demarcated Region vineyards”. CITAB Coordinator: Laura Torres. Starting Date: January 2011, duration: 40 months. Promotor: Real Companhia Velha (Proder 24043)	€495.122,00
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“Micoproject - Development of mycorrhizal inoculants and mycological management in marginal áreas”. CITAB Coordinator: Guilhermina Marques. Starting date: September 2008, duration: 82 months. Promotor: Bioinvitro (QREN/ADI 1589)	€83.436,00
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“Promotion and valuation of native forest species”. CITAB Coordinator: João Carvalho. Starting date: June 2013, duration: 36 months. (Associação Nacional Conservação Natureza – QUERCUS)	N/A
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“WFD - citizenship for accompanying public water policies”. Coordinator: Samantha Hughes. Starting Date: July 2013, duration: 24 months	N/A
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4.2.6.3 Publications in peer reviewed Journals

El Researchers published a total of 39 articles in SCI/JCR journals in 2014:

1. Águas, A., Ferreira, A., Maia, P., Fernandes, P.M., Roxo, L., Keiser, J.K., Silva, J.S., Rego, F.C., Moreira, F. (2014). Natural establishment of *Eucalyptus globulus* Labill. in burnt stands in Portugal. *Forest Ecology and Management*. 323 47-56. <http://www.sciencedirect.com/science/article/pii/S0378112714001571>
2. Arnaldo, P.S., Gonzalez, D., Oliveira, I., van Langevelde F and Wynhoff I. (2014). Influence of host plant phenology and oviposition date on the oviposition pattern and offspring performance of the butterfly *Phengaris alcon*. *Journal of Insect Conservation*. 18 1115-1122. <http://link.springer.com/article/10.1007%2Fs10841-014-9721-x>
3. Carrola, J., Fontainhas-Fernandes, A., Pires, M. J., Rocha, E. (2014). Frequency of hepatocellular fibrillar inclusions in European flounder (*Platichthys flesus*) from the Douro River estuary, Portugal. *Environmental Science and Pollution Research* 21(4), 3116-3125. <http://link.springer.com/article/10.1007%2Fs11356-013-2248-y>
4. Carrola, J., Santos, N., Rocha, M.J., Fontainhas-Fernandes, A., Pardal, M.A., Monteiro, R.A. et al. (2014). Frequency of micronuclei and of other nuclear abnormalities in erythrocytes of the grey mullet from the Mondego, Douro and Ave estuaries-Portugal.

- Environmental Science and Pollution Research* 21(9), 6057-6068.
<http://link.springer.com/article/10.1007%2Fs11356-014-2537-0>
5. Carvalho, M. I., Pires, I., Prada, J., Queiroga, F.L. (2014). A Role for T-Lymphocytes in Human Breast Cancer and in Canine Mammary Tumors. *Biomed Research International* vol. 2014, Article ID 130894, 11 pages.
<http://www.hindawi.com/journals/bmri/2014/130894/>
 6. Coelho D., Hughes S.J., Varandas S. and Cortes R.M.V. (2014). Conservation benefits of riparian buffers in urban areas. *Fundamentals of Applied Limnology*. (18) 55-70. <http://dx.doi.org/10.1127/fal/2014/0589>
 7. Coelho, C., Vieira-Pinto, M., Faria, A.S., Vale-Gonçalves, H.M., Veloso, O., Paiva-Cardoso, Md.N., Mesquita, J.R., & Lopes, A.P. (2014). Serological evidence of *Toxoplasma gondii* in hunted wild boar from Portugal. *Veterinary Parasitology* 202(3-4), 310-312.
<http://www.sciencedirect.com/science/article/pii/S0304401714001629>
 8. Costa, M.R., Calvao, A.R., Aranha, J. (2014). Linking wildfire effects on soil and water chemistry of the Marao River watershed, Portugal, and biomass changes detected from Landsat imagery. *Applied Geochemistry* 44, 93-102.
<http://www.sciencedirect.com/science/article/pii/S088329271300231X>
 9. Dias A. A., Pinto P. A., Fraga I., and Bezerra R. M. F. (2014). Diagnosis of Enzyme Inhibition Using Excel Solver: A Combined Dry and Wet Laboratory Exercise. *J. Chem. Educ.* 91 1017-1021. <http://pubs.acs.org/doi/pdf/10.1021/ed3006677>
 10. Félix, L.M., Antunes, L.M., Coimbra, A.M., (2014). Ketamine NMDA receptor-independent toxicity during zebrafish (*Danio rerio*) embryonic development. *Neurotoxicology and Teratology* 41, 27–34.
 11. Fernandes, L., Lucas, M.S., Maldonado, M.I., Oller I. and Sampaio, A. (2014). Treatment of pulp mill wastewater by *Cryptococcus podzolicus* and solar photo-Fenton: a case study. *Chemical Engineering Journal*. 245 158-165. [doi: 10.1016/j.cej.2014.02.043](https://doi.org/10.1016/j.cej.2014.02.043)
 12. Fernandes, P.M. (2014). Upscaling the estimation of surface-fire rate of spread in maritime pine (*Pinus pinaster*) forest. *iForest – Biogeosciences and Forestry*. 7 123-215.
<http://www.sisef.it/iforest/contents/?id=ifor0992-007>
 13. Fernandes, P.M., Loureiro, C., Guiomar, N., Pezzatti, G.B., Manso, F. and Lopes, L. (2014). The dynamics and drivers of fuel and fire in the Portuguese public forest. *Journal of Environmental Management*. 146 373-382.
<http://www.sciencedirect.com/science/article/pii/S0301479714004290>
 14. Ferreira, A.S., Sampaio, A., Maduro, A. P., Silva, I., Teles, F., Martins, M.L. and Inácio, J. (2014). Genotypic diversity of environmental *Cryptococcus neoformans* isolates from Northern Portugal. *Mycoses*. 57(2) 98–104.
<http://onlinelibrary.wiley.com/doi/10.1111/myc.12106/epdf>
 15. Fraga, I., Coutinho, J., Bezerra, R.M., Dias, A.A., Marques, G. and Nunes, F.M (2014). Influence of culture medium growth variables on *Ganoderma lucidum*

- exopolysaccharides structural features. *Carbohydrate Polymers*. 111(13) 936-946. <http://www.sciencedirect.com/science/article/pii/S0144861714005177>
16. Froufe E., Sobral C., Teixeira A., Sousa R., Varandas S., Aldridge D.C. and Lopes-Lima M. (2014). Genetic diversity of the pan-European freshwater mussel *Anodonta anatina* (Bivalvia: Unionoida) based on CO1: new insights on the genus phylogeny and implications for its conservation. *Aquatic Conserv: Mar. Freshw. Ecosyst.*, 24: 561–574 <http://onlinelibrary.wiley.com/doi/10.1002/aqc.2456/pdf>
17. Gomez-Vasquez, I., Fernandes, P.M., Arias-Rodil, M., Barrio-Anta, M., Castedo-Dorado, F. (2014). Using density management diagrams to assess crown fire potential in *Pinus pinaster* Ait. stands. *Annals of Forest Science* 71(4), 473-484. <http://link.springer.com/article/10.1007%2Fs13595-013-0350-4>
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4.2.6.4 Other publications International

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2. Barros, P., Braz, L., Vale-Gonçalves H. M., Cabral, J.A. (2014). First records of *Nyctalus noctula* social calls in Portugal. *Vespertilio* 17, 37-44.
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5. Botequim, B., Fernandes, P.M., Garcia-Gonzalo, J., Borges, J.G. (2014). Tools for creating fire-resistant landscapes in Portuguese ecosystems. DGS III 2014 – 3rd International Conference on Dynamics, Games and Science, 37-38.
6. Braz, L.F.P., Oliveira, B. & Hughes, S.J. (2014). The importance of emerging chironomids as a food resource for overwintering passerines in an Iberian high altitude lakes. *Chironomus Newsletter*, 27, 48 – 50. <http://www.ntnu.no/ojs/index.php/chironomus/article/view/1663>

7. DaCamara, C., Pereira, M.G., Calado, T.J., Calheiros, T. (2014). Impacts of climate change on the fire regime in Portugal. Abstracts of the VII International Conference on Forest Fire Research, N9.
8. Fernandes, P., Guiomar, N., Loureiro, C., Barros, A. (2014). Modelling the size of large fires in Portugal. Abstracts of the VII International Conference on Forest Fire Research, 250.
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11. Loureiro, C., Pinto, A., Fernandes, P.M. (2014). Fireglobulus: desenvolvimento de ferramentas de apoio à decisão no uso de fogo controlado em plantações de eucalipto. Resumos Expandidos, 3º Encontro Brasileiro de Silvicultura, 248-251.
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14. Pinto, P.A., Bezerra, R.M.F., Fraga, I., Dias, A.A. (2014). Kinetic constants estimation and model discrimination of laccase oxidation through reverse phase chromatography. XX Encontro Luso-Galego de Química, 34.
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16. Sousa, P., Trigo, R., Pereira, M., Camara, C., Gouveia, C., Bedia, J., Gutiérrez, J. M., (2014). Future burned area projections in Iberia. European Geosciences Union General Assembly 2013, Vienna, Austria. EGU General Assembly Conference Abstracts, 16, 6489.
17. Vale-Gonçalves, H.M., Cabral, J.A. (2014). New records on the distribution of three rodent species in NE Portugal from barn owl (*Tyto alba*) diet analysis Galemys, 26. <http://www.secem.es/galemys/index.php/Galemys/article/view/Galemys.2014.N3/58>

4.2.6.5 Book Chapters

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2. Amorim, J.H., Miranda, A.I., Valente, J., Marques, F.O., Borrego, C., Fernandes, J.M., Ottmar, R., Prichard, S.J., Andreu, A., Fernandes, P., Cunha, J.S. (2014). Fire safety

- management based on integrated monitoring and forecast of smoke exposure. In *Advances in Forest Fire Research*. Viegas, D.X. (Ed). Imprensa da Universidade de Coimbra. ISBN 978-989-26-0884-6. 1386-1394.
3. Amraoui M., Pereira M.G., DaCamara, C., Calado, T.J. (2014). Severe Fire Activity and Associated Atmospheric Patterns over Iberia and North Africa. In *Advances in Forest Fire Research*. Viegas, D. X. (Ed). Imprensa da Universidade de Coimbra. ISBN 978-989-26-0884-6. 940-948.
 4. Bacciu, V., Trigo, R., Spano, D., Masala, F., Duguay, B., Pastor, P., Sousa, P., Venäläinen, A., Mouillot, F., Moreno, J.M., Zavala, G., Urbieto, I.R., Koutsias, N., Xystrakis, F., Arianoutsou, M., Mallinis, G., González, M.E., Urrutia, R., Lara, A., Kavcaci, A., Midgley, G., Guo, D., Le Maitre, D., Forsyth, G., Southey, D., Arca, B., Bonora, L., Conese, C., Da Camara, C., Pereira, M.G., Gouveia, C., Camia, A., Amatulli, G., Vilar, L., San Miguel-Ayanz, J., Hairech, T., Assali, F., Mokssit, A., Cherki, K., Alaoui, H. (2014). Fire and weather relationships: present climate. In *Forest fires under climate, social and economic changes in Europe, the Mediterranean and other fire - affected areas of the world*. José M. Moreno (Ed). ISBN: 9788469597590. p. 18-19.
 5. Botequim, B.R., Ager, A., Pacheco, A.P., Oliveira, T., Claro, J., Fernandes, P., Borges, J. (2014). Addressing trade-offs among fuel management scenarios through a dynamic and spatial integrated approach for enhanced decision-making in eucalyptus forest. In *Advances in Forest Fire Research*. Viegas, D.X. (Ed). Imprensa da Universidade de Coimbra. ISBN 978-989-26-0884-6. 1623-1627.
 6. Carvalho MI; Raposo T; Rodrigues H; Pires I, Prada J, Queiroga FL (2014). Neoplastic Disease of Canine Mammary Glands. Edmund Rucker (Ed) In *Mammary Glands, Anatomy, development and diseases*, Nova Publishers, New York, EUA, Nova Publishers, New York, EUA, ISBN: 978-1-62948-856-1.
 7. Cabecinha, E., Alencão, A., Moreira, H., Sousa, L., Sousa, B., lemos, L., Quaresma, L., Gomes, E., Gabriel, R. (2014). Caracterização dos percursos no ramo norte das Arribas do Douro Internacional. In *Marca DUERO-DOURO: Manual Formativo*. Cabecinha, E., Alencão, A., Moreira, H., Sousa, L., Gabriel, R. (Ed). Serviço de Edições da Universidade de Trás-os-Montes e Alto Douro. ISBN: 978-989-704-197-6. 80 – 172.
 8. DaCamara, C., Pereira M.G., Calado, T.J., Calheiros T. (2014). Impacts of climate change on the fire regime in Portugal. In *Advances in Forest Fire Research*. Viegas, D. X. (Ed.). Imprensa da Universidade de Coimbra. ISBN 978-989-26-0884-6. 1193-1206.
 9. Ferreira, A.S., Maria das Neves Paiva-Cardoso, Gertrude Thompson, João Inácio. (2014). Capítulo 21 – Detecção de *Leptospira* em amostras biológicas de animais pela reação de polimerase em cadeia em tempo real em formato multiplex. In *Abordagens Moleculares em Veterinária: Como desvendar a etiologia e a epidemiologia da infeção*. Mónica V. Cunha e João Inácio (Ed). Lidel-Edições Técnicas, lda. ISBN: 978-989-752-034-1. 277-282.
 10. Martins, L. M., J. P. Moura, J. V. Cardoso, M. R. Anjos, P. Oliveira, P. S. Arnaldo e T. Pinto. (2014). Implementação de uma Rede de Avisos para Promoção da Qualidade da Castanha - AlertCast. In *UTAD*. 100.

11. Mateus, P. and Fernandes, P.M. (2014). Forest fires in Portugal: dynamics, causes and policies. In *Forest Context and Policies in Portugal, Present and Future Challenges*. Reboredo, F. (Ed). Springer. 97-115.
12. Morais, R., Alencão, A., Moreira, H., Cabecinha, E., Sousa, L., Gabriel, R., Quaresma, L., Gomes, E. (2014). Proposta de implementação da marca Duero-Douro a percursos pedestres. In *Marca DUERO-DOURO: Manual Formativo*. Cabecinha, E., Alencão, A., Moreira, H., Sousa, L., Gabriel, R. (Ed). Serviço de Edições da Universidade de Trás-os-Montes e Alto Douro. ISBN: 978-989-704-197-6. 1-25.
13. Moreira, H., Cabecinha, E., Sousa, L., Alencão, A., Sousa, B., Lemos, L., Quaresma, L., Gomes, E., Gabriel, R. (2014). Aspetos relevantes do ramo norte das Arribas do Douro Internacional. In *Marca DUERO-DOURO: Manual Formativo*. Cabecinha, E., Alencão, A., Moreira, H., Sousa, L., Gabriel, R. (Ed). Serviço de Edições da Universidade de Trás-os-Montes e Alto Douro. ISBN: 978-989-704-197-6. 26-72.
14. Pinto, A., Espinosa-Prieto, J., Rossa, C., Matthews, S., Loureiro, C., Fernandes, P. (2014). Modelling fine fuel moisture content and the likelihood of fire spread in blue gum (*Eucalyptus globulus*) litter. In *Advances in Forest Fire Research*. Viegas, D.X.(Ed). Imprensa da Universidade de Coimbra. ISBN 978-989-26-0884-6. 353-359.
15. Pinto, R.S., Sá, A.L., Benali, A., Pereira, J.M.C., Fernandes, P.M. (2014). Exploring the Capability to Forecast Wildfires: Spatial Modelling of the Tavira/São Brás de Alportel 2012 Wildfire. In *Advances in Forest Fire Research*. Viegas, D.X. (Ed). Imprensa da Universidade de Coimbra. ISBN 978-989-26-0884-6. 736-748.
16. Pinto, A., Fernandes, P.M., C. Loureiro (2014). Prescribed burning guide for blue gum plantations. In *Advances in Forest Fire Research*. Viegas, D. X. (Ed.). Imprensa da Universidade de Coimbra. ISBN 978-989-26-0884-6.
17. Sá, A.L., Benali, A., Pinto, R.S., Fernandes, P., Russo, A., Santos, F., Trigo, R.M., Pereira, J.M.C., Jerez, S., Dacamara, C.C. (2014). Improving wildfire spread simulations using MODIS active fires: the FIRE-MODSAT project. In *Advances in Forest Fire Research*. Viegas, D.X. (Ed). Imprensa da Universidade de Coimbra. ISBN 978-989-26-0884-6. 811-822.
18. Santos, M., Barros, P., Bastos, R., Vale-Gonçalves, H., Lourenço, V., Travassos, P., Carvalho, D., Gomes, C., Morinha, F., Cabral, J.A. (2014). Compensating the impact of Large Reservoirs in Amphibian Communities: a case study. In *Amphibians: Anatomy, Ecological Significance and Conservation strategies*. Martin P. Lombardi (Ed). Nova science. 1-26.
19. Trigo, R., Sousa, P. D Camara, C., Pereira, M.G., Gouveia, C. (2014). Fire and weather relationships: future projections. In *Forest fires under climate, social and economic changes in Europe, the Mediterranean and other fire - affected areas of the world*. José M. Moreno (Ed). ISBN: 9788469597590. 28-29

4.2.6.6 Books

1. Gonçalves, F., Carlos, C., Crespo, L., Torres, L. (2014). O campo no seu bolso nº 2. Amigos desconhecidos do agricultor - aracnídeos, insectos e centopeias. Edibio Edições, Lda. Castelo de Paiva. ISBN: 978-972-99697-4-4.
2. Cabecinha, E., Alencão, A., Moreira, H., Sousa, L., Gabriel, R. (2014). Marca DUERO-DOURO: Manual Formativo. ISBN: 978-989-704-197-6.
3. Alencão, A., Sampaio, E., Sousa, L., Gomes, E., Moreira, H., Gabriel, R. (2014). Marca DUERO-DOURO: procedimentos para a concessão da licença. ISBN: 978-989-704-179-2.
4. Gabriel, R., Moreira, H., Alencão, A., Sousa, L., Sampaio, E., Faria, A. (2014). Book of Abstracts of 3rd Seminar on Biomechanics, Health and Sustainable Environment. ISBN: 978-989-704-181-5.

4.2.6.7 Completed Master and Ph.D. theses

A total of 12 MSc theses and 1 PhD thesis were completed under the supervision of EI researchers in 2014.

1. MSc: ASSUNÇÃO, T.J.C. (2014) - Caracterização e proteção das espécies nativas nas lagoas costeiras da Barrinha de Mira, Lagoa de Mira, Lagoa da Vela e Lagoa das Braças. Supervisor: Simone Varandas (CITAB-UTAD) and Amílcar Teixeira (ESAB-IPB).
2. MSc: BAPTISTA, P.R.A.C. (2014) - Sistemas de Aproveitamento de Águas Pluviais para Utilizações Domésticas – caso de estudo. Mestrado em Engenharia Civil, Universidade de Trás-os-Montes e Alto. Supervisors: Luís Filipe Sanches Fernandes (CITAB-UTAD) and Fernando Pacheco (CITAB-UTAD).
3. MSc: CAMPILHO, M.D. (2014) - Consolidação do cordão dunar de Leça da Palmeira. Mestrado em Arquitectura Paisagista. Universidade de Trás-os-Montes e Alto Douro. Supervisor: Edna Cabecinha (CITAB-UTAD)
4. MSc: CORDEIRO, J.R.B. (2014) - Influência de Precipitações no escoamento de Sistemas Públicos de Águas Residuais Domésticas em Vila Real. Mestrado em Engenharia Civil, Universidade de Trás-os-Montes e Alto Douro. Supervisors: Luís Filipe Sanches Fernandes (CITAB-UTAD) and Pedro Mestre (CITAB-UTAD).
5. MSc: OLIVEIRA, B. (2014) - The Use of Exuviae (Diptera: Chironomidae) in monitoring of northern Portuguese Rivers: a preliminary approach. Bruno Oliveira Environmental Engineering. Supervisor for Master's degree, University of Trás-os-Montes e Alto Douro (UTAD). Supervisor: Samantha Jane Hughes (CITAB-UTAD)
6. MSc: PEREIRA, A.C.C. (2014) -
7. MSc: PIRES, L.M.G.R. (2014) – Vulnerabilidade Aquífera da Orla Ocidental. Optimização do DRASTIC por um método de análise multivariada. Mestrado em Engenharia Civil, Universidade de Trás-os-Montes e Alto Douro. Supervisors: Luís Filipe Sanches Fernandes (CITAB-UTAD) and Fernando António Leal Pacheco (CQ-UTAD).

8. MSc: PORTELA, A.C.S. (2014) - Avaliação da qualidade ambiental do Rio Sabor (Bacia do Douro) baseada nas comunidades de macroinvertebrados. Mestrado em Tecnologias Ambientais, IPB, Escola Superior Agrária, Bragança. Supervisor: Simone Varandas (CITAB-UTAD) and Amílcar Teixeira (ESAB-IPB).
9. MSc: SANTOS, M. (2014) - Bioecologia e Conservação das Populações de *Salmo trutta* (L.) na Bacia Hidrográfica do Rio Tua (NE Portugal). Mestrado em Gestão de Recursos Florestais. Escola Superior Agrária do Instituto Politécnico de Bragança. Supervisors: Amílcar Teixeira (ESAB-IPB) and Simone Varandas (CITAB-UTAD).
10. MSc: SANTOS, R.M.B. (2014) - Modelação dinâmico-espacial das tendências populacionais de Sisão (*Tetrax tetrax*) face à instalação de Linhas Elétricas de Muito Alta Tensão (LMAT) e alterações nos usos do solo na região do Alentejo. Mestrado em Sistemas de Informação Geográfica, Universidade de Trás-os-Montes e Alto Douro. Supervisors: Mário Gabriel Santiago dos Santos (CITAB-UTAD) and Fernando António Leal Pacheco (CQ-UTAD).
11. MSc: TERÊNCIO, D.P.S. (2014) - Estudo da Viabilidade de um Sistema de Aproveitamento de Águas Pluviais para fins não potáveis. Mestrado em Engenharia do Ambiente, Universidade de Trás-os-Montes e Alto Douro. Supervisors: Luís Filipe Sanches Fernandes (CITAB-UTAD) and Fernando Pacheco (CQ-UTAD).
12. MSc: VALE GONÇALVES, H.M. (2014) - Analysis and prediction of the occurrence of leptospirosis in wild boars (*Sus scrofa* Linnaeus, 1758) of the Trás-os-Montes region. Mestrado em Biologia Clínica Laboratorial, Universidade de Trás-os-Montes e Alto Douro. Supervisors: Maria das Neves Mitelo Morão de Paiva Cardoso (CITAB-UTAD) and João Alexandre Ferreira Abel dos Santos Cabral (CITAB-UTAD).
13. MSc: VELOSO, O. (2014) - Estudo e previsão da presença de anticorpos anti-Brucella em javalis (*Sus Scrofa*) da região de Trás-os-Montes. Mestrado em Biologia Clínica Laboratorial, Universidade de Trás-os-Montes e Alto Douro. Supervisors: Maria das Neves Mitelo Morão de Paiva Cardoso (CITAB-UTAD) and João Alexandre Ferreira Abel dos Santos Cabral (CITAB-UTAD).
14. PhD: NUNES, L. (2014) - Growth and productivity of mixed species in forest stands in northern Portugal. Tese de doutoramento. UTAD. Vila Real. pp 185. Supervisors: Domingos Lopes (CITAB-UTAD) and Francisco Castro Rego (CEABN-ISA).

4.2.6.8 Patents/propotypes

N/A

4.2.6.9 Organization of conferences

1. Cabecinha, E. (2014). Do Mar Student Day. Instituto Politécnico de Leiria. Berlengas, Portugal. 9 July.

2. Cabecinha, E. (2014). Scientific & Coordination Commission of the 3rd Seminar on biomechanics, health and sustainable environment: health co-benefits of climate change mitigation – the adaptaclima ii project. UTAD. Vila Real, Portugal. 14 - 15 May.
3. Cabral, J.A. (2014) Seminário Dia de Informação GBIF. UTAD. Vila Real, Portugal. 15 December.
4. Carvalho, J.P. (2014). II Jornadas Técnicas Sobre Os Carvalhos. Terras de Bouro, Portugal. 5 - 6 December.
5. Carvalho, J.P. (2014). Course Tree Seed Processing of Native Forest Species (14h). UTAD. Vila Real.
6. Carvalho, J.P. (2014). Course Introduction to Dendrology (8h). Cam. Mun. S. João Pesqueira - SEPNA (GNR). UTAD. Vila Real.
7. Coelho, A.C., Paiva-Cardoso, Md.N. (2014). Seminar Bioterrorismo alimentar, uma ameaça atual? UTAD. Vila Real, Portugal. 6 May.
8. Coelho, A.C., Paiva-Cardoso, Md.N. (2014). Seminar Como garantir a segurança alimentar em caso de catástrofe natural. UTAD. Vila Real, Portugal. 20 May.
9. Coelho, A.C., Paiva-Cardoso, Md.N. (2014). Seminar Encefalopatias espongiiformes transmissíveis: etiopatogenia e diagnóstico laboratorial. UTAD. Vila Real, Portugal. 11 December.
10. Coelho, A.C., Paiva-Cardoso, Md.N. (2014). Seminar Principais afeções bacterianas em avicultura intensiva. UTAD. Vila Real, Portugal. 19 November.
11. Coelho, A.C., Paiva-Cardoso, Md.N. (2014). Seminar Sushi: A segurança dos alimentos na restauração Japonesa. UTAD. Vila Real, Portugal. 13 May.
12. Fernandes, P.M. (2014). Seminar Investigação & Desenvolvimento de Fogo Controlado em Eucaliptal – Apresentação de resultados do projeto FIREglobulus. Observatório do Sobreiro e da Cortiça. Coruche, Portugal. 10 December.
13. Fernandes, P.M. (2014). Seminar Investigação & Desenvolvimento de Fogo Controlado em Eucaliptal – Apresentação de resultados do projeto FIREglobulus. UTAD. Vila Real. 15 December.
14. Martins, L.P. (2014). Curso de Cirurgia de Árvores e Poda em Castanheiro. GForm UTAD. Vila Real, Portugal. 1 May.
15. Martins, L.P. (2014). Curso de Cirurgia de Árvores. Curso de formação para técnicos, operacionais e guardas florestais. GForm UTAD. Furnas, S. Miguel, Portugal. 22 - 24 Jan.
16. Martins, L.P. (2014). Curso de Escalada de Árvores. Curso de formação para operacionais e guardas florestais. GForm UTAD & DRRF. Furnas, S. Miguel, Portugal. 17 - 21 Jan.
17. Martins, L.P. (2014). Curso de Patologia e Segurança de Árvores. Curso de formação para técnicos, operacionais e guardas florestais; Furnas, S. Miguel; GForm UTAD & DRRF. GForm UTAD & DRRF. Furnas, S. Miguel, Portugal. 13 - 16 Jan.

18. Martins, L.P. (2014). Curso de Patologia e Segurança de Árvores. GForm UTAD & Biostasia. Almada, Portugal. April.
19. Martins, L.P. (2014). Curso de Técnico de Floresta Urbana. GForm UTAD. Vila Real, Portugal. Oct - Nov.
20. Coimbra, A.M. (2014). 8^{as} Jornadas de Biologia. UTAD. Vila Real, Portugal. 22 - 23 October.
21. Paiva-Cardoso, Md.N. (2014). Ação de Formação Riscos Biológicos em Laboratório. UTAD. Vila Real, Portugal. 9 April.
22. Pereira, M.G., Trigo, R.M., Thonicke, K. (2014). European Geosciences Union General Assembly 2014 - Spatial and temporal patterns of wildfires: models, theory, and reality session (NH7.1). Vienna, Austria. 27 April - 2 May.
23. Pereira, M.G., Duarte, M.D., Gonçalves, N.J., Marinho, F. (2014). Sessão Nobel 2014. UTAD, Vila Real, Portugal. 10 December.
24. Sanches Fernandes, L.F. and Hughes SJ (2014). Primeiras Jornadas do CITAB. UTAD. Vila Real, Portugal. 19 November.

4.2.6.10 Industry contract research

Designation	Contractor	Implementation period	Value
Monitoring birds and bats of mortality in the Marco Alto Windfarm during the 3rd year of the operational phase	Parque Eólico de Gevancas, Lda	March 2014 to January 2015	€12.000,00
Characterization of the reference ecological situation of Bestança Valley, with regard to fauna and flora	Cinfães Municipal Council	March 2014 to February 2015	€40.000,00
Inventory and stability of urban forest in Guarda city	Guarda Municipal Council	September 2014 to August 2015	€8.442,00
Environmental characterization of Pedras Salgadas Spa & Nature Park and Hotel Vidago Palace.	BirdWatching, Portugal	June 2014	€1.225,00

Quantification of natural values and analysis of its relationship with the agrarian activity in ITI-DI intervention area	DRAPN	June 2013 to January 2014	€24.490,67
Evaluation of effectiveness of environmental flow regimes from dams of Fronhas and Alto Rabagão	LABELEC	May 2013 to April 2016	€22.944,40
Monitoring of River Cavado - Salamonde II and River Rabagão - Venda Nova III	LABELEC	May 2012 to April 2014	€4.186,00
Hydroelectric exploitation of the Baixo Sabor. Fauna monitoring programme – Quirópteros – Reforço de Monitorização de Espécies Fissurícolas e Arborícolas	EDP – Gestão da Produção de Energia, S.A.	April 2013 to February 2014	€63.362,67
Monitoring bats shelters destruction in flooding areas (reservoirs of AHBS)	EDP – Gestão da Produção de Energia, S.A	November 2013 to January 2014	€11.012,50
Medidas Compensatórias Nº 10 – Elaboração do Projeto para Implementação de Habitats Prioritários e Respetivo Plano de Gestão, no âmbito do Aproveitamento Hidroelétrico do Baixo Sabor (AHBS)	EDP – Gestão da Produção de Energia, S.A	January 2013 to May 2014	€36.000,00
Validação dos caudais ecológicos nos empreendimentos de Fronhas e Alto Rabagão	PROFICO Ambiente e Ordenamento Lda	2013-2015	€22.944,00
Elaboração de um Estudo de Avaliação de Riscos de Rotura de Infraestruturas Hidráulicas e Definição de Metodologia de Intervenção e Interação no Sistema de Planeamento.	ARH-N	January 2013-Dez. 2014	€57.000,00

Projeto para Implementação de Habitats Prioritários e Respetivo Plano de Gestão do Aproveitamento Hidroelétrico do Baixo Sabor.	EDP	January 2013-June 2014	€36.779,00
Clinical trials with animals	Merial Europa	Dez 2014-2016	€1.200,00

4.2.6.10.1 Internationalization

1. Amraoui, M., Pereira, M.G., DaCamara, C., Calado, T.J. (2014) Severe Fire Activity and Associated Atmospheric Patterns over Iberia. Speaker in the VII International Conference on Forest Fire Research (ICFR2014).Coimbra, Portugal. 17–20 November 2014.
2. Bastos, R., Cabral, J.A., Santos, M., Cortes, R., Hughes, S.J. (2014). Predicting the ecological status of non-monitored water bodies for Water Framework Directive compliant planning: a case study for northern Portugal. In the International Conference on Ecohydrology, Soil and Climate Change, EcoHCC'14. Tomar, Portugal. 10–12 September 2014.
3. Carrola, J.S. (2014). SEB Main Meeting. Manchester, UK. 1–4 July 2014.
4. Carvalho, J.P.F. (2014) Oaks – Importance and valuation in the Douro region and Portugal.
5. Carvalho, M.A., Pires, I., Prada, J., Queiroga, F.L. (2014). The Interplay Between Cd3+ T-lymphocytes And Concurrent Cox-2/Egfr Expression In Canine Malignant Mammary Tumours. 9th International Conference of Anticancer Research, 6-10 October, Sithonia, Greece.
6. Carvalho, M.I., Pires, I., Prada, J., Raposo, T., Queiroga, F.L. (2014). High COX-2 expression is associated with increased angiogenesis, proliferation and tumoural inflammatory infiltrate in canine mammary tumours. Esvonc Annual Congress, 22-14 May, Viena, Austria
7. Coimbra, A. (2014). SEB Main Meeting. Manchester, UK. 1–4 July 2014.
8. Coimbra, A. (2014). Speaker at the 27th Conference of European Comparative Endocrinologists. Rennes, France. 25–29 August 2014.
9. Coimbra, A. (2014). Challenges in Ecological Assesment: Integration of Different Levels of Organization. Speaker at the XVII Congresso Ibérico de Limnologia Univ. de Cantábria, Santander, Espanha.
10. Cortes, R.M.V. (2014). SEB Main Meeting. Manchester, UK. 1–4 July 2014

11. Cortes, R.M.V., Hughes, S.J., Varandas, S., Pereira, V., Pereira, S., Pinto, A., Lopes, M., Santos, C., Coimbra, A., Monteiro, S., Sampaio, A. (2014). Challenges in Ecological Assessment under WFD: Integration of Different Levels of Organization. In the XVII Congress of the Iberian Association of Limnology. Santander, Spain.
12. DaCamara, C., Pereira, M.G., Calado, T.J., Calheiros, T. (2014). Impacts of climate change on the fire regime in Portugal. Speaker at the VII International Conference on Forest Fire Research (ICFR2014). Coimbra, Portugal. 17–20 November 2014.
13. Fernandes, A.F. (2014). Speaker at the 27th Conference of European Comparative Endocrinologists. Rennes, France. 25–29 August.
14. Fernandes, A.F. (2014). SEB Main Meeting. Manchester, UK. 1–4 July 2014.
15. Ferreira, C., Resende, L., Pires, I., Prada, J., Queiroga, F.L. (2014). Study of EGFR Immunoexpression in Canine Melanocytic Tumors: Clinical and Therapeutic Implications. 9th International Conference of Anticancer Research, 6-10 October, Sithonia, Greece.
16. Gregório, H., Pires, I., Prada, J., Queiroga, F.L. (2014). Use of Metronomic Protocols In The Treatment Of Several End-Stage Dog Cancers: A New Approach And Implications As A Model For Human Disease. 9th International Conference of Anticancer Research, 6-10 October, Sithonia, Greece.
17. Gregorio, H., Prada, J., Pires, I., Queiroga, F.L. (2014). Role of Cyclooxygenase-2 in prognosis of canine mast cell tumours. 24th Annual ECVIM-CA Congress, 4-6 September, Mainz, Germany.
18. Hughes S.J., Oliveira B., Cortes, R.M.V. (2014). Chironomid Pupal Exuviae (Diptera: Nematocera) as Bioindicators of ecological quality in the Rivers of northern Portugal. In the 19th International symposium on Chironomidae, Biology Center of the Czech Academy of Sciences in České Budějovice. Czech Republic. Samantha Jane Hughes. 18–20 August 2014.
19. Hughes, S.J. (2014). 1st workshop Mediterranean Regional network of experts and practitioners Natural Water Retention Measures. Organized by the Spanish Water Research Agency IMDEA Water for the DG Environment, European Commission, the European initiative on Natural Water Retention Measures (NWRM). Alcalá de Henares, Madrid, Spain. 28–29 January 2014
20. Hughes, S.J. (2014). 2nd workshop Mediterranean Regional network of experts and practitioners Natural Water Retention Measures. Organized by the Spanish Water Research Agency IMDEA Water for the DG Environment, European Commission, the European initiative on Natural Water Retention Measures (NWRM). Turin, Italy.
21. Hughes, S.J. (2014). Climate-KIC Innovation Festival and Workshop EIT – Knowledge and Innovation Community. Valencia, Spain. 29–31 October 2014.
22. Hughes, S.J. (2014). Crucible 1 of the 2014 Pioneers into Practice Programme - Knowledge development and placements for climate professionals. Climate KIC

- initiative. Ciudad Politécnica de la Innovación, Universidade Politecnica da Valencia. Valencia, Spain. 12–13 June 2014.
- 23.** Hughes, S.J. (2014). Freshwater Ecological Monitoring studies in Valencia freshwater systems - Regional Placement at the Universidade Politécnica de Valencia, Spain as part of the Pioneers in Practise Programme. Climate KIC Knowledge and Innovation Community. Valencia, Spain.
- 24.** Hughes, S.J. (2014). Innovator Catalyst course on Water Management. An 8 day coached programme to develop transition thinking to a low carbon economy. EIT – Knowledge and Innovation Community – Climate-KIC. Valencia, Spain. 22–29 November 2014.
- 25.** Hughes, S.J. (2014). Introductory Workshop of the 2014 Pioneers into Practice Programme - Knowledge development and placements for climate professionals. Climate KIC initiative. Ciudad Politécnica de la Innovación, Universidade Politecnica da Valencia. Valencia, Spain. 5–7 May 2014.
- 26.** Hughes, S.J. (2014). Kick-off meeting of potential partners for Horizon 2020 proposal “Towards Better Basins”. IRTA, Barcelona, Spain. 11–12 December 2014
- 27.** Hughes, S.J. (2014). One month international Placement at Naturefund, a Non-Governmental Organisation for Environment and Conservation. Pioneers in Practise Programme. Climate KIC Knowledge and Innovation Community. Wiesbaden, Germany.
- 28.** Hughes, S.J. (2014). Workshop on practical guidance for supporting the design and implementation of NWRM. Organized by the Spanish Water Research Agency IMDEA Water and ACTeon (France) for the DG Environment, European Commission, the European initiative on Natural Water Retention Measures (NWRM). Paris, France. 4 December 2014.
- 29.** Hughes, S.J., (2014). Invited Speaker 1st workshop: Mediterranean Regional network of experts and practitioners NWRM. 28–29 January 2014.
- 30.** Hughes, S.J., Cortes, R.M.V., Santos, M., Bastos, R., Cabral, J. (2014). A simple model to predict the ecological status of non-monitored water bodies from land use data to meet Water Framework Directive criteria.
- 31.** Hughes, S.J., Oliveira, B., Cortes, R.M.V. (2014). Chironomid Pupal Exuviae (Diptera: Nematocera) as Bioindicators in the Rivers of northern Portugal. In the XVII Congress of the Iberian Association of Limnology. Santander, Spain.
- 32.** Liberal, A., Queiroga, F.L., Pires, I., Carvalho, M.I., Prada, J. (2014). Study Of Egfr Expression In Canine Mast Cell Tumors: Possible Implications For Therapy. 9th International Conference of Anticancer Research, 6-10 October, Sithonia, Greece.
- 33.** Luzio, A.C.G. (2014). Speaker at the 27th Conference of European Comparative Endocrinologists. Rennes, France. 25–29 August.
- 34.** Luzio, A.C.G. (2014). SEB Main Meeting. Manchester, UK. 1–4 July 2014.

35. Martins, L.P. (2014). Aulas de cariz teórico / prático a estudantes de licenciatura e mestrado, apelando sempre à discussão crítica; Aula de campo onde os alunos puderam adquirir conhecimentos ao nível do diagnóstico, escalda e cirurgia de árvores.
36. Monteiro, S.M.V. (2014). SEB Main Meeting. Manchester, UK. 1-4 July 2014.
37. Monteiro, S.M.V. (2014). Speaker at the 27th Conference of European Comparative Endocrinologists. Rennes, France. 25–29 August.
38. Moreira, J., Pereira, A.M., Pires, I., Prada, J., Queiroga, F.L., Cotovio, M. (2014). Cyclooxygenase-2 expression in equine cutaneous neoplasms. Esvonc Annual Congress, 22-14 May, Viena, Austria.
39. Pereira, M.G. (2014). Recent fire environmental history in the Mediterranean. Speaker at the Second World Congress of Environmental History (WCEH2014). Guimarães, Portugal. 8–12 July 2014.
40. Pereira, M.G. (2014). Management Committee member of the FPS COST Action FP1206 European mixed forests. Integrating Scientific Knowledge in Sustainable Forest Management (EuMIXFOR)
41. Pereira, M.G. (2014). WG and MC meeting of the FPS COST Action FP1206 European mixed forests. Integrating Scientific Knowledge in Sustainable Forest Management (EuMIXFOR). Ljubljana, Slovenia. 21st – 23rd October 2014
42. Pereira, S.I.R. (2014). SEB Main Meeting. Manchester, UK. 1–4 July 2014.
43. Pinto, A.L.P. (2014). SSEB Main Meeting. Manchester, UK. 1–4 July 2014.
44. Pires, I., Gomes, J.; Prada, J., Gregório, H., Queiroga, F.L. (2014). Study of the mechanisms behind COX-2 expression in canine melanocytic tumours. 24th Annual ECVIM-CA Congress, 4-6 September, Mainz, Germany.
45. Prada, J., Gregório, H., Pires, I., Queiroga, F.L. (2014). Insights into Cox-2 dependent pathways in canine mast cell tumours: a role for microvascularization and tumoural proliferation. Esvonc Annual Congress, 22-14 May, Viena, Austria.
46. Queiroga, F.L., Carvalho, M.I., Raposo, T., Prada, J. Gregório, H., Pires, I. (2014). New Insights into Cox-2 Pathways In Cancer: The Dog as a Promising Model. 9th International Conference of Anticancer Research, 6-10 October, Sithonia, Greece.
47. Raposo, T., Beirão, B., Pires, I., Prada, J., Queiroga, F. L., Argyle, D. (2014). Interrogating the Inflammasome in Canine inflammatory mammary cancer. Esvonc Annual Congress, 22-14 de Maio, Viena, Austria.
48. Rodrigues, H.I., Carvalho, M.I., Pires, I., Prada, J., Queiroga, F.L. (2014). Apoptosis and proliferation in canine mammary tumors. Esvonc Annual Congress, 22-14 May, Viena, Austria.
49. Santos, M.G.S. (2014). Discussion of project Socio-Ecology of Acacia ideas, methods and golds.

50. Sousa, P., Trigo, R., Pereira, M., Camara, C., Gouveia, C., Bedia, J., Gutiérrez, J.M. (2014). Future burned area projections in Iberia. In the European Geosciences Union General Assembly 2014, Vienna, Austria. 27 April – 2 May 2014.
51. Teixeira, A., Varandas, S., Sousa, R., Froufe, E., Hinzmann, M., Lopes-Lima, M. (2014). Ecology and conservation of freshwater mussel populations (*Unio delphinus*, *Anodonta anatina* and *Potomida littoralis*) of the River Sabor (Douro basin, NE Portugal). In the XVII Congress of the AIL. Santander, Spain. 6–11 July 2014.
52. Teixeira, A., Varandas, S., Sousa, R., Froufe, E., Hinzmann, M., Lopes-Lima, M. (2014). Distribution and Composition of Freshwater Fish and Mussel Communities of Sabor and Tua Rivers (Douro Basin): Main Threats and Conservation Measures. In the V Iberian Congress of Ichthyology. National Museum of Natural History. Lisbon, Portugal. 24–27 June 2014.
53. Varandas, S., Teixeira, A., Froufe, E., Sousa, R., Cortes, R.M.V., Hughes, S.J., Crespí A., Santos, C., Jesus, J., Magalhães, M., Pereira, V., Lopes, M., Assunção, T., Lopes-Lima, M. (2014). Ecological and conservation status of native freshwater bivalves in coastal lagoons of Portugal.
54. Varandas, S., Teixeira, A., Froufe, E., Sousa, R., Cortes, R.M.V., Hughes, S., Crespí, A., Santos, C., Jesus, J., Magalhães, M., Pereira, V., Lopes, M., Assunção, T., Lopes-Lima, M. (2014). Ecological and Conservation Status of Native Freshwater Bivalves in Coastal Lagoons of Portugal. In the XVII Congress of the Iberian Association of Limnology, Santander. Spain. 6–11 July 2014.

4.2.6.11 Other publications National

N/A

4.2.6.12 Government/Organization contract research

N/A

4.2.6.13 Awards

N/A

4.2.7 Future research

4.2.7.1 Objectives

CITAB is undergoing transition and restructuring as the new R&D strategic plan for the next 5 years (2015-2020) is implemented. EI research is an integral part of the next five years and will be developed in collaboration with the SAC and BE Research Groups. It will also follow key Horizon 2020 research calls in relevant areas.

The EI Research Group has recognised expertise in the integrated development and application of tools for monitoring, modelling and restoring ecosystems in the agri-food and forestry landscape to reduce various types of impact and ensure sustainability of the myriad of services that ecosystems provide. Many types of impacts, distributed over different temporal and spatial scales, affect ecosystems: diffuse and point discharge pollution, changes in land use, industrial pollutants and climate change. These impacts do not act in isolation, but interact with anthropogenic and natural factors, effecting ecosystem structure and function, the biota and the provision of fundamental ecosystem services such as sustainable supply and purification of water, climate regulation and soil health.

The complexity behind ecosystem processes and the necessity to understand them, what affects them and how to restore them and make predictions about them requires a multidisciplinary, holistic approach. EI research is highly inter and multidisciplinary, covering different spatial, temporal and organisational scales ranging from climate and land change impacts on catchment processes, ecosystems and biota (from communities to sub-cellular) to biotechnological studies of the potential of microbial organism in bioremediation. This unique approach provides a truly holistic overview of ecosystem integrity. EI researchers have strong links with regional and national stakeholders (SH) in both the public and private sector.

The ECOINTEGRITY (EI) group will comprise integrated researchers, collaborators and scholarship students oriented by integrated members that will work in a multidisciplinary environment on Thematic Strands tasks. EI research objectives will track and meet private and public sector SH needs associated with the impact of agricultural and forestry chains on the environment and the need to ensure human wellbeing, environmental sustainability and ecosystems services. . A principal scientific objective is to boost EI critical mass by increasing the number of integrated members and doctoral/post-doctoral scholarships. EI researchers will participate in ERA nets, COST actions in the domains Earth System Science and Environmental Management (ESSEM), Food and Agriculture (FA) and Domain Forests, their Products and Services (FPS) will be applied for in accordance with their compatibility with the thematic strands.

EI researchers will participate in the International Doctoral Programmes (*Agri-food Chains-fork to farm, Agro environmental Sustainability & Ecosystem Services and Advanced technologies applied to agriculture & forestry production chains*). The programmes will attract students to gain expertise by working in the thematic strands of the SP in fully equipped facilities available at national and international partner institutes. Outreach activities are important for strengthening links with society by disseminating EI research to potential new SH, budding scientists in regional schools, interest groups and other researchers. EI aims to excel in particular in the following areas

Integrated monitoring of climate and environmental impacts: adaptation and mitigation strategies

- (i) Develop & apply new analytical technologies;
- (ii) Understanding climatic & environmental forcing on target terrestrial & aquatic systems under current conditions;
- (iii) Assess climate & environmental change impacts under future scenarios in order to develop, test & implement appropriate mitigation & adaptation measures such as restoring riparian galleries to mitigate climate change induced rises in ambient temperature, sequester carbon, prevent erosion by stabilizing riverbanks & preserving biodiversity.

Conservation strategies and ecological modelling: recovering and improving sustainability in agri- food and forestry ecosystems and ecosystem service

- (i) Testing and application of spatiotemporally dynamic predictive analytical tools to understand how natural & anthropogenic changes affect ecosystem integrity.
- (ii) Developing models using remote data & data from monitoring programmes describing changes in indicators (habitat quality, genetic, biomolecular & biochemical level in individual organisms to the assessment of whole communities) of environmental gradients in terrestrial & aquatic ecosystems.

4.3 Biosystems Engineering

4.3.1 Group description

Principal Investigator	José Luís Penetra Cerveira Lousada
Research area	Engineering
Home Institution	Universidade de Trás-os-Montes e Alto Douro

4.3.2 Funding

	2012	2013	2014
FCT Projects	176.336,71€	271.840,51€	132.950,71€
Other (National)	361.619,14€	277.894,67€	246.377,76€
Other (International)	125.824,00€	178.038,00€	76.745,00€
Industry (National)	0,00€	0,00€	4.445,00€
Industry (International)	0,00€	0,00€	0,00€
Total	663.779,85€	727.773,17€	460.518,47€

4.3.3 Objectives

The general objective is the development of engineering technologies applied to agro-forestry systems, the environment and life towards providing sustainable development and better quality of life. Biosystems Engineering (BE) group research activities are focused into two ongoing projects.

Project #1 Wood mechanical and quality evaluation

This task aims the mechanical characterisation of bio-based materials through novel methodologies coupling full-field optical techniques with inverse identification methods. This project aims to develop a materials science approach to wood mechanics, from the micro to macro levels. This is fundamental for promoting wood as a thoroughly

characterized engineering material. The project also aims to improve bioenergetic conversion technology of agricultural and forest materials and wastes.

Project #2 Image-based systems

This project designed and developed computer vision and image processing based systems and solutions in the areas of agro-forestry, environment and biology. Image-based systems can be used in the guidance or control of many agricultural and food processes, providing a cheap, consistent and objective assessment for inspection, evaluation and measurement purposes. Artificial Intelligence and Soft Computing techniques, namely Fuzzy Sets Theory and its extensions, are also to be applied in image based feature/object tracking in team sports analysis. The complexity involved in these types of multi-tracking problems is huge. BE researcher work to better unravel this complexity by developing processes with necessary flexibility, while maintaining accuracy.

4.3.4 Main achievements

Project #1 – Wood mechanical and quality evaluation

The mechanical performance and quality of wood and wood-based materials are have addressed through novel methodologies by coupling full-field optical techniques with inverse identification methods. This project aimed to the development of a materials science approaches to wood mechanics, from the micro to macro levels. This is fundamental for promoting wood as a thoroughly characterized engineering material. The work is focused on the development of new experimental and numerical methods to identify the mechanical and fracture constitutive laws of wood and wood-based materials. The experimental and numerical tools developed in the context of mechanics of wood and wood-based materials and products are also applied to the mechanical behavior of cortical bone tissue.

The main outcomes are:

- Development of a new identification method of elastic properties of wood at the growth ring scale (earlywood and latewood) by coupling digital image correlation techniques with the virtual fields method.
- Development of a direct identification strategy of cohesive laws for wood and adhesively-bonded wood joints, under pure modes I and II, and mixed-mode I/II. This method is based on the loading – displacement curve and on the crack opening displacement, measured through the digital image correlation technique.
- Development of advanced computational tools based on interface finite

elements and cohesive zone modeling, to model the mechanical performance of wood dowel joints and repair solutions using carbon-fibre reinforced plastics.

- Development of strengthening techniques of dowel type wood connections, based on metallic inserts and CFRP laminates.
- Development of identification methods for variation patterns of wood density components in *Quercus faginea*, *Quercus suber*, and *Acacia melanoxylon*.
- Development of evaluation methods for the physical, chemical, mechanical and anatomical properties of the *Quercus faginea*, *Quercus suber*, *Eucalyptus grandis*, and *Acacia melanoxylon* hardwoods and *Pinus pinaster* and *Pinus sylvestris* softwoods regarding quality assessment and most suitable uses.

Project #2 – Image-based systems

During 2014 special attention continued to be paid to vine/grape innovative evaluation methods using conventional or hyperspectral imagery, alongside with work on meat evaluation, on object tracking, on the improvement of biological models and on device-independent image visualization techniques and data transmission. The continuous interest on the knowledge transfer to society has resulted in one patent.

The main outcomes are:

- Development of smart agriculture methodologies, namely:
 - Development of a novel non-invasive hyperspectral image based methodology for variety and clone identification in vines.
 - Development of a novel non-invasive hyperspectral image based methodology for anthocyanin concentration estimation in vinegrapes.
 - Development of an analysis methodology for neural networks generalisation evaluation.
 - Development of a novel image based methodology for meat quality estimation.
 - Development of image-based classification methodologies through image segmentation techniques using FSs, IVFSs, A-IFSs, machine learning and other computational intelligence techniques, and its application for agro-products quality assessment.
 - Software applications, for mobile devices, for assessment of meat quality, using image processing.
- Development of a novel methodology for object tracking.
- An experimental methodology to be applied in natural territories and smart sustainable cities to improve the carbon footprint by promoting more intelligent

use of energy.

- An experimental methodology was developed to predict lower limb biomechanics (over) loading during a walking trail that includes relevant information and proposes for a standardised survey and grading methodology, which can be employed to assess the ability of a trail in promoting a healthy lifestyle.

Regular visits to key anchor and collaborating institutions including La Rioja University in Logroño, Spain, and the Universidad Pública de Navarra (joint publications and reserach projects, and a Mobility Grants for Doctors Humberto Bustince, Prof. Edurne Barrenechea and Javier Tradáguila).

4.3.5 Group productivity

4.3.5.1 International Projects

BE researchers participated in 3 international projects during 2014:

Project name	Funding
ADAPTACLIMA II - Adaptation to Climate Change in SUDOE. CITAB coordinator: Ronaldo Gabriel. Starting Date: November 2012, duration: 24 months (SUDOE "SOE3/P2/E477"). http://www.adaptaclima.eu/en/project/	€100.000,00
A New Tool for Intelligent Computing: Autoadapted Aggregation Functions for Classification and Decision Making Problems. CITAB coordinator: Pedro Melo Pinto. Starting Date: November 2011, duration: 36 months	N/A
MARCADUERO "MARCA DUERO DURADERO: Sostenibilidad, Calidad y Promoción". CITAB coordinator: Ronaldo Gabriel. Starting Date: June 2011, duration: 52 months (0363_MARCADUERO_2_E)	€106.980,00

4.3.5.2 National Projects

BE researchers participated in 13 national projects during 2014:

Project	Funding
ENOEXEL – From vineyards to wine: targeting grape and wine excellency. CITAB coordinator: Pedro Melo Pinto. Starting Date: January 2014, duration: 18 months - NORTE-07-0124-FEDER-000032	€49.552,89
Biochemical, morphological and functional evaluation of breast cancer-induced muscle wasting: the role of exercise training. CITAB Coordinator: Mário Ginja. Starting Date: March 2011, duration: 36 months. (PTDC/DES/114122/2009)	€65.000,00
Fracture behaviour of cortical bone under mixed-mode I+II loading. CITAB coordinator: José Morais. Starting Date: April 2012, duration 36 months (PTDC/EME-PME/119093/2010)	€24.000,00
Douro Empreendedor. CITAB coordinator: Carlos Serôdio. Starting Date: January 2012, duration: 24 months (SIGON2QREN – ON2-NORTE-07-0927-FEDER-001).	€228.685,00
Hyper - Application of hyperspectral imaging and neural networks to viticulture. CITAB coordinator: Pedro Pinto. Starting Date: April 2012, duration: 39 months PTDC/EEA-AUT/121056/2010	€74.910,00
"Intelligent and Integrated System for Monitorization, Control and Management of Roads Infrastructure". CITAB coordinator: Carlos Serôdio. Starting date: September 2012, duration: 24 months (QREN)	€198.000,00
Scots pine in Portugal: the "Southwest end" or just "the end"? CITAB coordinator: José Luís Penetra Cerveira Louzada. Starting Date: January 2011, duration: 39 months. (PTDC/AGR-CFL/110988/2009).	€181.781,13
Phenotypic plasticity of maritime pine to climate change. CITAB coordinator: José Louzada. Starting Date: November 2010, duration 39 months (PTDC/AGR-CFL/099614/2008)	€14.400,00

Numerical and experimental study of cohesive laws in bonding wood joints. CITAB coordinator: José Morais. Starting Date: January 2011, duration 39 months (PTDC/EME-PME/114443/2009)	€38.761,00
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4.3.5.3 Publications in peer review Journals

BE Researchers published a total of 27 articles in SCI/JCR journals in 2014:

1. Albuquerque, C., Morinha, F., Requicha, J., Dias, I., Guedes-Pinto, H., Viegas, C., et al. (2014). A case-control study between interleukin-10 gene variants and periodontal disease in dogs. *Gene*, 539(1), 75-81. <http://www.sciencedirect.com/science/article/pii/S0378111914001115>
2. Anjos, O., Rodrigues, C., Morais, J., Pereira, H. (2014). Effect of density on the compression behaviour of cork. *Materials & Design* 53, 1089-1096. <http://www.sciencedirect.com/science/article/pii/S0261306913006663>
3. Aragão, F., Abrantes, C., Gabriel, R., Sousa, M., Castelo-Branco, C., Moreira, H. (2014). Effects of a 12-month multi-component exercise program on the body composition of postmenopausal women. *Climacteric* 17(2), 155-163. <http://informahealthcare.com/doi/abs/10.3109/13697137.2013.819328>
4. Arteiro, A., Catalanotti, C., Xavier, J. and Camanho, P.P. (2014). Large damage capability of noncrimp fabric thin-ply laminates. *Composites Part A: Applied Science and Manufacturing*. 63 110–122. <http://www.sciencedirect.com/science/article/pii/S1359835X14001043>
5. Caldeira T.V.P., Dourado N., de Jesus A.M.P., de Moura M.F.S. and Morais J.J.L. (2014). Quasi-static behavior of moment-carrying steel-wood doweled joints. *Construction and Building Materials*. 53 439 - 447. <http://www.sciencedirect.com/science/article/pii/S0950061813011112>
6. Catalanotti, C., Xavier, J. and Camanho, P.P. (2014). Measurement of the compressive crack resistance curve of composites using the size effect law. *Composites Part A: Applied Science and Manufacturing*. 56 300-307. <http://www.sciencedirect.com/science/article/pii/S1359835X13002923>
7. Dorotovic, I., Louzada, J. L., Rodrigues, J. C., & Karlovsky, V. (2014). Impact of solar activity on the growth of pine trees: case study. *European Journal of Forest Research* 639-648. <http://link.springer.com/article/10.1007%2Fs10342-014-0792-8>
8. Fernandes, R., de Moura, M. F. S. F., Silva, F. G. A., & Dourado, N. (2014). Mode I fracture characterization of a hybrid cork and carbon-epoxy laminate. *Composite Structures* 112, 248-253. <http://www.sciencedirect.com/science/article/pii/S0263822314000774>



9. Knapic, S., Pirralho, M., Louzada, J., & Pereira, H. (2014). Early assessment of density features for 19 Eucalyptus species using X-ray microdensitometry in a perspective of potential biomass production. *Wood Science and Technology* 48(1), 37-49. <http://link.springer.com/article/10.1007/s00226-013-0579-y>
10. Machado, J. S., Louzada, J. L., Santos, A. J. A., Nunes, L., Anjos, O., Rodrigues, J., et al. (2014). Variation of wood density and mechanical properties of blackwood (*Acacia melanoxylon* R. Br.). *Materials & Design* 56, 975-980. <http://www.sciencedirect.com/science/article/pii/S0261306913011497>
11. Matos C., Teixeira C., Bento R., Varajão J., Bentes I. (2014). An exploratory study on the influence of socio-demographic characteristics on water end uses inside buildings. *Science of the Total Environment*. 466–467. 467–474. <http://www.sciencedirect.com/science/article/pii/S0048969713008048>
12. Miranda N., Serôdio C., & Morais R. (2014). A new Electric Conductance Conversion Method Suitable for Very Low Power Applications. *Measurement* 47, 379-385. <http://www.sciencedirect.com/science/article/pii/S0263224113004442>
13. Moreira, H., Passos, B., Rocha, J., Reis, V., Carneiro, A., & Gabriel, R. (2014). Cardiorespiratory Fitness and Body Composition in Postmenopausal Women. *Journal of Human Kinetics* 43(1), 139-148. <http://www.degruyter.com/view/j/hukin.2014.43.issue-1/hukin-2014-0099/hukin-2014-0099.xml>
14. Orduna, R., Jurio, A., Paternain, D., Bustince, H., Melo-Pinto, P., Barrenechea, E. (2014). Segmentation of color images using a linguistic 2-tuples model. *Information Sciences* 258, 339-352. <http://www.sciencedirect.com/science/article/pii/S0020025513006701>
15. Pereira, F., de Moura, M.F.S.F., Dourado, N., Morais, J.J.L. and Dias M.I.R. (2014). Bone fracture characterization under mixed-mode I+II loading using the Single Leg Bending test. *Biomechanics and Modeling in Mechanobiology*. 13 1331–1339.
16. Pereira, J., Xavier, J., Morais, J. and Lousada, J. (2014). Assessing wood quality by spatial variation of elastic properties within the stem: case study of *P. pinaster* in the transverse plane. *Canadian Journal of Forest Research*, 44(2), 107-117. <http://www.nrcresearchpress.com/doi/abs/10.1139/cjfr-2013-0207#.VOHQrvmsVVO>
17. Pereira, J.C.R., de Jesus, A.M.P., Xavier, J. and Fernandes, A. (2014). Ultra low-cycle fatigue behaviour of a structural steel. *Engineering Structures*, 60, 214–222. <http://www.sciencedirect.com/science/article/pii/S0141029614000030>
18. Pitanga, C.P.,S. Pitanga, F.J. G., Gabriel, R.E.C.D., & Moreira, M.H.R. (2014). Association between the level of physical activity and area of visceral fat in postmenopausal women. *Revista Brasileira De Medicina Do Esporte* 20(4), 252-256.

http://www.scielo.br/scielo.php?script=sci_arttext&pid=S1517-86922014000400252&lng=pt&nrm=iso&tlng=en

19. Silva, F.G.A., Morais, J.J.L., Dourado, N., Xavier, J., Pereira, F.A.M. and de Moura, M.F.S.F. (2014). Determination of cohesive laws in wood bonded joints under mode II loading using the ENF test. *International Journal of Adhesion & Adhesives*, 51, 54–61. <http://www.sciencedirect.com/science/article/pii/S0143749614000530>
20. Subramani, P., Rana, S., Oliveira, D.V., Figueiro, R., & Xavier, J. (2014). Development of novel auxetic structures based on braided composites. *Materials & Design*, 61, 286-295. <http://www.sciencedirect.com/science/article/pii/S0261306914003422>
21. Tavares, F., Louzada, J. L., & Pereira, H. (2014). Variation in wood density and ring width in *Acacia melanoxylon* at four sites in Portugal. *European Journal of Forest Research*, 133(1), 31-39. <http://link.springer.com/article/10.1007%2Fs10342-013-0733-y>
22. Teixeira, C.A., Avelino, C., Ferreira, F., & Bentes, I. (2014). Statistical analysis in MSW collection performance assessment. *Waste Management*, 34(9), 1584-1594. <http://www.sciencedirect.com/science/article/pii/S0956053X14001470>
23. Teixeira, C.A., Russo, M., Matos, C., & Bentes, I. (2014). Evaluation of operational, economic, and environmental performance of mixed and selective collection of municipal solid waste: Porto case study. *Waste Management & Research*, 32(12), 1210-1218. <http://wmr.sagepub.com/content/32/12/1210>
24. Xavier, J., Monteiro, P., Morais, J. J. L., Dourado, N., & de Moura, M. F. S. F. (2014). Moisture content effect on the fracture characterisation of *Pinus pinaster* under mode I. *Journal of Materials Science*, 49(21), 7371-7381 <http://link.springer.com/article/10.1007%2Fs10853-014-8375-0>
25. Xavier, J., Oliveira, M., Monteiro, P., Morais, J. J. L., & de Moura, M. F. S. F. (2014). Direct Evaluation of Cohesive Law in Mode I of *Pinus pinaster* by Digital Image Correlation. *Experimental Mechanics*, 54(5), 829-840. <http://link.springer.com/article/10.1007%2Fs11340-013-9838-y>
26. Xavier, J., Oliveira, M., Morais, J. J. L., & de Moura, M. F. S. F. (2014). Determining mode II cohesive law of *Pinus pinaster* by combining the end-notched flexure test with digital image correlation. *Construction and Building Materials*, 71, 109-115. <http://www.sciencedirect.com/science/article/pii/S0950061814009325>
27. Xavier, J., Pereira, J. C. R., & de Jesus, A. M. P. (2014). Characterisation of steel components under monotonic loading by means of image-based methods. *Optics and Lasers in Engineering*, 53, 142-151. <http://www.sciencedirect.com/science/article/pii/S0143816613002807>

4.3.5.4 Other Publications International

1. Correia, A., Matias, J., Mestre, P., and Serodio, C. (2014). Comparison of Some Penalty and Barrier Techniques in Direct Search Methods. 14th International Conference on Computational Science and Its Applications (ICCSA). 191-191.
2. Arteiro, A., Catalanotti, G., Xavier, J., and Camanho P.P. (2014). A Finite Fracture Mechanics model for the prediction of the notched response and large damage capability of composite laminates. 13th International Conference on Fracture and Damage Mechanics, São Miguel Island, Azores, Portugal, September 23-25, 2014.
3. Berthoumieu, J., Debert, P., Patelli, E., Jonchères, C., Moreira, H., Gabriel, R., Cabecinha and E., Alençõ, A. (2014). Les contraintes et opportunités du changement climatique: comment gérer la question des canicules de manière durable en associant ville et campagne? *Révue de L'Ágenais*. 4 1-34.
4. Cruz, W., Xavier, J., Pierron, F., & Morais, J. (2014). Characterization of orthotropic stiffness components of *Pinus pinaster* from heterogeneous plate bending tests. II International Conference of the International Journal of Structural Integrity, 1-4 September, Funchal, Portugal, 2014.
5. Koerber, H., Xavier, J., Camanho, P.P., Sainz de Aja, J.R. and Essa, Y. (2014). High strain rate behaviour of textile composites under compression and combined compression-shear loading. 16th International Conference on Experimental Mechanics - ICEM16, University of Cambridge, UK, 7-11 July, 2014.
6. Monteiro, N., Xavier, J., Morais, J.J.L., Dourado, N. and de Moura, M.F.S.F. (2014). Moisture content effects on the fracture characterisation of *P. pinaster* under mode I. Workshop Thermo-hydro-Mechanical (THM) behaviour of wood, COST Action FP0904, Bordeaux, France, 13-14 February, 2014.
7. Morgado, L., Varajão, J., Dominguez, C., Oliveira, I. and Sousa F. (2014). Balancing European SME Managers' Training Contents: Perceived Importance / Training Needs. *Business Systems Research Journal*. <http://www.bsrijournal.org/vol-5-no-2.html>
8. Pereira, J.C.R., de Jesus, A.M.P., Coppola, T., Fernandes, A.A., Iob, F., Campanelli, F., & Xavier, J. (2014). Monotonic and ULCF behaviour of pipeline steels and components. Model identification and applications. 11th World Congress on Computational Mechanics (WCCM XI), 5th European Conference on Computational Mechanics (ECCM V), 6th European Conference on Computational Fluid Dynamics (ECFD VI) Barcelona, Spain, July 20-25, 2014
9. Pereira, J.C.R., de Jesus, A.M.P., Fernandes, A.A. and Xavier, J. (2014). ULCF and cyclic elastoplastic behaviour of linepipe steel grades. 11th World Congress on Computational

Mechanics (WCCM XI), 5th European Conference on Computational Mechanics (ECCM V), 6th European Conference on Computational Fluid Dynamics (ECFD VI) Barcelona, Spain, July 20-25, 2014.

10. Pereira, J.C.R., de Jesus, A.M.P., Fernandes, A.A., Xavier, J. and Martins, B. (2014). Comparisons of Monotonic, Low-Cycle and Ultra-Low-Cycle Fatigue Behaviours of X52, X60 and X65 Piping Steel Grades. ASME Pressure Vessels & Piping Conference, Hyatt Regency Orange County, USA, 20-24 July, 2014.
11. Pinto, V., Xavier, J. and Guedes, R.M. (2014). Experimental creep analysis of biodegradable polymer matrix nanocomposites for ACL replacement. 16th European Conference on Composite Materials - ECCM16, Seville, Spain, 22-26 June, 2014.
12. Santos, A., Cavalheiro, J., Santos-Ribeiro, R., & Lousada, J. L. (2014). Rootstock and Plant Spacing Influence Sweet Cherry Growth and Yield, under Different Soil and Water Conditions. *Acta Horticulturae - VI International Cherry Symposium, 1020*, 503-511. http://www.actahort.org/books/1020/1020_68.htm
13. Silva, A.L.L., Xavier, J., Carvalho, D., Jesus, A.M.P., & Fernandes, A.A. (2014). Evaluation of mixed-mode I+II fatigue crack propagation in steels assisted by DIC. II International Conference of the International Journal of Structural Integrity, 1-4 September, Funchal, Portugal, 2014.

4.3.5.5 Other National publications

N/A

4.3.5.6 Book Chapters

1. Cabecinha, E., Alençõ, A., Moreira, H., Sousa, L., Sousa, B., Iemos, L., Quaresma, L., Gomes, E., Gabriel, R. (2014). Caracterização dos percursos no ramo norte das Arribas do Douro Internacional. In *Marca DUERO-DOURO: Manual Formativo*. Cabecinha, E., Alençõ, A., Moreira, H., Sousa, L., Gabriel, R. (Eds). Serviço de Edições da Universidade de Trás-os-Montes e Alto Douro. ISBN: 978-989-704-197-6. 80 – 172.
2. Diago, M.P., Pou, A., Millan, B., Tardaguila, J., Fernandes, A.M., Melo-Pinto, P. (2014). Assessment of Grapevine Water Status from Hyperspectral Imaging of Leaves. In *Acta Horticulturae*. Volume: 1038. 89-96.
3. Lousada, J., Bento, J and Silva, M. (2014). Utilizações da madeira de *Pinus sylvestris* L. In *Pinheiro silvestre em Portugal: O extremo sudoeste ou apenas o fim?* Lima-Brito, J.; Lousada, J.; Bento, J.; SPCF (Eds). ISBN: 978-972-99656-4-7. 10-11.

4. Lousada, J., Bento, J, Roxo, L. and Gaspar, M. (2014). Material de estudo: identificação e proveniência. In Pinheiro silvestre em Portugal: O extremo sudoeste ou apenas o fim? Lima-Brito, J.; Lousada, J.; Bento, J.; SPCF (Eds). ISBN: 978-972-99656-4-7. 12-13.
5. Lousada, J., Morais, J and Pires, J. (2014). Características mecánicas da madeira de *Pinus sylvestris* L. In Pinheiro silvestre em Portugal: O extremo sudoeste ou apenas o fim? Lima-Brito, J.; Lousada, J.; Bento, J.; SPCF (Eds). ISBN: 978-972-99656-4-7. 38-39.
6. Lousada, J., Silva, M and Fernandes, C. (2014). Características físicas e de crescimento da madeira de *Pinus sylvestris* L. In Pinheiro silvestre em Portugal: O extremo sudoeste ou apenas o fim? Lima-Brito, J.; Lousada, J.; Bento, J.; SPCF (Eds). ISBN: 978-972-99656-4-7. 34-35.
7. Morais, R., Alencão, A., Moreira, H., Cabecinha, E., Sousa, L., Gabriel, R., Quaresma, L., Gomes, E. (2014). Proposta de implementação da marca Duero-Douro a percursos pedestres. In Marca DUERO-DOURO: Manual Formativo. Cabecinha, E., Alencão, A., Moreira, H., Sousa, L., Gabriel, R. (Eds). Serviço de Edições da Universidade de Trás-os-Montes e Alto Douro. ISBN: 978-989-704-197-6. 1-25.
8. Moreira, H., Cabecinha, E., Sousa, L., Alencão, A., Sousa, B., Lemos, L., Quaresma, L., Gomes, E., Gabriel, R. (2014). Aspectos relevantes do ramo norte das Arribas do Douro Internacional. In Marca DUERO-DOURO: Manual Formativo. Cabecinha, E., Alencão, A., Moreira, H., Sousa, L., Gabriel, R. (Eds). Serviço de Edições da Universidade de Trás-os-Montes e Alto Douro. ISBN: 978-989-704-197-6. 26-72.
9. Rodrigues, J., Lousada, J., Alevs, A and Simões, R. (2014). Características químicas da madeira de *Pinus sylvestris* L. In Pinheiro silvestre em Portugal: O extremo sudoeste ou apenas o fim? Lima-Brito, J.; Lousada, J.; Bento, J.; SPCF (Eds). ISBN: 978-972-99656-4-7. 36-37.

4.3.5.7 Books

1. Lima-Brito, J., Lousada, J., Bento, J. and SPCF (2014). Pinheiro silvestre em Portugal: O extremo sudoeste ou apenas o fim? ISBN: 978-972-99656-4-7.
2. Cabecinha, E., Alencão, A., Moreira, H., Sousa, L., Gabriel, R. (2014). Marca DUERO-DOURO: Manual Formativo. ISBN: 978-989-704-197-6.
3. Alencão, A., Sampaio, E., Sousa, L., Gomes, E., Moreira, H., Gabriel, R. (2014). Marca DUERO-DOURO: procedimentos para a concessão da licença. ISBN: 978-989-704-179-2.
4. Gabriel, R., Moreira, H., Alencão, A., Sousa, L., Sampaio, E., Faria, A. (2014). Book of Abstracts of 3rd Seminar on Biomechanics, Health and Sustainable Environment. ISBN: 978-989-704-181-5.

4.3.5.8 Completed Masters and Ph.D. Theses

BE researchers supervised a total of 24 completed MSc theses and 1 PhD theses during 2014.

1. MSc: ARAÚJO, R. E. V. (2014) - Avaliação do potencial energético da biomassa florestal residual produzida em Paredes de Coura. Mestrado em Engenharia Florestal, Universidade de Trás-os-Montes e Alto Douro. Orientação de José Luis Louzada (UTAD).
2. MSc: CARVALHO, B. (2014) - Caracterização numérica e experimental de ligações aparafusadas em madeira. Mestrado em Engenharia Mecânica da Universidade de Trás-os-Montes e Alto Douro. Orientação de Nuno Dourado (UTAD) e José Xavier (CITAB/UTAD).
3. MSc: CARVALHO, I.D.G.P.P. (2014) - Máquina virtual Java em FPGA. Mestrado em Engenharia Electrotécnica e de Computadores, Universidade de Trás-os-Montes e Alto Douro. Orientação de Pedro Mestre (UTAD) e Carlos Serôdio (UTAD).
4. CARVALHO, L. (2014) - Otimização do comportamento quase-estático de ligações com cavilhas em estruturas de madeira com transferência de momentos. Mestrado em Engenharia Mecânica, Universidade de Trás-os-Montes e Alto Douro. Orientação de Nuno Dourado (UTAD) e Fábio Pereira (CITAB/UTAD).
5. MSc: CASTRO, P. (2014) - Modelo de Gestão de RCD`s em Territórios de Baixa Densidade Populacional. Mestrado em Engenharia do Ambiente. Universidade de Trás-os-Montes e Alto Douro. Orientação de Carlos Afonso (UTAD)
6. MSc: CORDEIRO, J.R.B. (2014) – Influência de Precipitações no Escoamento de Sistemas Públicos de Águas Residuais Domésticas em Vila Real. Mestrado em Engenharia Civil, Universidade de Trás-os-Montes e Alto Douro. Orientação de: Luís Filipe Sanches Fernandes (UTAD) e Pedro Mestre (UTAD).
7. MSc: COUTO, L.A.D. A lei dos grandes números: Um olhar sobre a história e aplicações no ensino. 2º Ciclo em Ensino da Matemática no 3º Ciclo do Ensino Básico e no Secundário, Universidade de Trás-os-Montes e Alto Douro. Orientação de Irene Oliveira (UTAD) e Ana Paula Aires (UTAD).
8. MSc: CRUZ, W.T.H (2014). Identificação de propriedades elásticas da madeira através de um ensaio de flexão de placa. Universidade de Trás-os-Montes e Alto Douro, Vila Real. Orientação de José Xavier (CITAB) e José Morais (CITAB).

9. MSc: DIAS, A. (2014) - Análise numérica e experimental de ligações por parafusos metálicos do tecido ósseo cortical de cabra - fratura cominuta. Mestrado em Engenharia Mecânica, Universidade de Trás-os-Montes e Alto Douro. Orientação de Nuno Dourado (UTAD) e José Morais (UTAD).
10. MSc: JUSTO, D. (2014) - Análise numérica e experimental de ligações por parafusos metálicos do tecido ósseo cortical de cabra – fratura transversa. Mestrado em Engenharia Mecânica, Universidade de Trás-os-Montes e Alto Douro. Orientação de Nuno Dourado (UTAD) e José Morais (UTAD).
11. MSc: LOPES, J.M.S. (2014) Estudos sobre estruturas históricas de madeira: o Palacete da Quinta da Tranqueira. Mestrado em Engenharia Civil, Universidade de Trás-os-Montes e Alto Douro. Orientação de Maria Eunice da Costa Salavessa (UTAD) e José Manuel Cardoso Xavier (CITAB).
12. MSc: MENDES, P.I.P. (2014) - Estudos sobre a Igreja de São Domingos em Viana do Castelo: Base para a intervenção de conservação exterior. Mestrado em Engenharia Civil da Universidade de Trás-os-Montes e Alto Douro. Orientação de Maria Eunice da Costa Salavessa (UTAD) e Hipólito José Campos de Sousa (FEUP).
13. MSc: MESQUITA, D.A. (2014) - Identificação do comportamento ao corte do tecido ósseo cortical usando correlação digital de imagem. Mestrado em Engenharia Mecânica, Universidade de Trás-os-Montes e Alto Douro. Orientação de José Xavier (CITAB) e José Morais (UTAD).
14. MSc: MESQUITA, R.M.F. (2014) - RealTV. Mestrado em Tecnologias da Informação e Comunicação, Universidade de Trás-os-Montes e Alto Douro. Orientação de Pedro Mestre (UTAD) e Carlos Serôdio (UTAD).
15. MSc: MONTEIRO, A.C.R. (2014) - Perfil e Caracterização da Produção de Energia Elétrica do Gerador Eólico da UTAD, Mestrado em Engenharia Mecânica, Universidade de Trás-os-Montes e Alto Douro. Orientação de Amadeu Borges (UTAD) e Pedro Mestre (UTAD).
16. MSc: MONTEIRO, C. (2014) - A aplicação da Avaliação de Risco Ambiental na Localização de Aterros de Resíduos Não Perigosos. Mestrado em Engenharia do Ambiente. Universidade de Trás-os-Montes e Alto Douro. Orientação de Carlos Afonso (UTAD) e Catarina Avelino (UTAD)

17. MSc: RODRIGUES, D. (2014) - Caracterização numérico-experimental do comportamento mecânico da madeira submetida a regimes de carregamento cíclico. Mestrado em Engenharia Mecânica, Universidade de Trás-os-Montes e Alto Douro. Orientação de Nuno Dourado (UTAD) e Abílio de Jesus (UTAD).
18. MSc: SANTOS, D. (2014) - Gestão de Resíduos de Equipamentos Eléctricos e Electrónicos. Mestrado em Engenharia do Ambiente. Universidade de Trás-os-Montes e Alto Douro. Orientação de Carlos Afonso (UTAD)
19. MSc: SANTOS, D.J (2014) - Sistema Integrado de Comunicações para uma Rede de Monitorização e Controlo de Tráfego. Mestrado em Engenharia Electrónica e de Computadores, Universidade de Trás-os-Montes e Alto Douro. Orientação de Pedro Mestre (UTAD) e Carlos Serôdio (UTAD).
20. SEIXAS, V.C.T. Qualidade do ar interior em salas de aula com diferentes formas de ventilação: monitorização e modelação matemática. Mestrado em Engenharia do Ambiente, Universidade de Trás-os-Montes e Alto Douro. Orientação de Margarida Correia Marques (UTAD) e Irene Oliveira (UTAD).
21. MSc: SEVERINO, N. T. (2014) - Aplicação Context-aware LBS para Dispositivos Móveis. Mestrado em Comunicação e Multimédia, Universidade de Trás-os-Montes e Alto Douro. Orientação de Carlos Serôdio (UTAD) e Pedro Mestre (UTAD).
22. MSc: SOARES, S.F.S. Avaliação de parâmetros de segurança alimentar em estabelecimentos de restauração e bebidas – implementação de pré-requisitos. Mestrado em Segurança Alimentar, Universidade de Trás-os-Montes e Alto Douro. Orientação de Cristina Saraiva (UTAD) e Irene Oliveira (UTAD).
23. MSc: SOUSA, J.A.C. (2014) - Controlo de Iluminação Pública e Sinalização Rodoviária. Mestrado em Engenharia Electrotécnica e de Computadores, Universidade de Trás-os-Montes e Alto Douro. Orientação de Carlos Serôdio (UTAD) e Pedro Mestre (UTAD).
24. MSc: VAZ, C. (2014) - Efeito do teor de humidade nas propriedades termodinâmicas e de fratura em modo I do betão. Mestrado em Engenharia Mecânica, Universidade de Trás-os-Montes e Alto Douro. Orientação de Amadeu Borges (UTAD) e Nuno Dourado (UTAD).
25. PhD: REVA, V. (2014) - Impact of the pine wood nematode (*Bursaphelenchus xylophilus*) on the chemical and physical properties of *Pinus pinaster* wood. Socio-economic and

environmental aspects of pine wilt disease in Portugal. Doutoramento em Ciências Agronómicas e Florestais, Universidade de Trás-os-Montes e Alto Douro. Orientação de José Luis Louzada (UTAD) e Rui Figueiredo (UC).

4.3.5.9 Patents/propotypes

1. Melo-Pinto, P.; Fernandes, A.; Laso M.; Santamaria, M.; Prior, B. Fast Clone ID. Ultra-fast, destructive or non-destructive and environmentally friendly identification of plant clones using spectroscopy, multivariate analysis or artificial intelligence methods. National patent n.º PT 106 253, 2014
2. Teixeira, Carlos; Varajão, João; Bentes, Isabel. IDGRU – Indicadores de Gestão de Resíduos (January 2014 version). Registered Software nbr. 20/D/2013 da ASSOFT.
3. Pedro Mestre and Carlos Serôdio. LED public illumination controller, prototype resulting from an industry contract project In.lighting. Contractor and stakeholder: I-Sete - Inovação, Soluções Económicas e Tecnologias Ecológicas, Lda.

4.3.5.10 Organization of conferences

1. I Encontro Luso-Galaico de Estatística em Ecologia e Ambiente, Vila Real, de 6 a 9 de novembro. Irene Cristina Salgueiro de Oliveira.
2. I Jornadas de Engenharia do Ambiente. Organização conjunta da Direcção do 1º Ciclo em Engenharia do Ambiente e o Núcleo de Estudantes de Engenharia do Ambiente da Universidade de Trás-os-Montes e Alto Douro. 11 de Abril de 2014. Carlos Afonso de Moura Teixeira.
3. Ciclo de Palestras “Novas Tecnologias Aplicadas à Viticultura – Emergent Technologies Applied to Viticulture”. 16 de Outubro de 2014 e 13 de Novembro de 2014. UTAD, Vila Real. Pedro José de Melo Teixeira Pinto.
4. Scientific Committee - Jornadas de Classificação e Análise de Dados-JOCLAD 2014. Irene Cristina Salgueiro de Oliveira.
5. XIV Jornadas de Fractura/XIV Portuguese Conference on Fracture (PCF2014), UTAD, Peso da Régua, Portugal, 6-7 February 2014. Integra a Comissão Executiva responsável pela Organização deste evento. Nuno Miguel Magalhães Dourado.
6. Scientific Committee – ICEEE’14 - The 2014 International Conference of Electrical and Electronics Engineering, World Congress on Engineering 2014 (WCE2014), London, United Kingdom, 2 - 4 de July 2014. Pedro Mestre.

7. Scientific Committee - ICWN'14 - The 2014 International Conference of Electrical and Electronics Engineering, World Congress on Engineering 2014 (WCE2014), London, United Kingdom, 2 - 4 de July 2014. Pedro Mestre.

4.3.5.11 Industry contract research

In.lighting. CITAB coordination: Carlos Serôdio and Pedro Mestre. Starting date: October 2014. Contractor: I-Sete - Inovação, Soluções Económicas e Tecnologias Ecológicas, Lda. Funding: €8.890,00.

4.3.5.12 Internationalization

1. Training School on “Thermo-hydro-Mechanical (THM) behaviour of wood”, COSTAction FP0904, Bordeaux, France, 10-13 février, 2014. José Manuel Cardoso Xavier.
2. Monteiro, N.; Xavier, J.; Morais, J.J.L.; Dourado, N.; de Moura, M.F.S.F. Moisturecontent effects on the fracture characterisation of *P. pinaster* under mode I. Workshop “Thermo-hydro-Mechanical (THM) behaviour of wood”, COST Action FP0904, Bordeaux, France, 13-14 February, 2014. José Manuel Cardoso Xavier.
3. Xavier, J.; Heterogeneous bending tests for the characterisation of wooden plates. Workshop “WOOD MUSICK - WOODen MUSical Instrument Conservation and Knowledge”, COST Action FP1302, Paris, France, 27-28 February, 2014. José Manuel Cardoso Xavier.
4. Xavier, J.; Pereira, J.; Pierron, F.; Morais, J. Identification of elastic properties of *P. pinaster* from heterogeneous tests. Workshop “Experimental Research with Timber”, COST Action FP1004, Czech Technical University, Prague, 21-23 May, 2014. José Manuel Cardoso Xavier.
5. Cruz, W. Xavier, J.; Pierron, F.; Morais, J. Characterization of orthotropic stiffness components of *Pinus pinaster* from heterogeneous plate bending tests. II International Conference of the International Journal of Structural Integrity, 1-4 September, Funchal, Portugal, 2014. (oral presentation) Silva A.L.L.; Xavier, J.; Carvalho, D.; Jesus, A.M.P.; Fernandes, A.A. Evaluation of mixed-mode I+II fatigue crack propagation in steels assisted by DIC. II International Conference of the International Journal of Structural Integrity, 1-4 September, Funchal, Portugal, 2014. (oral presentation). José Manuel Cardoso Xavier.

6. 6th Summer School on “Biomechanics: Trends in Modeling and Simulation”, Graz University of Technology, Austria September 8-12, 2014. José Manuel Cardoso Xavier.
7. XIV Portuguese Conference on Fracture, Peso da Régua, 6-7 Feb 2014. José Luís Penetra Cerveira Lousada.
8. EuroDendro Conference 2014. 8-12 September 2014, Lugo, Spain. José Luís Penetra Cerveira Lousada.
9. Preparation of collaborative work to be done in harvesting time. Discussion about ongoing work on enological parameters estimation based on hyperspectral images. Pedro José de Melo Teixeira Pinto.
10. Image acquisition for ripeness assessment in grape berries. Image acquisition for botrytis assessment in grape berries. Pedro José de Melo Teixeira Pinto.

4.3.5.13 Government/Organization contract

N/A

4.3.5.14 Awards

N/A

4.3.6 Future research

4.3.6.1 Objectives

Because most researchers of CITAB are also teachers, with a heavy teaching-related workload, it is very important to increase the critical mass of the group, attracting and engaging more researchers to the group. This will increase the number of group’s stakeholders, attracting more funding through projects (national and international) as well as by services.

Other objectives of the group include increase the participation of the members in international networks (COST Actions, ERA-NETS, etc.), development of pin-off and continue to offer advanced training (PhD courses).

Outreach activities (dissemination of science), increase in the participation and organization of national and international conferences, results dissemination to the stakeholders and joint actions with other Research Units are also considered as a priority.

Project #1 Bio-based materials

Task #1.01 - Mechanical behaviour of bio-based materials (wood and bone): Several tests will be run to test the new data reduction strategy previously proposed for characterising wood at the growth ring scale, taking into account both orthotropy and heterogeneity. A single heterogeneous plate bending test which was proposed for characterising clear wood by the deflectometry technique will be further tested. It will be pursued the complete mechanical characterisation of cortical bone tissues, coupling digital image correlation with several test methods. Finally, the integrated toolboxes of white-light optical methods, namely, digital image correlation, grid method/deflectometry and feature-tracking method will be developed.

Task #1.02 - Fracture behaviour of bio-based materials (wood and bone) and structures: The determination of cohesive laws in wood bonded joints involves the application of a direct method or an inverse approach, which is associated to an optimization strategy. Through the first planned activity, the determination of the crack opening displacement is required. The digital image technique is envisaged for this purpose. In the second planned activity, a genetic algorithm combined with the finite element method is needed. The characterization of wood-steel dowelled-joints, wood repairs and metal fixations for bone repair will be performed experimentally using the digital image technique.

Task #1.03 – Bio-based fibre and particle composites: Wood can be mixed with other products incorporating co-products, agro-forestry wastes and other biological materials, with significant environmental & economic benefits. This task intends to continue with the characterisation of these products incorporating alternative materials. Novel approaches are proposed for a robust evaluation.

Project #2 Image-based systems

Task #2.01 Image-based classification using computational intelligence techniques:

Soft Computing techniques will be applied in image classification problems, for agricultural, forestry, environmental and biological systems, providing a way to incorporate the intrinsic ambiguity and complexity in the methodologies. Regarding team sports analysis, the huge complexity involved in multi-tracking problems is softened by introducing the necessary flexibility while maintaining accuracy, using the above mentioned techniques to deal with the uncertainties (occlusions, misdetections, etc.). Robust methodologies are being developed for feature tracking in image sequences using FSs concepts along with feature behavioral characterization methodologies for feature identification and tracking. Classification methodologies based on statistical and textural measures, FSs concepts and its extensions for meat quality assessment and characterization are also being developed.

Task #2.02 Hyperspectral imaging techniques for agro-forestry, environment and biology: Hyperspectral imaging will continue to be used for non-destructive analysis of biological materials, namely vine and grapes. Advanced machine learning algorithms will continue to be developed to extract from hyperspectral information the values of parameters to be measured.

Task #2.03 Imaging techniques as a tool to improve biological models: This task employs biomechanical and environmental analysis, using computer assisted imaging techniques, to assess the quality and type of the movement in biological models, such as plantar pressure abnormalities- development of a methodology to determine local (over)loading of the plantar surface, biomechanical load over walking trails, and the development of methodologies to improve radiographic and ultrasound imaging diagnosis.

Task #2.04 - Device-independent image visualization techniques and data

transmission: This task aims to study, model and develop Embedded Systems and WSNs to characterize and perform automatic control over activities (design of devices) related with agro-food environments, including the development of embedded communication protocols, instrumentation (sensor) systems and mobile applications for precision agriculture and food quality evaluation.

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