2016 Activities Plan

CITAB

Compiled and edited by

CITAB's BOARD

This Activity Plan is in strict agreement with the 2015-2020 Strategic Programme

INDEX

1 Introduction

The 2016 Plan will focus into two thematic lines and five tasks previously defined in in the Strategic Programme. These lines, designated by "Sustainability of Agri-food and Forestry Ecosystems in a changing environment" and "Technology & innovation in Agri-food and Forestry chains" meet CITAB's vision to provide scientific, technological and innovative knowledge based on multidisciplinary and complementarity to meet stakeholder needs and challenges in agri-food and forestry value chains. After a previous consolidation of research strategies in previous years, internationalisation and improving critical mass this Activity Plan define the framework for the 1st year of the 2015-2020 Strategic Programme. This step, in general terms, aims to contribute to an increasing quality of research outputs in the agri-food and forestry sector, without losing the links to the regional development. Therefore, CITAB for 20146 intends to respond to concrete societal challenges:

1- to understand mechanisms of climate change climate and their impact on plant physiology and to set studies on mitigation on crops and forest production;
2- to develop technological tools capable of online monitoring of chains of value in order to promote a more sustainable agri-forest activity, through better management of natural resources;
3- to contribute to the circular economy following the ongoing work by creating added value in the co-products.

Thus, the 2016 Plan will be also in close agreement with the recently approved Project INTERACT, financed by the Regional funds in the framework of Portugal 2020. Since this Project stemmed on CITAB human resources (even if it was enlarged to members of other Research Centres of UTAD), it is natural that the CITAB Activity Plan for 2016 will be deeply rooted on that project. The INTERACT project aims to improve the agriculture by developing new scientific and technological knowledge that may increase yields of important crops, for new market segments, and is oriented towards the preservation of natural resources, integrated management and valorisation of agrarian chain production facing new challenges. This Project is organized in 3 lines: Innovation for Sustainable Agro-food Chains (ISAC), BioEconomy and Sustainability (BEST) and Sustainable Viticulture and Wine Production (VitalityWINE). The efforts of CITAB members will contribute for the increment of technological value of the region, mainly through the development and dissemination of innovation and knowhow, improving the competitiveness of the Northern region through new methods, technologies and more environmental friendly and efficiently processes.

Besides research, outreach activities are important as well in 2016 to ensure that CITAB researchers work together to divulge the centre's activities and capture the interest of potential young scientists in regional secondary schools. Moreover the local community and state and private organizations are also a target of CITAB, to demonstrate that the research carried out in the Centre has application at different levels of the society, and

has important impacts on the socio-economic life and in the environment. CITAB wants to prosecute the concept of "open laboratory" to high schools students (e.g. "Ciência Viva" programme), and media attention, especially on "hot topics" such as climate change and greenhouse emissions, and its influence in agriculture, shortage and quality of water, forest fires and biodiversity and sustainable management of agri-forest ecosystems.

2016 is another important year to apply for Horizon 2020 projects, and CITAB's Board considered it a priority in both strands, promoting the development of consortia.

2 Major Objectives

The objectives for 2016 are close related with the implementation of the 2015-2020 Strategic Programme (SP). This Programme is focused in resolving societal and private sector (such as small and medium enterprises or SMEs) 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 science and socioeconomic needs. The SP will be based on a multidisciplinary approach that addresses both benchmark science and the human dimension of issues.

In SP the research is structured into two thematic strands (SP): i) Sustainability of Agri-food and Forestry Ecosystems in a changing environment and ii) Technology & innovation in Agri-food and Forestry chains for a more competitive bio economy. The first thematic area has two tasks a) Integrated monitoring of climate and environmental impacts: adaptation and mitigation strategies and b) Conservation strategies and ecological modelling: recovering and improving sustainability in Agri-food and Forestry ecosystems and ecosystem services. The second thematic area comprises three tasks a) Technological innovation and processes; b) Bio-based products and waste research and c) Towards valorization of agro-food co-products

More specifically CITAB intends in 2016 to attain specific targets:

- To participate actively in the INTERACT - Integrative Research in Environment, Agro-Chains and Technology, which comprises 3 lines: Sustainable Agro-food Chains (ISAC), BioEconomy and Sustainability (BEST) and Sustainable Viticulture and Wine Production (VitalityWINE).
- Continuation of the FCT funded International Doctoral Programme “Agrichains – Agricultural Production Chains - From fork to farm”
- Submitting syllabi for new international doctoral programmes with national and international research centres, universities and stakeholders.
- Development of and participation in Horizon 2020 proposals in key areas that are compatible with the Thematic Strands of the 2015-2020 Strategic Programme.
- Development of planned, strategic outreach activities aimed to capture the interest of young scientists, media and to show the application of the research in various sectors of activity, with a priority on ecosystem services.

3 Activities

The Thematic Strand (TS) **Sustainability of Agri-food and Forestry Ecosystems in a changing environment** and respective tasks arise from the SP 2015-2020, and their definition was based on the natural and rational identification of two research topics, taking into account national and regional needs to boost capacity and fill gaps in science. The TS were previous validated in 2014 by CITAB's Stakeholder Committee, the Scientific Advisory Committee, and Scientific Council.

This TS integrates the following Tasks:

Task 1.1 Integrated monitoring of climate and environmental impacts: adaptation and mitigation strategies;
Task 1.2 Conservation strategies and ecological modelling: recovering and improving sustainability in Agri-food and Forestry ecosystems and ecosystem services.

3.1 Sustainability of Agri-food and Forestry Ecosystems in a changing environment

The TS will address how impacts affect agri-food and forestry chains systems as well as biodiversity and ecosystems they house to develop effective measures that contribute to sustainable strategy development, planning and decision making.

Recent-past climate and environmental change, accompanied by the development of new analytical and modelling technologies, highlight the urgent need to meet societal challenges and create a new paradigm in planning and sustainable management strategies. Task 1.1 will develop integrated monitoring systems with stakeholders, based on climatic, environmental, biological and chemical elements, complemented with innovative engineering solutions, to develop cost-effective, environmentally sustainable and eco-innovative adaptation and mitigation measures. Task 1.1 will be highly interdisciplinary, using different field, laboratory and computational techniques using advanced analysis, scaling and modelling tools and testing novel potential indicators of environmental change. The 3 aims of task 1.1 are (i) to develop and apply new analytical technologies; (ii) to understand climatic and environmental forcing on target terrestrial and aquatic systems under current conditions; (iii) to assess climate and environmental change impacts under future scenarios in order to develop, test and implement appropriate mitigation and adaptation measures, such as restoring riparian galleries to mitigate CC impacts (e.g. temperature regulation, carbon sequestration, prevention of erosion, biodiversity) or cultivar re-planning to adapt to projected changes in bioclimatic conditions (e.g. zonation of important crops). Results will that guarantee sustainability in AFFPC activities and their co-products and will contribute to maintain, or restore, quality in associated ecosystems, thereby contributing towards sustainability in the provision of natural resources and ecosystem services. Results from this task will bring important added-values not only to science and environment, but to key socio-economic sectors.

The TS addresses the complexity of this topic and the necessity for focused multidisciplinary research, in collaboration with stakeholders, to address the balance between a demand for a sustainable AFFPC and environmental change caused by anthropogenic intervention and their environmental impacts.

3.1.1 - Task 1.1: Integrated monitoring of climate and environmental impacts: adaptation and mitigation strategies

This task follows the strategic plan of CITAB, and this task looks for the development of innovative techniques for monitoring agri-forestry and environmental systems that may bring important added-value for several socioeconomic sectors and for a wide range of shareholders. Our objective is to achieve more integrated approaches through multidisciplinary interchange within and among tasks. Furthermore, new datasets have been created and applied for this purpose. We aim to bring all these new perspectives together so as to potentiate a better assessment of the likely impacts of a changing climate and environment on our target systems, also enabling the development of suitable, timely and cost-effective adaptation and mitigation measures. The present task follows the main achievements obtained recently and projects new steps for 2016:

3.1.1.1 - Climate variability and change

Climate variability, irregularity and, more prominently, climate and weather extremes have been an important area of research within task 1.1. The identification of their forcing mechanisms has been envisioned, with new promising results. The impacts of climate variability and change on environment, water resources and agri-forestry systems has been addressed, including assessments at hydrographic basin scales. A thorough study of the microclimate in the Baixo-Sabor basin (North of Portugal) and of the potential modifications induced by a hydropower generating dam have also been investigated in this task, in strong collaboration with other tasks in the CITAB.

This line of research was based on the collection, compilation, treatment and exploratory analyses of a wide range of datasets. Besides the use of instrumental datasets from different sources (e.g. weather stations and remote sensing), additional information is being retrieved from different proxies, namely from wood samples for a paleo-reconstruction of climate in Portugal and Europe. Climate change projections have also been developed taking into account different greenhouse gas emission scenarios for future periods and using state-of-the-art regional climate models and advanced statistical downscaling approaches. Climate change patterns at innovatively high spatial resolutions for Portugal and Europe have been obtained within task 1.1.

3.1.1.2- Climate *vs.* agriculture

Economically relevant crops are being studied, such as grapevine, olive-tree, chestnut-tree, almond-tree, cherry-tree and berries. Given the strong climatic influence on these crops, climate change can challenge the sustainability of the agricultural sector in

Portugal. Therefore, one main objective is to enhance our current understanding of the responses of these crops to climate, environmental stresses and water availability. The mechanisms underlying the physiological and agronomic processes are an important topic of research. The outcomes from these studies are delivering guidelines to stakeholders, fostering resource-efficient economic growth and safeguarding agricultural jobs in Portugal.

CITAB/UTAD researchers jointly work on developing and applying short-term adaptation measures, as the first protection strategy against climate change. These studies focus on: irrigation strategies; sunscreens for leaf protection; soil tillage; cover crops; crop and canopy microclimates; varietal and rootstock decisions; mycorrhizal associations; technological advances and land use and allocation changes.

More specifically for the chestnut sector, research has been developed in order to mitigate several threats, such as the chestnut gall wasp and chestnut blight disease and ink disease. Additionally, process-based crop models are being applied either for short-term prediction of crop parameters or for long-term assessment of climate change impacts. In particular, the STICS crop model, developed at INRA, was already successfully applied to European viticulture, providing projections for a large number of viticultural-relevant parameters (e.g. yields, water and nitrogen stresses, phenological stages/timings and biomass partitioning).

3.1.1.3- Climate vs. aquatic and forestry systems

We managed to overcome the limitations of single-level approaches to assess the diversity of human stressors in the aquatic ecosystems (acting at different scales). It was developed the index MELIS, integrating biological indicators, with biochemical and histopathological biomarkers and functional indicators, representing the different levels of biological organization. Moreover, this index included distinct aquatic communities, namely fish and invertebrates, and established baseline values at different pollution gradients, identifying potential variations due to climate and environmental impacts (physical habitats and chemical ones) Therefore, the main achievements were based on the selection of indicators to disturbance and their further integration. A more intensive work was developed related to toxicity mechanisms (e.g. signaling pathways and gene networks implicated in toxic and adaptive responses) in aquatic animals, associated to emerging compounds where there is little or no information on toxic effects. The research produced then important results concerning the quantification of ecological integrity in aquatic ecosystems based on the integration of indicators (molecular, biochemical, cellular, physiological, population and community level) including indicators of ecosystem function (decomposition), and producing a reliable system to be used in water assessment and sensitive to a wide range of impacts. At laboratory scale it was shown that pharmaceuticals present on aquatic systems can impair fish embryonic development at different levels of organization (genes, proteins and tissues) and the reproductive development and capability. It was also shown that these

compounds can induce different impacts depending on water temperature raising concerns regarding future climate changes.

The Portuguese rural fire database (PRFD) is being updated. The characterization of the fire regime will be complemented, in particular the relationship with environmental variables (weather, geographic, socio-economic, etc.) for various current and future scenarios of change, for the development of adaptation and mitigation strategies. This has allowed showing that land and forest management mitigate weather-related effects on wildfire size and that large-fire spread as determined by environmental drivers is weakly affected by fire-suppression effort.

3.1.2 -Task 1.2.:Conservation strategies and ecological modelling: recovering and improving sustainability in agri- food and forestry ecosystems and ecosystem services

3.1.2.1 New techniques for watersheds management and sustainability

Different techniques were applied and tested in actions related to the restoration of the ecological functions of impacted systems and the rehabilitation of degraded environments, particularly under climate change scenarios, particularly in aquatic ecosystems under extreme hydrological events (droughts and floods), leading to soil loss and nutrient leaching. In this field the research will test new soil engineering techniques designed for bank protection in order to decrease fluvial erosion and to allow habitat restoration (namely by applying bioengineering procedures), allowing the recovery of riparian galleries and the mitigation of fluvial erosion. But the actions integrated other components of the aquatic system, particularly the improvement and validation of environmental flows, control of exotic species (e.g. the bivalve *Corbicula fluminea*) and protection of endangered fish species, especially in situations of low connectivity (for the first time it was tested the effect of flow management on the reproductive success of native fish species in regulated rivers).
New spatio-temporal statistical techniques for studying microorganisms and parasites
Spatio-temporal modelling concepts to application of new statistical techniques in the conservation of species/environmental quality. It was also possible to provide statistical studies that could be useful for research in microbiology and microorganism studies. Namely to study F. Huffmanela sp. (Nematoda: Trichosomoididae) from Microchirus azevia captured off Portuguese coast.

3.1.2.2. Recent findings on environmental determinants of wildfires

Research on the dynamics of large wildfires in Portugal allowed us to identify the main environmental and anthropogenic influences involved in their spread, as well as to quantify their contribution to fire size: climate and weather variables; vegetation and fuel hazard; topography; fire recurrence; land development; and fire suppression effort.

3.1.2.3. Novel applications for managing the ecological status of surface waters

We built and tested a dynamic model framework to assess the effect of land use change scenarios, including the occurrence of stochastic wildfire events, on the biological quality elements and physical support elements used to determine ecological status of surface water under the Water Framework Directive (WFD). The framework, which can also extrapolate to non-monitored waterbodies, was tested in the Alto Minho River Basin District, situated in North West Portugal. The model is an innovative step towards developing a decision-making and planning tool to assess the influence impacts such as LU change and climate change on these complex systems and can be adapted to any type of WFD defined surface water system.

3.1.2.4. Novel "One health" concept developments and applications

Our worldwide unique and novel modelling framework, designated by the acronym StDM (Stochastic Dynamic Methodology), is a promising approach that will provide the development of more global techniques in the scope of this research area, enabling us to develop more powerful predictions of biological patterns in changing environments. As an example, the StDM frameworks will be used in predicting the occurrence patterns of wild species and the occurrence of zoonosis positivity (serological and/or molecular) to leptospirosis, brucellosis and Lyme disease in target regions taking into account scenarios of climate, water resources and land use changes at the level of regional agro-forestry ecosystems.

3.1.2.5. Conservation genetics of endangered populations

The development of innovative ecological models by integrating landscape, environmental, ecological and molecular genetic data is a forthcoming challenge. Landscape genetics and genomics are emerging interdisciplinary research fields revolutionized by continuous advances in high-throughput DNA sequencing technologies and bioinformatics tools.

Specific Objectives

3.1.2.6. Effects of using green infrastructures for watersheds management

In 2016, the objective is to apply Natural Water Retention Measures. These ones are measures that aim to safeguard and enhance the water storage potential of landscape, soil, and aquifers, by restoring ecosystems, natural features and characteristics of water courses and using natural processes. They are adaptation measures that use nature to regulate the flow and transport of water so as to smooth peaks and moderate extreme events (floods, droughts, desertification, salination). They are also better environmental option for flood risk management in Mediterranean streams subject to an intense variety of hydrological conditions. In fact, they reduce vulnerability of water resources to Climate Change and other anthropogenic pressures.

3.1.2.7. Modelling fire behaviour and wildfire risk for diverse environmental conditions

Compilation of a worldwide database on fire behaviour characteristics and carbon emissions from experimental fires, managed burns and wildfire case studies for subsequent analysis and modelling. Analysis and characterization of prescribed burning in southern Europe and best practice recommendations to decrease wildfire risk and maintain or enhance ecosystem sustainability. Experimental lab-scale study of fire behaviour characteristics in live fuel complexes to model the effects of fuel moisture and fuel structure.

3.1.2.8. Combining new statistical developments for wildlife conservation

Developing, testing and using predictive and multivariate methodologies to obtain results and to decision support tools concerning ecological environments for the endangered population of Phengaris alcon population in Portugal. To provide more accurate Mark Release Capture models for insects population: and disseminate results of adult demography, spatial distribution and movements of Phengaris alcon (Lepidoptera: Lycaenidae) populations in Portugal.

3.1.2.9. Applying the green infrastructure concept to enhance ecosystem services provided

We will start the development of an StDM modelling framework to assess the role of Green Infrastructures - namely Riparian zones in the landscape. Focussing on a catchment level approach, we will assess how scenarios of change such as socio-economic change, affect riparian ecosystem service (ES) provisioning. We will focus on northern river catchment (possibly the Sabor) as a case study sites and take into account the link between fundamental riparian ecological and biogeochemical processes, ecosystem services and societal wellbeing. We will account for diverse interests and potential conflicts of "stakeholders" and longitudinal change in river catchments. We will continue to develop the StDM developed for the Water Framework Directive.

3.1.2.10. Innovative and ready to use management platforms

The Laboratory of Applied Ecology aim to integrate advancing predictive innovative dynamic tools with GIS environments to provide simple, suitable and intuitive outputs (easily interpreted by stakeholders), making our methodologies accessible beyond the scientific community. In this perspective, we aim to continue developing innovative research in 2016 by integrating long-term biodiversity datasets in multi modelling frameworks in order to improve data robustness and predictive power on the binding scope of ecosystem dynamics and biodiversity conservation. We aim to examine and discuss the performance of those principles, by combining biostatistics and spatially dynamic modelling techniques under common and interactive frameworks, from which management strategies can be designed and tested. The “symbiosis” between long-

term monitoring datasets, conservationist measures and predictive scientific research is emphasised by proposing the development of innovative protocols and tools regarding the ecological values that the national entities has been established to protect and/or mitigate.

3.1.2.11. Long Term Ecological Research Investigation

The ongoing general ecological monitoring program at the lower Sabor river valley (funded by the EDP) will represent the starting point of a promising collaboration with the LTER (Long Term Ecological Research) network, namely to assess the ecological status of changing ecosystems and predict the trends of vulnerable vertebrate communities and endangered species (fishes, amphibians, reptiles, mammals, including bats, and birds) facing the impacts of a recent hydropower reservoir construction and exploitation.

3.2 Technology and innovation in Agro-food and Forestry chains for a more competitive bioeconomy

3.2.1. Task 2.1 - Innovative technologies and processes

This task focuses on the development of innovative approaches and methods to stimulate the adoption of new production methods. The major objective will be to increment food and forestry crop productivity, reduce agricultural practice management costs and increase profit by developing technical studies at different but interconnected levels.

The present task can be subdivided into specific topics of research.

3.2.1.1 Increase the productivity and yield of crops and forestry resources through physiological and best management tools

Identification of the patterns of wood density components and growth traits of softwood species (*Pinus sylvestris*, *Pinus pinaster* and *Pinus nigra*) through alternative methods to x-rays.

1. Developing new technique for measure the wood density profiles (softwoods) by the analysis of the RGB components of the wood image.
2. Computing the wood density components and growth traits by the RGB components analysis.

3.2.1.2 Produce new technological applications, including management software prediction, spectral imaging applied to food crops and forestry in order to predict

maturation stages, growth rates, harvest periods, water and cycle nutrients or fertilizers management, disease or plague occurrences, among others parameters.

Developing methods to evaluate physical and anatomical wood properties regarding quality assessment and suitable uses.

1. Expedite method to evaluate the wood density (at annual ring level) for heartwood and sapwood, by image analysis.

2. Identification and quantification of the different hardwood tissues (fibers, vessels and parenchyma) by image analysis, based on the transverse dimensions of the cells.

Smart agriculture sensor based approaches for agro-forestry production.

1. Prototyping of a portable Geo-referenced (GPS) sensing station, that includes hyper spectral and vegetation index cameras. Field testing in real environment.

2. Development of mobile device, desktop and server software applications to collect data, storage and web service support and deployment.".

Assessment and evaluation of quality.

1. Grape images and reference values databases construction.

2. Development and testing of predictive models for oenological parameter estimation.

3. Development and testing of predictive models for water stress estimation.

4. Model assessment for different varieties, growing conditions and harvest year.

Mechanical and fracture behaviour of bio-based materials and structures

1. Study of the influence of storage protocol over the in vitro mechanical properties of cortical bone.

2. Identification of elastic properties of cortical tissue of long bones through inverse methods, which combine experimental data (statically indeterminate tests) with optimization techniques. The experimental tests will be performed at the diaphysis scale, and will be instrumented with Bragg sensors embedded in optical fibres and with digital image correlation.

3. Experimental and analytical characterization of the effect of strain rate and temperature on the fracture behaviour of wood in mode I and mode II.

4. Identification of cohesive laws for the fracture behaviour of wood in mixed mode I / II, through the MMB test ("bending mixed-mode") and digital image correlation.

5. Development of identification methods of fracture constitutive laws of cortical bone, under mode I (DCB test), mode II (ENF test) and mixed-mode I/II (MMB test).

6. Development of characterization methods of the in situ mechanical and fracture properties of wood bonded joints by using digital image correlation and Bragg sensors in optical fiber.

7. Experimental identification and computational modelling of wood compression failure in the material symmetry directions, at the meso-mechanical and micromechanical scales.

8. Computer modelling (using the finite elements method) of the nonlinear behaviour of doweled timber connections, based on the Hill criterion of plasticity.

9. Use of acoustic spectroscopy and mechanical spectroscopy for the identification of the viscoelastic behaviour of wood.

3.2.1.3 Identify key intervention points in resources to optimize production and thus identify potentially suitable species, varieties and rootstocks

Evaluation of the phytochemical and nutritional composition of agro-food products and co-products in close collaboration with key stakeholders. The plant materials evaluated will be addressed to identify the most promising extracts concerning biological activities in vitro. These materials will be further tested through dietary intervention trials towards the assessment of their capacity to modify pathophysiological biomarkers, therefore, retrieving information on their impact on the health status *in vivo*.

3.2.1.4 Characterize vegetation and quality assessment to optimize physiological responses to climate conditions. Finding will show us how to produce with innovative methods, providing optimized solutions for current and future stakeholders by boosting competitiveness and income. This will contribute to sustainable economic income for regional stakeholders which obviously extend findings to national level.

3.2.2. - Task 2.2: Bio-based products and waste research

The main objective of this task is the evaluation of the potential of agri-food and forestry residues (AFFR), native flora and aromatic and medicinal plants (AMP) respecting their contents in phytochemicals, antinutrients, toxins and aflatoxins, in order to understand their features as sources of valuable compounds addressed to the development of new products with high bio-based value. Furthermore, the development of a tool for rapid and accurate assessments of these matrices, respecting the presence of these compounds in amounts that turn them valuable stuffs is foreseen, with the view of evaluating, in situ, the best utilization alternative for these residues. Moreover, the optimal valorization procedures, according to the constitution of each residue, will be explored. This will allow to reduce the current claim for raw materials enhancing the sustainability and competitiveness of the diverse economic actors.

These main goals will be achieved by the development of the following activities:

1. Identification and quantification of pesticides, toxins, and antinutrients present in the agri-food and forestry residues (AFFR), native flora and aromatic and medicinal plants (AMP) by spectrophotometric and chromatographic methods;

2. Identification of the major bioactive phenolic compounds, to support rational innovative applications for these materials by food and cosmetic industries;

3. Development and validation of a multivariate based approach, allowing the straightforward determination of the composition of these residues by solely FTIR (NIR/MIR), and validate the interest of FITR analysis coupled to chemometric analysis to immediately evaluate the optimal destination and timing for valorizing of these residues;

5. Design and development of optimal valorization procedures, according to the specific constitution of each residue. To achieve this objective, it is envisaged to establish multidisciplinary cooperation ways between researchers from the chemical, biological, and veterinary areas of knowledge.

3.2.3 - Task 2.3: Towards valorisation of agro-food co-products

The present task deals with the challenges arising from Task 2.2, retrieved from the study of agri-food and forestry residues (AFFR), besides native flora and aromatic and medicinal plants (AMP), with the view of developing new bio-applications for these valuable products. The research work will involve BE and SAC researchers, in order to create new products with both biological and innovative industrial value.

Within this scope, the network arising from CITAB multipurpose collaborations, represents critical mass, with enough potential as to overcome the existing constraints within each challenge, therefore, empowering the currently existing valences towards the assessment of target materials on biochemical composition and biological activity of whole extracts. Moreover, in a second stage, besides these extracts (explored in a

preliminary phase), also isolated compounds (previously demonstrated on their biological potential with resort to multivariate chemometric analysis developed with whole extracts). Therefore, the latter will be identified as potential candidates to be evaluated in vivo.

Moreover, the safety of the compounds isolated from each matrix, will be assessed. Furthermore, the same compounds will be evaluated in which respects to functional, nutritional quality and toxicological/pharmacological properties, using appropriate in vitro (biochemical and cellular) methods, which will be further validated

CITAB will continue to promote its Cycle of Conferences on transversal themes under development within CITAB's areas of expertise. Target audiences will include the academic community, actual and potential key stakeholders and the private sector. Contributions and keynote talks will be given by CITAB and consortium members and invited experts.

CITAB will increase the outreach activities for secondary schools through a yearly program of talks aimed to promote science and research activities, and to engage the students in the Unit activities as early as possible in their academic studies. The objective is also to project the Center at a national and international level in order to gather more fellowships for research activities, which is a priority for both strands.

The most crucial event is the organization of the 10th Iberian and 7th Iberoamerican Conference on Environmental Contamination and Toxicology - CICTA. This event conferences, using the motto Environmental Sustainability, looks for Insights to the future of research of ecotoxicology and environmental contamination. It will highlight top scientific approaches, encouraging the debate on issues related to pollution and environmental toxicology within an Iberoamerican context. It will also project the investigation carried out in CITAB.

We must refer also I the outreach activities, such as the production of a movie related to the conservation of coastal lagoons. Other outreach activities will comprise Dia Aberto da UTAD, Ciência Viva and Biodiversidade and seminars promoted by local/regional entities.

CITAB will consolidate its communication office, which is responsible for the divulgation of the Unit and its researchers' activities on different levels and for different target audiences, from the general public, partners and institutions to stakeholders and industry. CITAB is expecting an increasing level of awareness for CITAB activities and its impact on society, reaching more and more different sectors of the scientific community, students and the population.

4 Cooperation

4.1 Internal

CITAB continues to promote internal cooperation with ExCo members meeting and encouraging dialogue with CITAB researchers who make suggestions on actual and potential activities which are transmitted to the Board. This dialogue helps to define adequate policies for the center.

Regular meetings (4 times a year) between working group coordinators and ExCo members are meeting on a monthly basis to discuss, organize and implement research, outreach and dissemination activities, solve problems and promote integration.

The development and teaching of advanced courses and the international Doctoral Program AGRI-CHAINS will promote greater internal cohesion as CITAB members work together to develop syllabi based on areas with high levels of expertise and critical mass.

4.2 National

CITAB continues to aim for increasing cooperation with national research centres via joint applications for funding, MSc and PhD thesis supervision, and FCT sponsored *projects have been a good occasion to establish contacts with other organizations.*

4.3 International

CITAB will expand cooperative research work initiatives, through funding initiatives such as the Horizon 2020 programme. At the international level these projects are also a good possibility to establish contacts with other international research centres. Since in 2015 members of both strands are involved in three applications, the links established will create in the future the conditions for a more intense cooperation in the European context.

CITAB researchers will continue to actively participate in international conferences, management, scientific meetings and technical visits develop contact with important foreign researchers and acquire expertise through visits to foreign (mobility).

4.4 Anchor Institutes

Biosystems Engineering
Cooperative Wine Institute (ICV), France
Dept of Biokinetics, Sport and Leisure Sciences, University of Pretoria, Pretoria, South Africa
Institut de Mécanique et d'Ingénierie de Bordeaux, France
Instituto de Ciencias de la Vid y del Vino, Spain
Istituto Dalle Molle di Studi sull'Intelligenza Artificiale University of Manno, Switzerland (IDSIA)
Polytechnic University of Madrid (UPM), Spain
SOING, Italy
INRA, Orleans (Unité Amélioration Génétique et Physiologie Forestières)

Universidad Complutense de Madrid, Spain
INSA de Lyon, LaMCos, France
University of Southampton , UK
École Nationale Supérieure des Mines de Saint Étienne, France
Technical University of Munich, Germany
Universidad de La Rioja, Spain
University of Exeter – United Kingdom
University of Navarra (UPNA), Spain
Symington Estates
UAVision
Ecointegrity
Botany Department, U.of Salamanca, Spain
Center for Genome Regulation, U. de Chile, Chile
Center for Macroecology, Evolution and Climate Department of Biology, U. of Copenhagen, Denmark
Centro Ibérico de Restauração Fluvial (CIREF), Spain.
Department of Biology and Botanical Garden, Fribourg, Switzerland
Euskal Herrido Unibertsitatea U.del Pais Vasco, Bilbao, Spain
Institute of Ecosystem Study, National Research Council, Verbania Pallanz, Italy
Lehrstuhl für Aquatische Systembiologie, Technische Universität München, Germany
Universidad Complutense de Madrid, Spain
Universidade de Castilla la Mancha, Toledo, Spain
Universidade Estadual de Paraíba, (UEPB), Brasil
Universidade Federal de Minas Gerais (UFMG), Brasil
University of Dronten, ALMERE Holland
University of Santiago de Compostela, Spain
University of Wageningen, Holland
Sustainable Agro-food Chains
Biotechnical Faculty of University of Slovenia
Indian Institute of Technology, India
Institute for Geophysics and Meteorology, Uf Cologne, Germany
ISVV, Bordeaux, France
Laboratory of Plant Raw Materials Processing and Agricultural Storage, U of Szczecin, Poland
University of California, Davis, USA
University of Copenhagen, Denmark
University of Crete, Greece
University of Reading, United Kingdom
University of Verona, Italy
University of Santiago de Compostela, Spain.
University of Salamanca, Spain
Technische Universität Dresden, Germany
Department of Plant Sciences, University of California, USA
UMR Ecophysiologie et Génomique Fonctionnelle de la Vigne, UBordeaux - France
CENTRO DE INVESTIGACIÓN FORESTAL, SPAIN
Centre for Forestry and Climate Change, UK

Department of Applied Physics, U of Santiago de Compostela, Spain
INRA - Centre de Bordeaux / UMR TCEM, France
Escuela Politécnica Superior, Soil Science and Agricultural Chemistry, U Santiago de Compostela, Spain
Institute for Crop and Soil Science, Federal Research Centre for Cultivated Crops, Germany

4.5 Stakeholders

Biosystems Engineering

Stakeholders listed for BE 2014 research activities include Iberia HealthCare Systems, Instituto de Ciencias de la Vid y del Vino (Spain), Symington Estates, UAVision, Instituto dos Vinhos do Douro e do Porto, I P (IVDP, IP), Grupo Avanza and the Douro Alliance.

Ecointegrity

For 2015 the company of electricity EDP established already an intense program at the environmental level with CITAB members involved in monitoring and rehabilitation of aquatic and terrestrial ecosystems. Besides, EI researcher have strong ties with key public stakeholders such as CCDR – Norte, LABELEC - Energias de Portugal (EDP group), the National Forest Authority (AFN), the National Civil Protection Authority, the Agência Portuguesa do Ambiente (APA) and North Region Water Authority, Vila Real Municipal Council, Mira Municipal Council, Figueira da Foz Municipal Council. Associação para o Desenvolvimento da Viticultura Duriense (ADVID), Associação de Agricultores para Produção Integrada de Frutos de Montanha (AAPIM).

Private stakeholders include Águas do Algarve S.A., forestry industry end users (Grupo Portucel, Soporcel), SME's (Gestão Integrada de Fogos Florestais, S.A,) and organizations dealing with environmental impact assessment and ecosystem rehabilitation and renewable energy sources (PROFICO Ambiente, Prosistemas, Ecosfera, Energia Verde and Energiekontor – Parques Eólicos Unipessoal, Lda). Sogevinus Quintas S.A, Companhia Geral da Agricultura das Vinhas do Alto Douro, S.A. (Real Companhia Velha).

Sustainable Agro-food Chains

Research activities within this group will continue via close cooperation with stakeholders from different sectors of the agro-food industry. Links with stakeholders include joint participation in projects, transfer of know-how transfer, dissemination of results, development of new products and developing technological solutions.

Listed stakeholders for 2014 are: The "Amândio Galhano" Viniculture Station (EVAG) of the Comissão de Viticultura da Região dos Vinhos Verdes (CVRVV), Associação para o Desenvolvimento da Viticultura Duriense (ADVID), Associação dos Olivicultores de Trás-os-Montes e Alto Douro (AOTAD), BioBaga – Estarreja, Mirtilusa - Sociedade de Produtores Horto-Frutícolas - Sever do Vouga, Regiefrutas, Sogrape, Unidade de Investigação e Desenvolvimento - Departamento de Alimentação e Nutrição - Instituto Nacional de Saúde Doutor Ricardo Jorge, Frulact- Gemunde, Maia – Portugal, NEIKER-Tecnalia Centro de Derio, Queijos Lagos e Sabores e Ambientes Serra da Estrela, Associação Nacional de Criadores de Ovinos da Serra da Estrela (ANCOSE).

5 Dissemination & Image

CITAB will continue to promote its Cycle of Conferences on transversal themes under development within CITAB's areas of expertise. Target audiences will include the academic community, actual and potential key stakeholders and the private sector. Contributions and keynote talks will be given by CITAB and consortium members and invited experts.

CITAB will increase the outreach activities for secondary schools through a yearly program of talks aimed to promote science and research activities, and to engage the students in the Unit activities as early as possible in their academic studies. The objective is also to project the Center at a national and international level in order to gather more fellowships for research activities, which is a priority for both strands.

The most crucial event is the organization of the 10th Iberian and 7th Iberoamerican Conference on Environmental Contamination and Toxicology - CICTA. This event conferences, using the motto Environmental Sustainability, looks for Insights to the future of research of ecotoxicology and environmental contamination. It will highlight top scientific approaches, encouraging the debate on issues related to pollution and environmental toxicology within an Iberoamerican context. It will also project the investigation carried out in CITAB.

We must refer also I the outreach activities, such as the production of a movie related to the conservation of coastal lagoons. Other outreach activities will comprise Dia Aberto da UTAD, Ciência Viva and Biodiversidade and seminars promoted by local/regional entities.

CITAB will consolidate its communication office, which is responsible for the divulgation of the Unit and its researchers' activities on different levels and for different target audiences, from the general public, partners and institutions to stakeholders and industry. CITAB is expecting an increasing level of awareness for CITAB activities and its impact on society, reaching more and more different sectors of the scientific community, students and the population

6 Human resources

CITAB will maintain the number of MSc, PhD and postdoctoral students carrying out their studies at the Centre. However, the INTERACT project will allow the close involvement in the centre activity of a large number of new fellowships (with MSc. And

Ph. D. degrees). We will continue to actively encourage foreign students and researchers, in particular from Brazil, China and India, to carry out their studies at the centre.

7 Summary of metrics of scientific production for 2016

Expected scientific production for 2016:

Item	2016
Books	6
ISI Publications	63
Publications in national journals	30
Oral communications in international conferences	150
Oral communications in national conferences	60
Reports	70
Organisation of seminars and conferences	5
Doctoral theses	3
Masters theses	10
Patents	1

8 Budget

Item	%	2016
Human Resources	62	113.973€
Missions	6	10.667€
Aquisition of Goods & Services	9	25.000€
Dissemination	1	3.000€
Overheads	20	40.000€
Equipament	2	7.360€
Total	**100**	**200.000€**