



Highlights and Editorial

Globalization and internationalization are key words in business and science. We fully recognize the importance and multiple positive effects of the internationalization of science for small countries and small research centres like CITAB such as the mobility of researchers, joint research projects and joint research based publications.

Internationalization is a major goal in CITAB's Plan of Activities. We are making steady progress, but still have some way to go. This edition highlights key CITAB internationalization initiatives; China, the USA, Brasil and our neighbours in Spain provide examples of new and existing international links. However CITAB continues to develop both new and existing national cooperation initiatives.

The "Hot Topic" section of this edition describes integrated environmental research in monitoring and modeling, an area with a high level of critical mass in CITAB.

Eduardo Rosa, CITAB's Director

Cooperation with the Chinese Academy of Sciences

Two distinguished Chinese academics visited CITAB and UTAD on 2 October 2012, as part of an initiative organized by Dr. Yongning Chen (First Secretary of Science and Technology at the Chinese Embassy in Portugal), and Dr. Changhe Zhang (CITAB-SAC). Professor Zhihong Xu is an academic at the Third World Academy of Sciences (TWAS), the Chinese Academy of Sciences (CAS) and Chairman of the Chinese Society of Plant Biology. Professor Xu's research interests include plant development, plant cell culture, genetic manipulation, and plant biotechnology. During his visit Professor Xu gave a talk on the higher education, R&D and technological innovation in China. Professor Hong-Wei Xue is Director of the Institute of Plant Physiology and Ecology (IPPE), CAS, and China's National Laboratory of Plant Molecular Genetics. Professor Xue gave a presentation on the work carried out by his research groups on functional mechanisms of plant hormones and regulatory networks in seed development, signalling cross-talk in starch metabolism and endosperm development.

The visiting academics were welcomed by the Chancellor of UTAD, then attended a seminar with UTAD's Vice-Chancellor for Research and Cooperation and the Heads of UTAD's research centres. Professor Eduardo Rosa gave a talk on the centre's current situation and future perspectives, focusing on research to improve plant adaptations to climate change. There was keen mutual interest in establishing cooperation in scientific research and advanced training via joint PhD courses and post-doc training. Collaboration between CITAB and IPPE/CAS will focus on biotechnology and development of new cultivars adapted to climate change. A return visit to Peking University and IPPE, CAS, is planned before the end of this year to strengthen and consolidate cooperation.



CITAB's Director Prof. Eduardo Rosa (right), accompanied by Prof. Zhihong Xu (left) of Third World Academy of Sciences



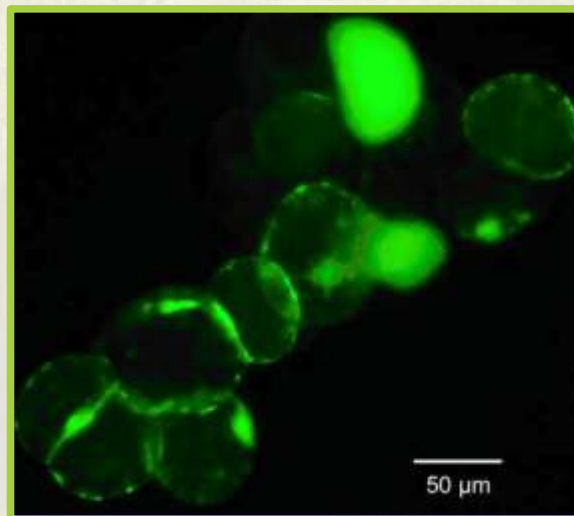
In this edition



Study of copper stress in the vineyard - a cooperation between CITAB and UCDavis (USA)

Copper-based fungicides have been widely used against several grapevine (*Vitis vinifera* L.) diseases since the late 1800's when the Bordeaux mixture was developed. However, the intensive use of these fungicides has raised phytotoxicity concerns.

Collaborative research aiming at elucidating copper impacts in the grape berry is being conducted by the CITAB team headed by Professor Hernâni Gerós (Universidade do Minho, Portugal) and Professor Eduardo Blumwald (UC Davis, USA). Professor Gerós and Viviana Martins, an FCT funded PhD student (FCT grant no. SFRH/BD/64587/2009) carried out studies on the physiological, biochemical and molecular copper uptake mechanisms and intracellular compartmentation at Professor Blumwald's laboratory during 2012. This work formed part of Viviana Martins' PhD studies as well as ongoing FCT funded research projects. Professor Gerós was supported by a Fullbright grant and Viviana Martins' visit was funded by the FCT. Results of part of these studies were recently published in the International scientific journal Plant and Cell Physiology (Martins et al. 2012. "Copper Transport and Compartmentation in Grape Cells" Plant Cell Physiol (2012). Ongoing research aims to investigate the effects of copper application on the metabolism/quality of the grape berry, which may provide important practical implications.



Grape cells labeled with the copper-sensitive probe PhenGreen™, observed under the fluorescence microscope.

Portuguese onion varieties "Branca da Póvoa" and "Vermelha da Póvoa": the effect of pre and post-harvest conditions and domestic cooking in flavonoids and organoleptic attributes

Flavonoids are a large and diverse group of polyphenolic compounds with known antioxidant effects. Extensive research is carried out on polyphenols and the factors that influence their accumulation in different types of products. CITAB researcher Dr. Ana Rodrigues recently defended her PhD study on flavonoid compound function and contribution to product quality in the Portuguese onion varieties 'Branca da Póvoa' and 'Vermelha da Póvoa' and how external factors influence flavonoid content. Results show that both genetic and abiotic factors influence the composition of onion bulbs. 'Vermelha da Póvoa', was found to be firmer and had higher levels of pungency and flavonoids than the 'Branca da Póvoa'. Total flavonoid content was higher in years with higher global radiation and lower rainfall during the growing season and in field cured bulbs. Bulbs stored in the field (traditional storage) had higher flavonoid levels than onions stored in commercial refrigerated systems.

The red 'Vermelha da Póvoa' variety, with higher flavonoid content and dormancy capacity, had superior storage capacity than white 'Branca da Póvoa'. These low-cost, energy-efficient traditional storage facilities were found to positively influence flavonoid metabolism although complementary methods were also necessary to inhibit sprouting and prevent weight loss. Studies on cooking treatments revealed that the greatest losses of flavonoids occurred in boiled onions. The findings of Dr. Rodrigues thesis provide a foundation for further work on ecotype improvement programmes, epidemiological studies and health promotion programmes.



Curing and storage system of onions by traditional methods in Póvoa do Varzim-Esposende region



Zeolite can improve chestnut growth in water limited areas

Zeolites are hydrated aluminosilicate minerals, characterized by a high surface area and high cation exchange capacity. The aluminium and silica arrangement in zeolite form a stable, open three dimensional honey-comb structure that can occupy up to 50% of its volume, providing a large surface area on which chemical reactions can take place. Zeolites can absorb large amounts of materials, such as ions, water or gas molecules. These properties can be applied to significantly decrease irrigation intensity in agricultural systems, especially in regions that are water limited.

CITAB researchers José Gomes Laranjo and Changhe Zhang and the masters students Américo Guedes and António Gonçalves carried out a study to assess the effects of the clinoptilolite, a form of zeolite (Fertisol®) on chestnut growth. This study which was run between 2010 and 2011, was supported by the stakeholder Ana Antunes S.A.. Plants treated with clinoptilolite had higher mineral content (nitrogen and potassium) and exhibited a notable increase in net photosynthesis and transpiration rates.

The results of this study indicate that the application of clinoptilolite during planting or in young groves had a positive effect on water retention and that further studies that adjust the amount of zeolite may optimizes plant growth, not only for chestnut, but also for other species typically cultivated in regions with strong water limitations such as grapevines, olive trees or almonds since they are.



Course "Forest Health and Climate Change"

The worldwide increase in greenhouse gases is widely cited as the main causes of climate change, with direct global impacts on ecosystems and socio-economic sectors. These changes often favour biotic agents, which can worsen the condition of trees, resulting in considerable forest damage.

With this highly relevant topic in mind, UTAD in collaboration with CITAB, organized the course "Forest Health and Climate Changes", which ran from February 15th to March 29th, 2012. The course structure comprised seminars and theoretical and

practical training, aiming to improve scientific and technical skills by providing in depth knowledge of the abiotic and biotic factors causing plant decline. A total of 18 graduate and master students participated, with backgrounds in Forestry, Agricultural, Ecology, Biology and Landscape Architecture. The course's seminars were given as open sessions, allowing UTAD and CITAB's scientific community to participate and discuss the topics under analysis.

Lectures were given by academics from the Department of Forest Sciences and Landscape Architecture at UTAD and Professor Tom DeGomez of the School of Natural Resources and the Environment, the University of Arizona, USA. Professor DeGomez has extensive research experience in monitoring the decline of forests in Southwest Arizona (USA) where he collaborates with state and private agency resource specialists in detecting and evaluating severity of decline, determining treatment, and implementing measures to treat emerging insect infestations, disease epidemics, invasive plant introductions, and other types of disturbance. The ultimate aim of these measures is the restoration of forest systems damaged by these agents.

The course provided an excellent opportunity for strengthening collaborative links between UTAD/CITAB and the University of Arizona.



Prof. DeGomez and Prof. Luís Martins examining ornamental trees



Practical lesson on tree surgery



Seminars & Cooperation

CITAB researchers provide training at the University of the Algarve

CITAB (EcolIntegrity) researchers Dr Samantha Jane Hughes and Professor Simone Varandas, gave a 3 day introductory course on the Identification of Freshwater Benthic Macroinvertebrates of the Rivers of the Algarve at the University of the Algarve (UAlg), between the 18th and 20th of October 2012. The workshop was organized by UAlg colleagues Prof. Luis



Course participants sort macroinvertebrate material for identification

Chicharo, Dr. Radhouan Ben-Hamadou and Dr. Pedro Range as part of the European project "IMPACT - Developing an Integrated Model to Predict Abiotic habitat ConDiTions and biota of rivers". This project aims to develop and couple different models to predict the abiotic habitat conditions, species dispersal, and species assemblages under different anthropogenic pressures scenarios, including Climate Change, operating at different spatial scales and how this would affect the viability of river restoration measures. The invited CITAB-EI researchers worked with 19 graduate students and IMPACT project participants over three days, providing hands on guidance and tips on how to sort and identify freshwater macroinvertebrates from the intermittent Mediterranean river

systems that are typical of the Algarve Region. The workshop was considered a great success and will hopefully be repeated next year as part of the UAlg and CITAB collaborative protocol for developing research and teaching initiatives.



Seminar - Biomechanics, Health and Sustainable Environment

The "Biomechanics, Health and Sustainable Environment" seminar was held on the 3rd May 2012 at the Central Auditorium of UTAD's Library. The seminar provided a forum for discussing state of the art developments on the association between sustainable environmental biomechanics and green health care development. Over 140 participants attended the seminar including collaboration and participation of several academic and professional organizations from Portugal, Spain and Brazil. Graduate and postgraduate students from a variety of backgrounds gave

presentations of their work carried out under the guidance of experienced scientists and researchers. The seminar resulted in a development strategy to promote sustainable production chains of natural products, provision of ecosystem services and public goods to improve quality of life and human health.

Cooperation with Brazil: mobility of researchers

Two Brazilian doctoral students are carrying out research at CITAB as part of their CAPES funded sandwich course. Kedma Silva Maria Pinto (Federal University of Paraíba) is studying "Bioactive substances, extracted from wild plants in Brazil, with the potential to induce defense mechanisms in plants against plant pathogenic", as part of the SAC project "Agronomy, climate change and environmental studies." She will conduct research for six months started in October 2012. Taynan Henriques Tupinambás (Federal University of Minas Gerais) is studying the "Ecological effects of flow changes in macroinvertebrate communities: ecological parameterization of environmental flows", as part of the EI project "Biodiversity, biotechnology and environmental assessment". Taynan has been comparing how macroinvertebrate taxonomic data, metrics and traits can be used to detect community level changes under different operational flow regimes at sites situated downstream of the Itutinga Reservoir on the Rio Grande, a highly regulated river in Minas Gerais. Taynan will be leaving in December after a productive 9-month stay.



International Meeting on Biology and Conservation of Freshwater Bivalves

CITAB was co-organizer of the "International Meeting on Biology and Conservation of Freshwater Bivalves" which took place at the Agricultural School of Bragança Polytechnic Institute 4th-7th of September. About 120 participants, including international experts in biology and conservation of freshwater bivalves attended the event. Invited keynote speakers were Dr. Arthur Bogan (North Carolina Museum of Natural Sciences, USA), Dr. Christopher Barnhart (Missouri State University, USA), Dr. David Aldridge (University of Cambridge - United Kingdom), Dr. David L. Strayer (Cary Institute of Ecosystem Studies, USA), Dr. Jurgen Geist (Wildlife Biology & Wildlife Management Unit, Germany), Dr. Mary Seddon (Director of IUCN Mollusc Specialist Group, UK) and Dr. Rafael Araujo Armero (Museo Nacional de Ciencias Naturales, Spain). Sessions were held on bivalve biology and ecology, conservation and threats to species and ecosystems, invasive species, phylogeny and phylogeography, systematics and taxonomy, physiology and reproduction and freshwater bivalves and ecosystem function. A "knowledge network" was created to guide development for collaborative projects and directives for bivalve protection and conservation. Populations of the protected freshwater pearl mussel *Margaritifera margaritifera* were observed on a field trip to Montesinho Natural Park.



"Ciência Viva" – Living Science pastimes for youth during the Summer Holidays

This year CITAB offered two youth oriented scientific pastimes during July 2012. The first pastime, entitled "Evaluation of cellular proliferation using animal cell lines in culture", was coordinated by Professor Amélia M. Silva, Professor Dario Santos and Tatiana Andreani B.Sc. between the 2nd and 6th of July. The students Diana Dinis, Pedro Martins and Miguel Monteiro, from Tondela, Lisbon and Mesão Frio respectively, participated in a study of the effect of natural bioactive compounds with anti-proliferative properties from plant extracts on cell viability and proliferation rates. The second scientific pastime "Yeast from floral nectar" ran from the 16th to the 20th of July and was coordinated by Professor Ana C. Sampaio. The students Diana Dinis and João Coimbra, both from Viseu, participated in a field trip to Alvão Natural Park to collect flowers and subsequent laboratory work to isolate and culture yeasts from the collected flowers. Both students also accompanied other CITAB's research projects, namely "Food composition and health effects" and "Application of microorganisms in biotechnology and in nutrient cycling".

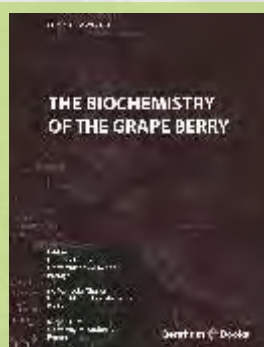


Prof. Dario Santos and Prof. Amélia Silva with "Ciência Viva" students

Recent Publications



In collaboration with ADVID – Associação para o Desenvolvimento da Viticultura Duriense, CITAB members João Santos and Aureliano Malheiro published the book "A Climate Assessment for the Douro Wine Region: An Examination for the Past, Present and Future conditions for Wine Production". The book is a result of research carried out as part of "Climate variability and environmental impacts" task undergoing on the research projects of the Sustainable Agro-food Chains CITAB's Group.



Written by CITAB member Hernâni Gerós and other 2 editors, the on-line book "The Biochemistry of the Grape Berry" was recently published. The book gives a focused and integrated overview of the key biochemical and molecular aspects of grape berry development and ripening. The comprehensive range of topics covered in this e-book is valuable to a multidisciplinary readership including plant physiologists, enologists, microbiologists, wine makers, biochemists and students.



EcolIntegrity – monitoring and modelling towards improving the Environment



CITAB researchers and scholarship students carry out electric fishing surveys in the field

Man's activities cause profound changes in the natural environment and can lead to the loss of vital ecosystem services and biodiversity. EcolIntegrity (EI) research focuses on the abiotic and biotic characterization, monitoring, modelling and restoration of natural or anthropogenically altered terrestrial and aquatic ecosystems. Research is carried out at different spatial scales of observation, ranging from the microhabitat, to the catchment or even the geographical region. Results from these studies are used to assess and select appropriate indicators or ecosystem processes that allow EI researchers to monitor different ecosystem component dynamics, develop models to assess how different scenarios could affect altered ecosystems or patterns of biodiversity and define guidelines for ecosystem or natural resource management at local,

regional and national scale. An effective monitoring system is only as good as the quality of the data it is developed upon and the accuracy of the measurable change of candidate indicators across environmental quality gradients. This paradigm is particularly relevant for aquatic ecosystems, which under the European Water Framework Directive (WFD), must be assessed using biological indicators. Selected EI researchers actively collaborate with and advise regional and national stakeholders, resource managers and governmental organisations on implementation of the WFD.

Developing an Integrated Monitoring Methods for Assessing River Systems

The FCT funded interdisciplinary EI project "River Biomonitoring – an integrated approach" (PTDC/BIA-ECS/114859/2009) aims to improve sensitivity and the precision in the detection and quantification of the impact of multiple stressors in the lotic environment by integrating monitoring techniques that embrace sub-cellular and cellular observation (biomarkers), community level processes (bioindicators) and ecosystem functional processes (decomposition). Four FCT funded masters research fellowship students are working on this project in collaboration with EI researchers. The integrated and interdisciplinary approach of this project overcomes the fragmented application of separate techniques by testing and developing metrics and indices that will better reflect ecologically relevant cause-effect associations. The findings of this project are highly relevant for aquatic resource managers who need easily comprehensible scientific information on aquatic ecosystems for sustainable catchment planning.



CITAB researchers carry out riparian and aquatic macrophyte surveys in the field

Preliminary findings from the first year of the project were presented at the XVIth Congress of the Iberian Society of Limnology which took place in the city of Guimarães, Portugal (2 - 6 July 2012).[see text box]

XVIth Congress of the Iberian Society of Limnology, Guimarães, Portugal (2 - 6 July 2012).

Oral: Effects of pollution on leaf-litter breakdown in low-order streams. Lopes M, Sampaio A, Varandas S, Hughes SJ, Cortes R (Department of Biology and Environment, CITAB-UTAD, Vila Real, PT)

Oral: Assessing stream macroinvertebrate responses to multiple pressures. Cortes R, Hughes S, Varandas S, Pereira V, Santos C, Pinto A and Jesus J (CITAB-UTAD, Vila Real, PT)

Poster: Pinto AL, Pereira S, Cortes R, Fontainhas-Fernandes A, Coimbra A and Monteiro S Biomarkers evaluation in fishes of the Ave River. (Departamento de Ciências Florestais e Arq. Paisagista, CITAB-UTAD, Vila Real, PT)

Poster: Pereira V, Rocha R, Varandas S, Hughes SJ, Jesus J, Santos C, Pinto A, Martins J. Estado das massas de água das regiões hidrográficas do Norte (RH1 e RH2) e medidas de requalificação (CITAB-UTAD, Vila Real, PT)



Modelling the effects of environmental change – EI researchers lead the way

EI researchers are recognised leaders in the development and application of The Stochastic Dynamic Methodology (StDM), a sequential modelling process that uses a mechanistic understanding of holistic ecological processes to predict impacts of anthropogenic activities in the ecological status of ecosystems. StDM output allows preventative management strategies to be developed and implemented. EI researchers have been testing, applying and improving StDM for different scenarios for almost a decade. Advances as well as limitations have emerged from the different ecological contexts, scales and target organisms or communities. StDM has been successfully applied, tested and validated in agro-ecosystems, mountain streams and reservoirs, estuaries, wildlife conservation, bird survey testing, fire effects in forest ecosystems, wind farm impacts assessment, peri-urban patch ecosystems and exotic plants invasion patterns. [see text box]

In the most recent published article a new framework combining StDM dynamic models with spatial models was tested to predict the evolution of populations of the endangered Azorean endemic bullfinch *Pyrrula murina* in face of changes in land use (Fig. 1). Results clearly contribute to the development of management strategies for conserving areas of remnant native laurel forest and the endangered bird population.

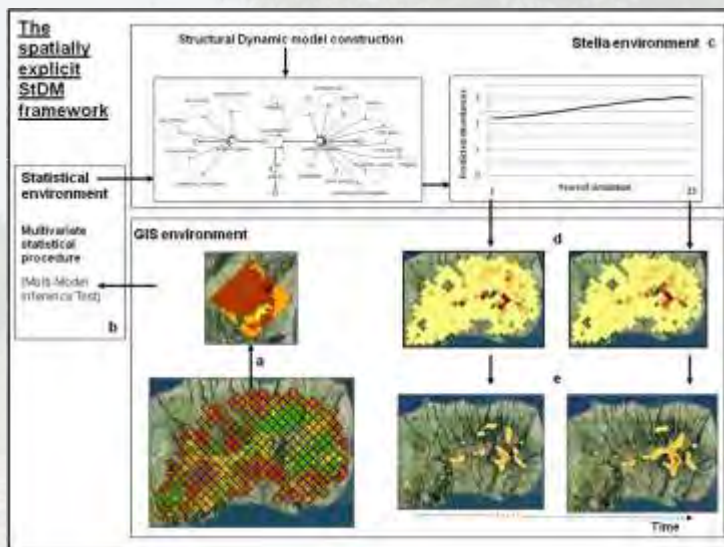


Fig.1- The spatially explicit StDM framework for the Azores bullfinch abundance (PRIOLO) forecasting: (a) the previous analyses of landscape and main habitats in each study unit; (b) the statistical analysis to define the convenient parameters that contextualize the physical and habitat descriptors at the study unit level; (c) the construction and simulations of the structural dynamic and stochastic dynamic model (StDM) at the study unit level; (d) the projection of the resultant stochastic dynamic simulations into a geographic plane; (e) the final geostatistical interpolation that create an interactive and integrative picture, in space and time, at regional level.

Stochastic Dynamic Methodology – CITAB's most recent publications

Terrestrial Systems

Santos M., Freitas R., Crespi A., Hughes S. & Cabral J. A. (2011) Predicting trends of invasive plants richness using local socio-economic data: An application in North Portugal. *Environmental Research* 111, 960-966.

Santos M. & Cabral J. A. (2011) Simulating the effects of anthropogenic disturbances in landscape patches: an application in North Portugal. *Applied Ecology and Environmental Research* 9(2): 101-122.

Bastos R., Santos M., Ramos J., Vicente J., Guerra C., Alonso J., Honrado J., Ceia R., Timóteo S. & Cabral J. A. (2012) Testing a novel spatially-explicit dynamic modelling approach in the scope of the laurel forest management for the endangered Azores bullfinch (*Pyrrhula murina*) conservation. *Biological Conservation* 147(1): 243-254.

Aquatic Systems

Cabecinha E., Cortes R., Pardal M. A. & Cabral J. A. (2009) A Stochastic Dynamic Methodology (StDM) for reservoir water quality management: Validation of a multi-scale approach in a south Europe basin (Douro, Portugal). *Ecological Indicators* 9 (2): 329-345.

Cabecinha E., Lourenço M., Moura J. P., Pardal M. A. & Cabral J. A. (2009) A multi-scale approach to modelling spatial and dynamic ecological patterns for reservoir's water quality management. *Ecological Modelling* 220, 2559-2569.

Hughes, S. J., Cabecinha, E., Andrade dos Santos, J. C., Mendes Andrade, C. M., Mendes Lopes, D. M., da Fonseca Trindade, H. M., dos Santos Cabral, J. A. F. A., dos Santos, M. G. S., Lourenço, J. M. M., Marques Aranha, J. T., Sanches Fernandes, L. F., Morais, M. M., Mendonça Leite, M. S., de Oliveira, P. C. R. C. and Cortes, R. M. (2012) A predictive modelling tool for assessing climate, land use and hydrological change on reservoir physicochemical and biological properties. *Area* 44(4):432-442.



Short notes

CITAB Board, Executive Committee and Members meet with the External Advisory Committee

CITAB's External Advisory Committee met for the second time with the Board, Executive Committee and Members to discuss the Centre's progress since the first meeting held in January 2010.

Comprising Jean-Marc Chourot, Gregorio Antolín Giraldo and David Gordon Lindsay CITAB's External Advisory Committee provides guidance and makes recommendations for meeting national and international scientific excellence. The Advisory Committee's first report, following their first meeting with CITAB members in January 2010, made a number of recommendations for improving research output, which mainly related to streamlining CITAB working group aims, objectives and tasks and making inroads concerning contact and collaboration with stakeholders.



David Gordon Lindsay and Gregorio Antolín Giraldo

The day long meeting, held on September the 10th 2012, comprised a series of closed and open meetings where a series of presentations were given divulging measures that had implemented to improve CITAB's progress and discussing future strategies. The External Advisory Committee's second report is available on CITAB's website. The findings of the report forward recommendations in five key areas, namely improve international visibility in CITAB's 3 main groups, ensuring greater scientific coherence within the Groups, increasing scientific productivity (through publications in JCR journals), increase collaboration with stakeholders; and increasing human resources to obtain a critical mass in all areas.

"Science at Lunchtime" kicks off for 2012-2013

CITAB continues to hold the "Science at Lunchtime" meetings. Talks or visits given by CITAB members during these sessions bring together the centre's researchers in an informal setting to share and discuss ideas. The first of the academic year 2012 – 2013 was "Methodology for assessing the ecological status and requalification measures on the River Corgo – Project SeivaCorgo" given by the Master's student Diana Coelho on 10th October 2012. The talk, based on results from extensive fieldwork and analyses of environmental and biological data carried out as part of the SeivaCorgo project and Diana's Master's thesis, showed (i) how the ecological status along the River Corgo was derived, using Water Framework Directive Compliant protocols and (ii) how habitat preference curves of indigenous cyprinid can be used in rehabilitation projects. Diana will defend her thesis in November 2012.

Location and contacts

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Job Opportunity - Post Doctoral Research Position (Agricultural Sciences)

Under the terms of the "Compromisso com a Ciência" Programme, funded by FCT, CITAB invites applications for one full-time research fellow position (with PhD in Biochemistry).

The applicant will focus on the identification and development of added-value co-products with anti-oxidant, antifungal, anti-parasitic and anti-cancer activities from selected Portuguese plants and residues derived from major food plants. This will be an opportunity to develop novel and economically-valuable research within the framework of national and international networks.

Deadline for Application

For full consideration all documents must be received by 14th December 2012. More information at: <http://www.eracareers.pt>



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