Coimbra Master in Ecology (ME)
&
International Master in Applied Ecology (IMAE)

Reseach topics & Supervisors
2021

Junho 2021

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FACULDADE DE CIÊNCIAS E TECNOLOGIA
UNIVERSIDADE D COIMBRA

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DEPARTMENT OF LIFE SCIENCES
FACULTY OF SCIENCES AND TECHNOLOGY
UNIVERSITY OF COIMBRA

This document has been assembled to help prospective students to get in touch with potential supervisors that match their interests. You can use this list to approach several potential supervisors and discuss these or other research ideas you want to develop during your dissertation.

This document will be updated yearly. For any correction please contact the course coordinator: rheleno@uc.pt

Índex

28. Genetically inherited tolerance to acid mine drainange by an impacted zooplankton population: a recessive trait?

29. The value of second broods in **hole-nesting birds** in a Mediterranean habitat in a climate change scenario

30. Recolonisation as an ecologically relevant and **ethical alternative to fish lethality** for chemicals registration

31. Seed coating with plant beneficial **microbes in agroecology**

32. Valorisation of **"Sargaço" as a fertiliser**

33. The effect of **slash and burn treatments** on the regeneration of *Hakea sericea* and *Acacia dealbata*

34. Genomics and quantitative genetics of **vocal learning** in Harzer Roller canaries

35. **Fish-Omics**: Unveiling fish nutritional quality by NMR-Metabolomics

36. Protection of **estuarine native fauna** – Testing innovative methods

37. MicroaLiBi - Microalgal Lipid Biosynthetic potential

38. Are tracheids better than **tree rings** when it comes to detecting climate change?

39. Assessing **effects of bio-pesticides** in non-target terrestrial organisms

40. Land use and land management effects on **soil fauna** and their ecosystem services

41. Plant-**parasitic nematodes** - a threat to Mediterranean agriculture

42. Tools for the ecological assessment of **rivers**

43. Biological control of plant pathogens

44. Searching for **pinewood nematode** pathogenic determinants

45. Pelagic **seabirds** as sentinels of Ocean health

46. AquaCSI - **AquaCulture** using Stable Isotopes

47. Dynamics of plant growth promoting rhizobacteria and arbuscular mycorrhizal fungi associated with **hyperaccumulator plants**

48. Exploring **bionematicides** delivery systems against root knot nematodes

49. Biological control of the invasive Acacia longifolia

50. Heartworm disease in Coimbra: a case study

51. How does **(micro)plastic pollution** affect coastal and marine ecosystems?

52. Toxicity bioassays of **nanoplastics** to model stream biota

53. How does **climate change** affect soil functioning in drylands?

54. Soil fauna of Gorongosa: a biodiversity and ecological survey on soil meso and macrofauna

55. Identifying cohort-specific **growth** variability in juvenile **flatfishes**

56. Can landscape topography affect the interpretation of **honeybee "waggle dances"**?

57. Characterization of the **bacterial diversity** inhabiting **extreme environments** such as deep-groundwater, biofilms and lava tubes

1. Antarctic food webs research: Assessing the role of Antarctic organisms in a climate change context

Contact:

José Xavier (jxavier@zoo.uc.pt) http://cientistapolarjxavier.blogspot.com/
https://www.youtube.com/playlist?list=PLB2RIlbJSkyLS4KUdVrtDC3fkCTkGuS9d

Research group: **EcoTop** - Ecology and Conservation of Top Predators
https://www.facebook.com/ecotop.mareuc/

WATCH IT ON YouTube **https://youtu.be/x_qBcjCMMWk**

Description:

The Antarctic strongly influences the global climate, harbours unique and diverse biological communities. Seabirds, marine mammals and other organisms are often cited as sentinels of ecosystem change, this is because they integrate biological and environmental variability across spatial and temporal scales and across various trophic levels.

As part of international research programs, the project contributes a piece of the puzzle of the key question "How are the structure and key functioning processes of Antarctic Ocean from a conservation perspective", particularly on the feeding ecology and population dynamics of penguins, seals, albatrosses, squid, fish and zooplankton under a climate change context. Research work will focus on collecting and/or analysing samples from these organisms), using a range of methods (e.g. stable isotopic analyses, trace metals, modelling), to assess the role of certain species in Antarctic Peninsula and adjacent areas. To achieve this, work will be carried out at the University of Coimbra and/or at the British Antarctic Survey (Cambridge).

The most important characteristic is that the students are genuinely interested in marine ecology, used to work hard in the lab. and in an independent way to answer ecological questions. The student will get familiar with scientific techniques while learning application of them to conservation (when possible).

2. Sensors for **real-time monitoring** of water quality for predictive management

Contact:

Paulo Rocha (procha@uc.pt) www.greenproject.pt

Description:

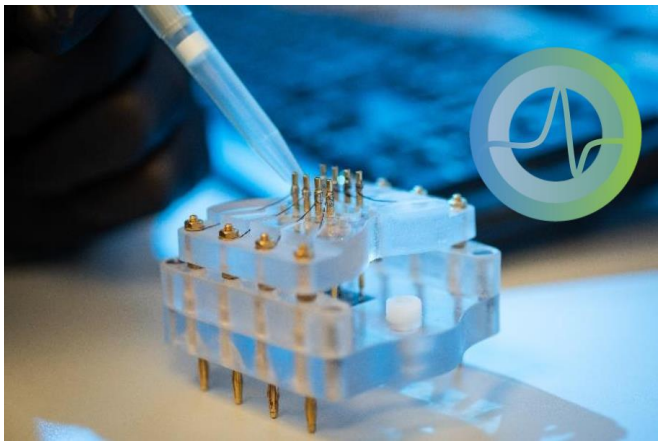
Harmful algae blooms in water supply reservoirs must be eradicated due to unwanted toxin production and filter blocking at water treatment works. Until now there has been no efficient consensus that harmful microorganisms, prevailing in water reservoirs, such as diatoms and cyanobacteria, communicate with each other and no accurate and self-sustained tool to monitor such communication.

Our group recently discovered that the electrical communication of microorganisms can be recorded extracellularly by means of a unique measurement setup based on low impedance electrodes. Their low impedance allows low frequency measurements of the whole population of cells, with improved signal-to-noise ratio. We have previously investigated Pseudo-nitzschia fraudulenta, given their ecological importance as a harmful algae bloom (HAB) forming species.

One key finding of our work was that the electrical response of diatoms was responsive to an external stress such as light deprivation and temperature. Our results indicate that a population of diatoms cooperatively engage into quasi-periodic spikes. These findings could open a new page in the understanding of algal signalling and enable novel sensing technologies to predict the development of algae blooms and of an extensive range of stress-induced alterations in the aquatic ecosystem. The overarching aim for this multidisciplinary master project will therefore be to determine if measurements of cell signalling and adhesion indicate periods when HAB taxa productivity is enhanced and hence acts as an early warning for high productivity as well as for the early onset of filter clogging by diatoms and cyanobacteria - occurring in water supply reservoirs.

The two main objectives are:

- Objective 1: Devise an electrochemically stable transducer for microalgae and cyanobacteria long term electrical monitoring;
- Objective 2: Characterize the electrical signals from different types of microorganisms at different growth stages and stress conditions.



3. Plant diversification and sympatric speciation through polyploidization processes

Contact:

João Loureiro (jloureiro@bot.uc.pt)

Sílvia Castro (scastro@bot.uc.pt)

Research group: **FLOWer Lab**
https://www.facebook.com/cfeFLOWerLab/

Description:

Polyploidy, i.e. whole genome duplications, is a widespread process in flowering plants and has long been considered as a major mechanism of sympatric speciation. After new polyploid emergence theoretical models predict that its establishment is restricted by strong negative frequency-dependent selection, and thus, neopolyploid success is conditioned by its advantage when compared with its progenitors, otherwise it will be eliminated from the population. Although the importance of this mechanism in speciation processes, only a few studies were focused on the ecological requirements of neopolyploids. Therefore, in the FLOWer Lab we explore the ecological and evolutionary consequences of genome duplications and the factors affecting the establishment and persistence of new polyploids using a diploid-tetraploid complexes. We employ innovative multidisciplinary approaches that consider reproductive and ecological traits of diploids, neopolyploids (already synthesized) and established polyploids.

4. Are you singing to me? Birdsong communication and development

Contact:

Paulo Gama Mota (pgmota@uc.pt)

https://cibio.up.pt/people/details/pjgmota

WATCH IT ON YouTube **https://youtu.be/kf5TyBwXTpk**

Description:

Birdsong is one of the most conspicuous forms of animal communication, which has caught the attention of humans since early times. The song of birds can have functions of territory defence or mate attraction. We know that the songs of male serins (S. serinus) have both a mate choice function (with females preferring the highest pitched songs), while they also function in male-male interactions. We have been using this model animal to test evolutionary questions related with the evolution of signals.

I am currently developing a number of different projects around the function, communication system and development (genes vs environment) of birdsong. Besides, we started to perform some experiments on cognition in loosely social small birds.

Those interested in animal behaviour, particularly in birds, can contact me.

5. Sensitivity to pesticides across different life stages of amphibians

Contact:

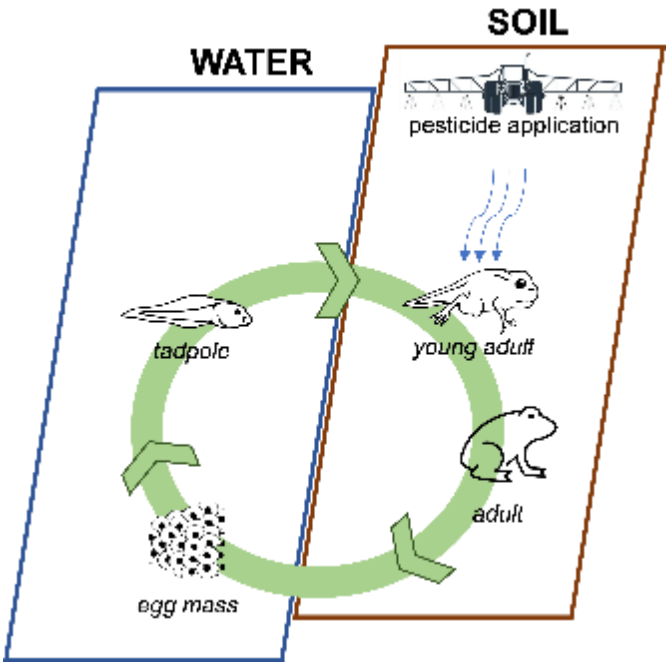
Rui Ribeiro (rui.ribeiro@zoo.uc.pt) https://publons.com/researcher/2743232/rui-ribeiro/

Isabel Lopes (ilopes@ua.pt) www.cesam.ua.pt/ilopes

Cátia Venâncio (catiavenancio@gmail.com) https://www.cienciavitae.pt/portal/A111-9781-C943

Description:

Anthropogenic pressures (e.g. pesticides) are a major cause contributing to amphibians' global decline. Until recently the risk posed by pesticides to amphibians was extrapolated from data generated for fish (for the aquatic life stages), mammals and/or birds (for the terrestrial life stages). While for some groups of pesticides the existing toxicity data suggests that fish may not accurately protect aquatic life stages of amphibians, such an association is difficult to establish for the terrestrial life stages due to the lack of toxicity data. Amphibian's exhibit a skin that is highly vascularized, as it plays an important role in respiration, being permeable to gases and other chemicals in the surrounding environment, whilst facilitating the uptake of chemicals through dermal exposure. This is of particular relevance in the terrestrial life stages of amphibians, which commonly inhabit agricultural areas near aquatic systems, where they can be exposed directly to pesticide when overspray takes place or through contact with already contaminated soil. Considering the above, this work aims at assessing the toxicity of pesticides across aquatic and terrestrial life stages of amphibians. For this, experiments will be performed by exposing embryos, tadpoles and juveniles of the amphibian species *Pelophylax perezi* to different pesticides, in order to provide novel insights on pesticides regulatory frameworks and amphibians conservation action plans. This will work will be carried out in collaboration between the University of Coimbra and University of Aveiro. It is also aimed to endow the student with field and laboratorial skills, as well as writing skills that will allow him/her to publish in a peer-reviewed journal.



6. Assessment of **ecosystem services** of agriculture and forests

Contact:

Paula Castro (pcastro@ci.uc.pt)

Research line of CFE – Societies and Environmental Sustainability
http://cfe.uc.pt/profile/lines/7

Description:

If you are interested in issues related to the sustainability and resilience of agricultural systems and forests, come and discover more about potential research projects for your Master's thesis. We want to commit to a productive agriculture that satisfies societies' food needs, but at the same time promotes its ecology and the conservation of biodiversity (plant and animal) and its multiple services.

Our research is also focused on understanding the services provided by forest ecosystems and how we may strengthen their multifunctionality and sustainability.

The relationship with the various stakeholders that interface with these systems is another key topic. The involvement of local communities and local actors in the development of sustainable strategies for agricultural and agroforestry exploitation is essential in our research.

You may explore research topics as:

Mapping cultural ecosystem services of agriculture landscapes

Mapping ecosystem services of forests

Biodiversity and ecosystem services in agroecosystems: ways to go!

And much more…

In these research projects you can join a multidisciplinary team with experts from the natural and social sciences!

7. Looking for viral RNA of SARS-CoV-2 in environmental matrices collected during the third Portuguese wave of the Covid-19 pandemic

Contact:

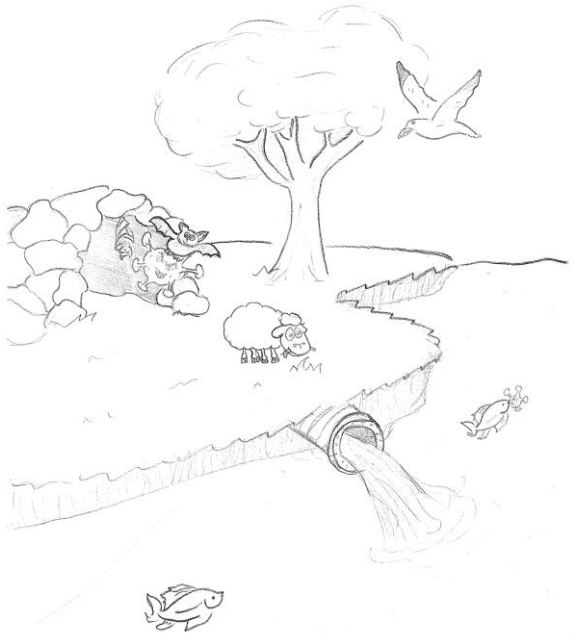
Elsa Teresa Rodrigues (etrodrig@uc.pt)

Research group: **Marine Research Lab**
http://cfe.uc.pt/profile/lines/3

Description:

We are looking for a highly-motivated MSc student with a strong interest in aquatic ecotoxicology. The student will join the Marine and Coastal Ecosystem Research Group at the Centre for Functional Ecology (CFE), Department of Life Sciences, University of Coimbra, and will work under the supervision of the researcher Elsa Teresa Rodrigues (FCTUC-DCV) and co-supervision of Professor Ana Miguel Matos (FFUC).

Even though new data are emerging every day, there is still very limited knowledge of the ecology of the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and its strains in nature. Hence, a study was designed to support the "One Health" approach, which recognizes that the health of people is closely connected to the health of animals and our shared environment, to obtain reliable data that characterizes the occurrence of SARS-CoV-2 genetic material in environmental samples (wastewater, sediment, animal faeces) collected during the third Portuguese wave of the Covid-19 pandemic. Consequences will also be studied in the context of human exposure via food items, as mollusc bivalves and fish were also sampled. Gathered data are, thus, fundamental to our understanding of SARS-CoV-2 trends in nature and to the clarification of the possible role of the environment in the spread of this virus.



8. Non-crop *Solanum* - *Meloidogyne* interactions

Contact:

Isabel Luci Conceição (luci@zoo.uc.pt) http://cfe.uc.pt/profile/members/1589

Clara Santos (clara.santos@bio.uminho.pt) https://cbma.uminho.pt/people-detail/?userid=183

WATCH IT ON YouTube **https://youtu.be/VS6qindLLZ8**

Description:

Plant parasitic nematodes (PPN) especially root-knot nematodes (RKN, Meloidogyne spp.) and potato cyst nematodes (PCN, Globodera spp.) are globally distributed plant pathogens that cause loss of function, leading to significant yield losses. Although RKN are polyphagous, potato, Solanum tuberosum, is becoming more infested by this genus, and RKN damage to this crop is particularly evident in protected culture. The presence of both RKN and PCN in the same field is becoming more frequent. More environmentally friendly control methods are required as an alternative to chemical nematicides. In UK and Holland, a trap crop, Solanum sisymbriifolium, is being used for several years to control PCN, with promising results. The plant is resistant to both species of PCN and to some RKN species; it promotes PCN hatch and can reduce densities of nematode populations in the soil. However, as a non-native plant, its introduction must be controlled. Other plants already present in some regions of Portugal may exhibit similar resistance, namely S. linnaeanum. The behaviour of infective juveniles of the four most common RKN species (M. arenaria, M. hapla, M. incognita and M. javanica) in the rootzone of plants of S. sisymbriifolium cvs. and S. linnaenum accessions will be assessed by in vitro tests. Successful interactions will be further explored in host reaction tests in pot assays in controlled conditions. Knowledge acquired on non-crop Solanum species-plant parasitic nematode interactions will contribute to the development of sustainable methods of management of plant-parasitic nematodes in agriculture in order to reduce dependence on nematicides and improve crop productivity and food quality.

9. Conservation of biodiversity in the genomics era

Contact:

Luís Cunha (luis.cunha@uc.pt) http://cfe.uc.pt/profile/members/1809 http://luiscunha.xyz/

José Paulo Sousa (jps@zoo.uc.pt) http://cfe.uc.pt/profile/members/1621

Research group: **SEEL** - Soil Ecology and Ecotoxicology Laboratory
https://www.facebook.com/labsolos/

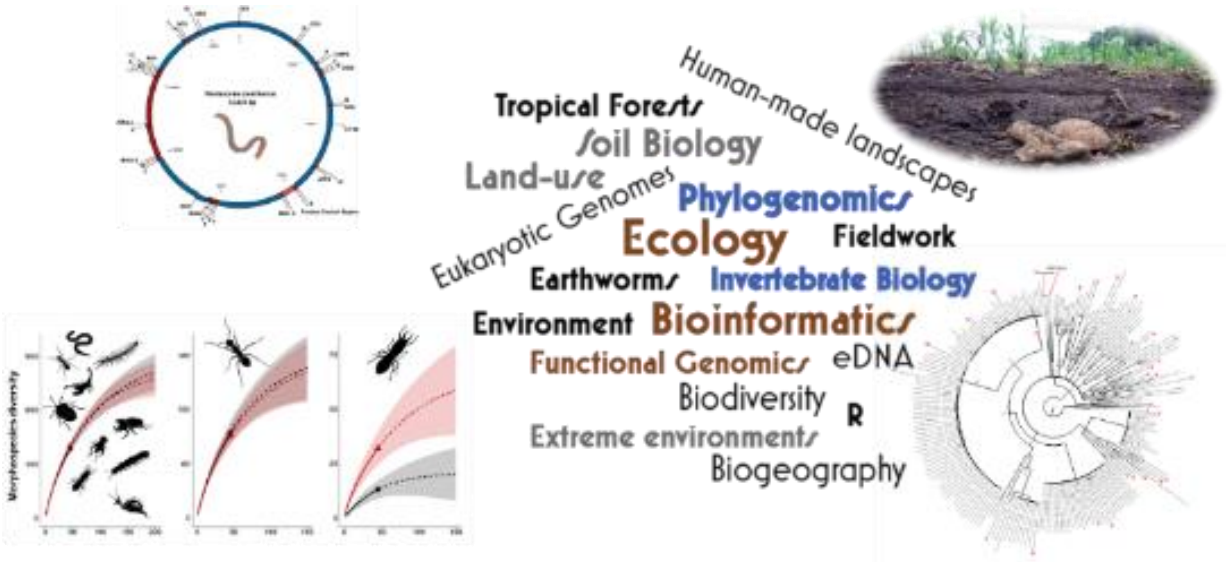
Description:

Several projects available

"Conservation genomics" englobes the assumption that genome-scale data allow us to protect any given species with an inherent conservation value. Genetic approaches have long been used in conservation biology, however with the recent advances in sequencing technologies, genome-wide data become available allowing an unprecedented scale of useful information. Your project will involve genome-scale data to inform ecological and evolutionary questions for a chosen species (in the face of admixture, identification of adaptive alleles, and informed conservation guidelines in face of inbreeding). This project is well-fitted for someone with a profound interest in contributing to the conservation of a species but also keen in learning wet-lab techniques and bioinformatic approaches. The same techniques can be applied to other contexts, and there is also an interest in understanding the colonisation patterns of invasive species (see below a range of titles for different possible projects). Additionally, several of these projects can use previously generated genomic data for a pure in silico approach (bioinformatics-based). I will be happy to discuss a range of project possibilities.

Some Possible Research Topics: http://luiscunha.xyz/research/

Discord Channel: https://discord.gg/enzpbg



10. Spatial and foraging ecology of waterbirds in relation to human stressors

Contact:

Jaime Ramos (jramos@ci.uc.pt) http://www.mare-centre.pt/en/user/68

Ana Cláudia Norte (aclaudia.norte@gmail.com) http://www.mare-centre.pt/pt/user/45

Vitor Paiva (vitorpaiva@uc.pt) http://www.mare-centre.pt/pt/user/137

Research group: **EcoTop** - Ecology and Conservation of Top Predators
https://www.facebook.com/ecotop.mareuc/

WATCH IT ON YouTube **https://youtu.be/FPay7bGmYs0**

Description:

Coastal areas are exposed to anthropogenic stressors, such as human disturbance, pollution and overfishing, which cause a loss of biodiversity and ecosystem services. Estuarine and coastal waterbirds are top predators that are usually used as indicators of ecosystem health, since they are sentinels of changes occurring at lower trophic levels. However, appropriate management measures require information about the impact of human stressors in breeding success and exposure to different contamination levels, and in shaping the spatial and foraging ecology of top predators.

This project will address the impact of different stressors in the spatial, foraging and reproductive ecology of estuarine and coastal waterbirds, with a view to contribute for their conservation and the management of coastal marine reserves: 1) GPS loggers will be placed on Little Terns (Sternula albifrons) to evaluate its spatial ecology in relation to human disturbance, because this species is very sensitive to the presence of humans. 2) Shorebirds (avocets, stilts and plovers) and coastal seabirds (gulls) are exposed to plastic pollution, that they may ingest or use as nesting material. Biological samples will be used to assess plastic assimilation by waterbirds, and evaluate its effects on breeding success and health measures. This study will be performed in Ria Formosa Natural Park (Algarve), a protected area with a high diversity of waterbirds.

The project is open for two MSc students. Part of the logistics of this work will be funded by projects from the LIFE EU program. The information gathered will contribute to two international peer-reviewed publications.

Little tern incubating on a sandy beach at Ria Formosa, Algarve

11. Sexual segregation and grouping behaviour in ungulates

Contact:

Joana Alves (jalves@uc.pt | joanasilvaalves@gmail.com) http://cfe.uc.pt/profile/members/13

Research group: **MebLab/SEEL** - Mammal Ecology and Behaviour Lab from **SEEL**
https://www.facebook.com/labsolos/

WATCH IT ON YouTube **https://youtu.be/PuxPur57PBI**

Description:

The degree of sexual segregation and its patterns varies across different populations of the same species as well as between species. Sexual segregation has three components, i.e. habitat segregation, spatial segregation and social segregation, and these components may independently or together be responsible for the temporal patterns of sexual segregation. To understand this widespread phenomenon, it is necessary to identify the factors capable of modelling sexual segregation in vertebrates. Depending on which factors are expected to contribute to sexual segregation, different hypotheses arise. Sexual segregation is often associated with habitat preferences, so comparing patterns from different species inhabiting in the same environment and different populations of the same species inhabiting in different environmental conditions will help to decipher the factors modelling sexual segregation patterns.

The project will be based in the collection of behavioural data from video recordings, and aims to test different hypotheses in sexual segregation and grouping behaviour.

This project counts with the collaboration of international researchers, in particular Kathreen Ruckstuhl, from the University of Calgary, Canada, and the co-supervision of José Paulo Sousa.

12. Trophic and ecological characterisation of key aquatic species present in estuarine communities

Contact:

João M. Neto (jneto@ci.uc.pt) http://www.mare-centre.pt/joaoneto

Ana Marta Gonçalves (amgoncalves@uc.pt) http://www.mare-centre.pt/pt/anamartagoncalves

João Carlos Marques (jcmimar@ci.uc.pt) http://www.mare-centre.pt/pt/joaocarlosmarques

http://www.mare-centre.pt/en

Description:

Aquatic ecosystems are known as a principal dietary resource of some essential components, both for aquatic and terrestrial animals (such as humans). Indeed, some of these components are only produced by bacteria, plants and algae, as the expression of the water properties through metabolic and cellular processes. They cannot be synthesised de novo by primary consumers, being the feeding behaviour the basic process in the food web. They constitute useful trophic markers because they are assimilated, accumulated and transferred by animals to higher trophic levels. In comparison to terrestrial ecosystems, marine and freshwater ecosystems are characterised by relatively high levels of "essential components" and, indeed, fish and seafood are the most important sources of these vital nutrients in the human food basket. The balanced presence of these "essential nutrients" in tissues of terrestrial predators is essential on physiological functions and on the metabolism of all animals and on the prevention of diseases, and it's known to increase directly with the consumption of aquatic preys. For that reason, the detection of the presence of these trophic markers constitutes a useful tool on the study of environmental health. Thus, it becomes vital to study biochemical changes in aquatic species and the repercussions in aquatic trophic food webs caused by differences in the habitat (presence/absence of vegetation).

The main objective of this study is to assess the biochemical profiles of key species inhabiting different estuarine habitats (e.g., fish, macroinvertebrates) and link it to environmental stress sources. Biological samples will be seasonally collected in the field and prepared in the laboratory for subsequent biomarkers' analyses and compared to parameters affecting environmental conditions.

Photos Ana Marta Gonçalves and students

13. Assessing **pharmaceuticals accumulation** in non-target organisms

Contact:

Sara Leston (saraleston@ci.uc.pt) http://cfe.uc.pt/profile/members/1696

Miguel Pardal

Research group: **Marine Research Lab**
http://cfe.uc.pt/profile/lines/3

WATCH IT ON YouTube **https://youtu.be/Y3amdTqGi8g**

Description:

The continuous release of pharmaceuticals to the ecosystems entangles serious safety concerns, representing potential risks. Antibiotics are biologically active substances designed to prevent and treat diseases but represent a potential hazard when their active ingredients (either the parent compound or metabolites) come in contact with non-target organisms.

This project will focus on the effects of pharmaceuticals on non-target species, particularly macroalgae. Through experimental laboratorial assays, algae will be exposed to different classes of antibiotics (mainly used in aquaculture production) and different endpoints will be assessed.

14. Sustainable development of **seafood products** with added value

Contact:

Tiago Verdelhos (tverdelhos@ci.uc.pt) http://www.mare-centre.pt/pt/user/132

Ana Cristina Rocha (acsrocha@uc.pt) http://www.mare-centre.pt/pt/user/7934

http://www.mare-centre.pt/pt

Description:

This project focus on the development and promotion of added value seafood products, from both fisheries and aquaculture, through ecological based processes in order to combine seafood valorisation and environmental sustainability.

Students enrolling in this research topic will have the chance to work on one of the following studies:

1. **The importance of a balanced diet on Sea Urchin aquaculture** – *P. lividus* is a common sea urchin species along the Atlantic and Mediterranean coasts, it is an important fisheries resource and an appreciated seafood with high market value. *P. lividus'*s aquaculture production still needs to overcome some constraints – the development of protocols for producing adults with excellent quality gonads could be available for the market throughout the whole year. Food availability and quality affect individual growth and gonad production, hence it is important to understand its nutritional composition to improve sea urchin farming. The quality of gonads – size, taste, colour and consistency - are influenced by the diet contents on protein, lipid, carbohydrate and carotenoid. Students enrolling in this project will contribute to widen the knowledge in sea urchin P. lividus, working in indoor aquaculture system either by focusing their work on the effects of different diets across biochemical analyses; redox homeostasis, food preferences; colour and texture in gonads.
2. **Dried or Smoked?** - Valorisation of seafood products – In this work, traditional seafood species of "Região Saloia" – streak fish and octopus, will be processed through traditional drying and smoking methods in order to develop differentiated and added value products. Three products will be produced on an experimental scale, at MAREFOZ Laboratory (MARE-UC): i) dry and smoked ray; ii) dry and smoked octopus; iii) dry and smoked octopus roe, using species collected by Cascais and Ericeira local fishermen. The main objectives are to: i) monitoring the diversity and quantity of fish catches in the region; ii) determine the most appropriate methodologies for fish processing; iii) quality assessment of fresh, dried and smoked product; iv) dissemination and promotion of value-added products.

The work will be carried out at the MAREFOZ laboratory in Figueira da Foz, within the scope of the projects OtimO – Otimização dos processos de produção de Ouriço-do-mar, and É Seco ou Fumado?

Students are also strongly encouraged to propose new ideas to be explored within this research topic.

15. Insectivorous birds as potential suppressors of rice pests in Guinea-Bissau

Contact:

Sérgio Timóteo (sergio.timoteo@uc.pt) http://cfe.uc.pt/profile/members/1700

Ana Rainho (amrainho@fc.ul.pt) https://ce3c.ciencias.ulisboa.pt/member/anarainho

Research group: **Community Ecology Lab (CFE)**

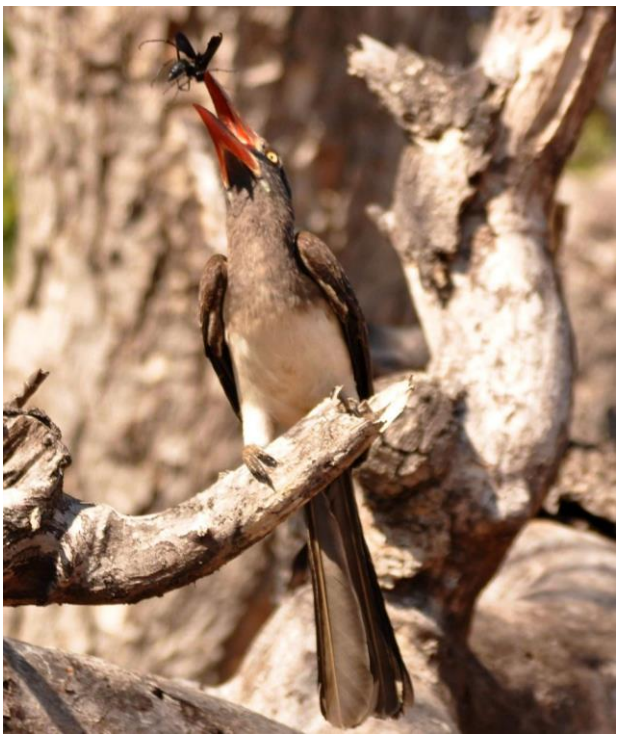
Description:

Feeding a rapidly increasing human population in an environmentally sustainable way poses a major global challenge. One way to increase agricultural production is through ecological intensification by including ecosystem services and using nature-based solutions in agricultural management. Our main goal is to assess the relative contribution of bat- and bird-mediated suppression of insect pests of rice and to provide an economic valuation of their ecosystem services. The study will focus on Guinea-Bissau, however, rice is an important staple crop also in West-Africa, if not globally.

We are looking for someone with an interest in ecology or entomology, who enjoys working with a team but also capable of carrying out independent field work if needed. The work will involve staying abroad for periods of several months (3-4) in shared accommodations and very simple housing, working outdoors in changing and challenging weather conditions and learning quickly to identify local taxa on site.

The project will further allow valuable insights into how tropical agro-ecosystems should be managed to maximize vertebrate insectivores and enhance food security sustainably in developing nations. The results should contribute for a paper to be published in an international peer reviewed journal.

More information: https://en.riceguardians.com



16. Applying Dendrochronology and Remote Sensing to determine **Forest Productivity** in central Portugal

Contact:

Joana Vieira (joana.vieira@uc.pt)

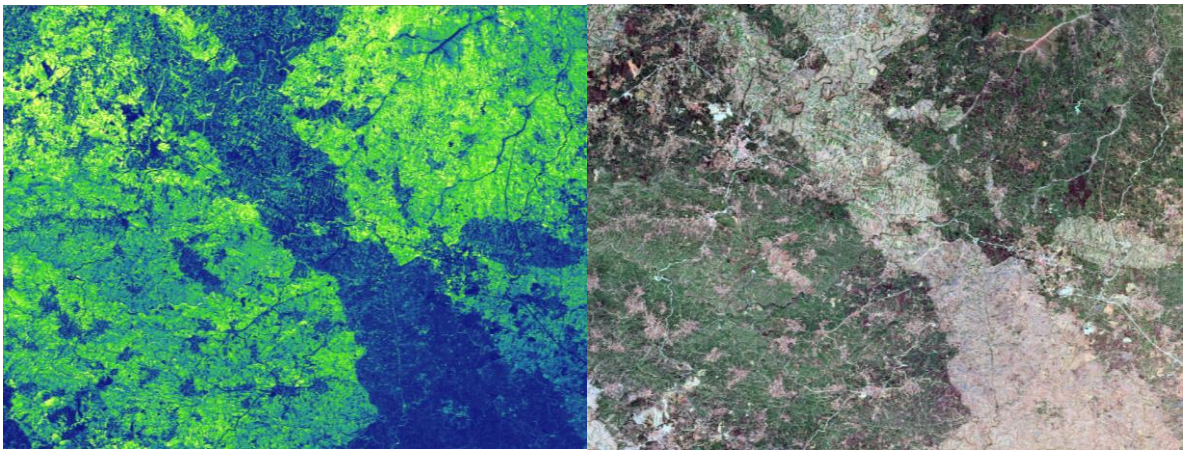
Vasco Mantas (vasco.mantas@dct.uc.pt)

Research group: **MedDendro Lab**
https://www.uc.pt/fctuc/ID/meddendro

Description:

Radial growth and canopy dynamics of trees play a critical role in terrestrial carbon cycle. Yet, it is still not clear how climate variability influences radial growth and canopy dynamics. To help bridge the knowledge gap in this field, we propose to combine Tree Ring Width Index (TRWI, radial growth) and satellite imagery, including precipitation measurements and spectral indices like the Normalized Difference Vegetation Index (NDVI), to quantify how forests responded to climatic variability. Climate change is already a reality with record breaking temperatures registered in the last 10 years in Europe. Integrating canopy foliage dynamics (e.g. NDVI) and radial growth will reflect how vegetation responds to environmental variability and help predict the response of forest ecosystem productivity to climate change.

In this research project the student will sample maritime pine forests in central Portugal (*Pinus pinaster*, the third forest species of the Portuguese forest) to analyse and measure tree-rings using dendrochronological methods. The student will also learn the fundamentals of remote sensing and how to process satellite data (Copernicus and MODIS) and extract meaningful metrics for advanced research and applications. Machine-learning and cloud computing topics may be pursued if of interest to the student.



17. Valuing wild pollinators for sustainable pollination services in agroecosystems

Contact:

Sílvia Castro (scastro@bot.uc.pt)

João Loureiro (jloureiro@bot.uc.pt)

Helena Castro (hecastro@ci.uc.pt)

Research group: **FLOWer Lab**
https://www.facebook.com/cfeFLOWerLab/

Description:

Pollination is a biodiversity-dependent ecosystem service of vital importance for nature, agriculture and human well-being. Currently, pollinator's decline resulting from globally prevalent drivers constitutes a major threat to sustainable crop production. However, there is limited quantitative evaluation on the abundance, diversity and function of wild pollinators across regions, time and crops. The applied research line of FLOWer Lab focuses on pollination as key regulation ecosystem services to understand current biodiversity levels in nature towards conservation and sustainable use of wild resources. Our goals include, the establishment of baselines and monitoring programs to assess status and trends of wild pollinators and crop pollination deficits, incorporating citizen science, quantify economic and environmental consequences of pollinator deficit and map pollination ecosystem services. This will be achieved through funded projects (CULTIVAR; i9Kiwi; Polimax).

18. Seabirds as bioindicators of chemical contaminants and environmental health in the North Atlantic

Contact:

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Jaime Ramos (jramos@ci.uc.pt) http://www.mare-centre.pt/en/user/68

Research group: **EcoTop** - Ecology and Conservation of Top Predators
https://www.facebook.com/ecotop.mareuc/

WATCH IT ON YouTube **https://youtu.be/OKSFsHTvVaw**

Description:

This research tests a multiple technique analysis applied to seabirds for an ecological assessment at a large spatial scale in the North Atlantic. Using seabirds as bioindicators, this study will link geographic, pollutant and health information in the marine environment based on stable isotope analyses, metal contamination and biochemical stress responses. Fieldwork with seabirds are performed in Deserta (Ria Formosa - Algarve) and Berlenga (Peniche) Islands. It includes tracking breeding adults (Cory's shearwaters *Calonectris borealis*, Yellow-legged gulls *Larus michahellis* and Audouin's gulls *Larus audouinni*) using GPS loggers in order to map their foraging locations, and collection of samples (blood and feathers) for laboratory analyses.

Two MSc. This project is open for a maximum of two students interested in trophic interactions and contamination issues. The students will perform fieldwork surveys, laboratory procedures and data analyses. This work will be performed at the laboratories of MARE-University of Coimbra with support of both supervisors and ECOTOP team. Data gathered will be used conjunctly to relate contaminants and oxidative stress biomarkers (which will be conducted at MARE-IPLeiria by specialized human resources) with trophic and spatial data in seabirds (in which the students will directly be involved at MARE-UC).

19. Managing natural seed dispersal to assist post-fire recovery

Contact:

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Research group: **Community Ecology Lab (CFE)**

Description:

Wildfires have shaped the Mediterranean landscapes for millennia but the recent decades have seen changes to fire regime in the region, and particularly in Portugal. Such changes have direct implications for biodiversity and on post-fire forest recovery. Seed dispersal is vital for the dynamics of biological communities, however, little research has been done on the contribution of animal seed dispersal to post-fire forest recovery. Natural perches have been often shown to be effective in concentrating bird-mediated seed rain into particular sites, as birds tend to use prominent habitat structures to defend territories and attract females. For this reason, the use of perches ("poleiros") has been proposed as a cost-effective management activity for the habitat restoration, but their potential use to assist post-fire restoration has not yet been considered. This process might be particularly relevant in the reconversion of abandoned agricultural or forested fields in critical areas (e.g., high risk of erosion) as part of an integrated forest management.

In this project the student will work with the team of project "**Life-after-fire" to evaluate the potential of perches as a cost-effective management practice for ecological restoration of burned areas by directly manipulating seed dispersal** and plant nucleation processes. To achieve this goal, exogenous seed rain and germination patterns will be evaluated under three scenarios: 1) burned areas where all the remaining wood is removed (i.e. no perches - control); 2) burned areas where trees with economic value are removed but thin and tall interspaced perches are left on the ground to be used by birds as nucleation perches; and 3) burned areas adjacent to highly invaded forest patches.

20. On the search of a better (stream) water

Contact:

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Research group: **FreE** - Freshwater Ecology Lab
http://cfe.uc.pt/profile/members/1544

WATCH IT ON YouTube **https://youtu.be/NqJDkms2S2Q**

Description:

Freshwaters are among the most threaten ecosystems in the planet. In the face of global changes, understanding and predicting the effects of single and multiple stressors on streams and rivers constitute a main step for their conservation and maintenance of the services (e.g. drinking water) provided to man.

Streams and rivers are exposed to a growing number of stressors such as:

- ***Riparian forest management*** (our studies deal with the effects of *Eucalyptus* afforestations and native riparian forests composition on streams ecological integrity);
- ***Increased water temperature*** (we perform our studies using controlled conditions, mesocosms and a manipulated warmed stream);
- ***Intermittency*** (we use Lousã's intermittent streams and their riparian areas as "playground");
- ***Salinization*** (worldwide, still underexplored, threat to freshwaters; we assess the problem using several aquatic groups, levels of organization and approaches … "from genes to the ecosystem");
- ***Man!*** The team is also engaged in citizen science activities (international project - LivingRiver) using a key ecosystem process in streams - litter decomposition - for the assessment of stream water ecological integrity.

Some of our studies are developed in collaboration with other groups, National (e.g. "Fish themes" - ISA, Lisbon) or International Universities. We are mainly focused on a key-ecosystem-level process - leaf decomposition - to understand stressor impacts in streams whose food chains are *brown* (i.e. aquatic webs rely on leaves from the terrestrial systems).

The results of each investigation project are expected to originate a master thesis and one scientific paper to be published in an international peer reviewed journal.

If you are interested in any of these topics or any other topic in stream ecology… contact us!

21. Effects of forest changes on stream ecosystems

Contact:

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Research group: **Freshwater Ecology (MARE)**

WATCH IT ON YouTube **https://youtu.be/-2rqiFe7xiQ**

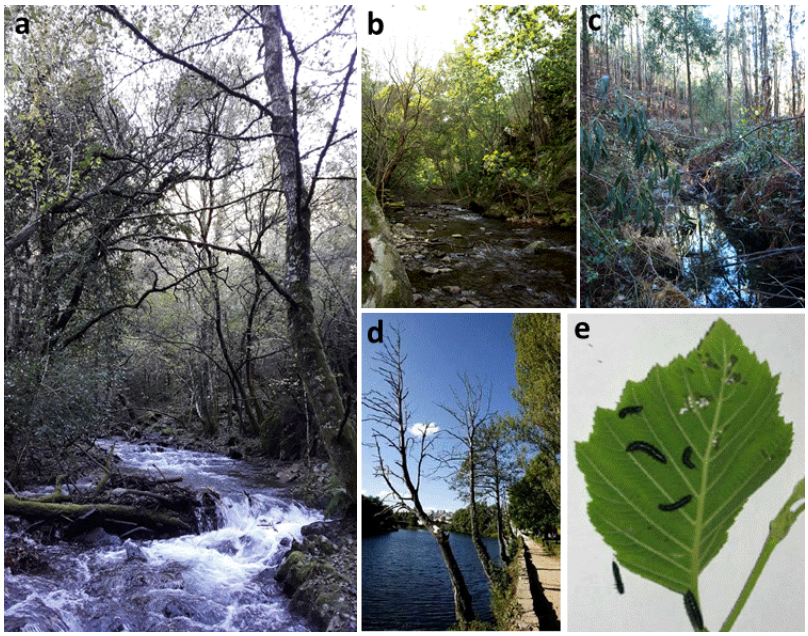
Description:

Small forest streams are strongly dependent on the riparian forests, which provide shade and organic matter, control the inputs of nutrients, sediments and pollutants, among other important roles on which aquatic communities depend[a]. Changes to riparian forests may thus have impacts on aquatic communities and processes.

In the Freshwater Ecology Research Group of MARE, we address the effects of changes in riparian forests on stream communities (microbial decomposers and benthic macroinvertebrates) and processes (e.g., decomposition of plant organic matter) by performing laboratory and field experiments, and systematic reviews/meta-analysis. Forest changes in which we are most interested include:

- Invasion of native deciduous forest by exotic *Acacia* species[b]
- Replacement of native deciduous forests by monocultures of *Eucalyptus globulus*[c]
- Infection of native tree species by invasive pathogens[d]
- Formations of galls on leaves of native tree species
- Herbivory of native tree species by insect larvae[e]

We seek for enthusiastic students to join our team and help us pursue new ecological questions.



a) Stream flowing through a native deciduous forest, Central Portugal, b) Stream flowing through a forest invaded by exotic *Acacia dealbata*, central Portugal, c) Stream flowing through a *Eucalyptus globulus* plantation, central Portugal, d) Stream bordered by dead *Alnus glutinosa* trees infected with the parasitic oomycete *Phytophthora alni*, Galicia, Spain, e) Herbivory on *Alnus incana* leaves by larvae of *Agelastica alni* bettles. Photos: a, VFerreira; b–c, AFerreira; d, XornalGalícia; e, LHuttunen.

22. Natural resources as sustainable alternatives to control plant enemies

Contact:

Paula Castro (pcastro@ci.uc.pt)

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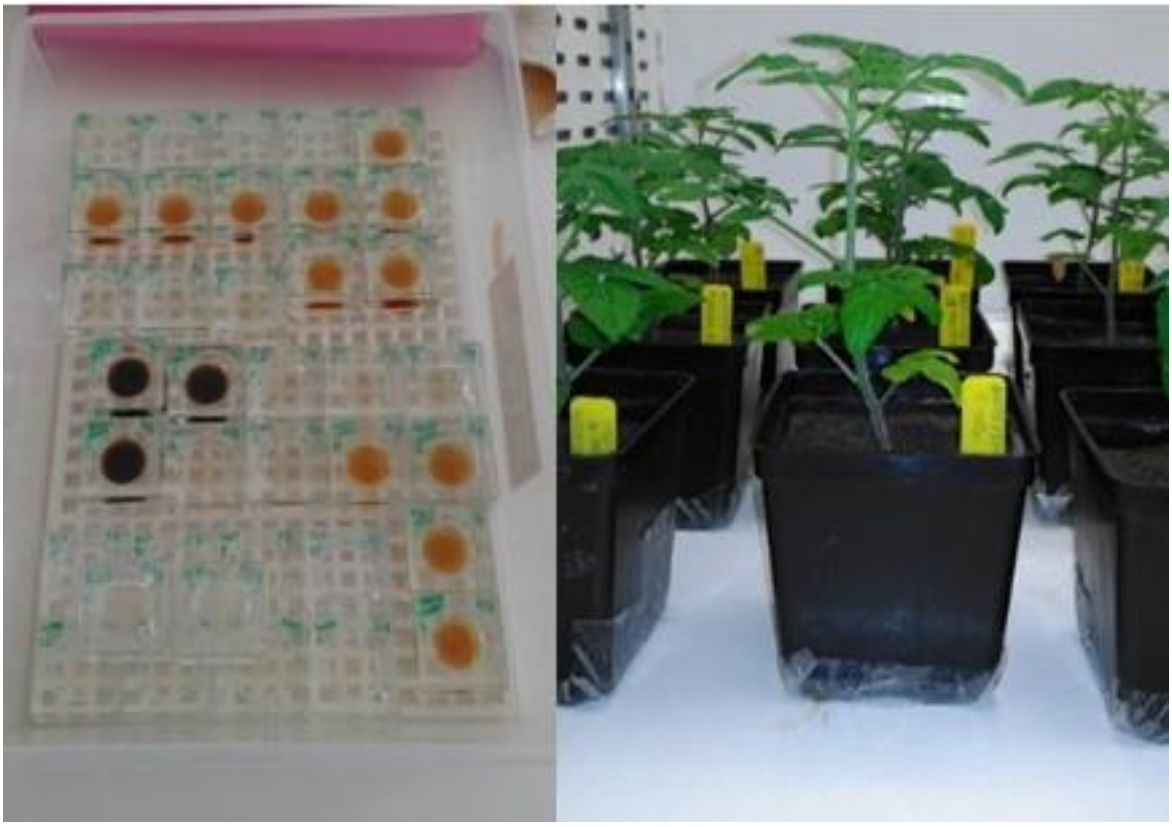
Research line of CFE – Societies and Environmental Sustainability
http://cfe.uc.pt/profile/lines/7

Description:

Plants are the feeding source for all living organisms, either directly or indirectly. In general, cultivated and spontaneous plants have a regular growth with a positive yield if the environmental conditions are adequate. However, this normal development is often negatively affected by enemies (weeds, pests and diseases).

This project aims to explore the potential of plant biocides in order to contribute to the sustainable development of the agro-forestry sector. We will study the biocide's effects on plant parasitic enemies (e.g. nematodes), but we also will assess its potential in controlling weeds, pests, and other problematic diseases in the agricultural and forestry sector.

We aim to develop new products that may in near future replace common pesticides. Data gathered in this research proposal will originate one scientific paper to be submitted to a peer reviewed journal.



23. Are **nanoplastics** a threat to fresh water ecosystems?

Contact:

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Research group: **Freshwater Ecology (MARE)**

WATCH IT ON YouTube **https://youtu.be/kfphyqLBiFo**

Description:

Currently, plastic pollution is acknowledged as a crucial problem in the aquatic environment. Plastic production and demand have been increasing rapidly over the past decades. Although freshwaters have plastic concentrations similar to marine waters, freshwaters are often overlooked. It guesstimated that between 1.15 and 2.41 million metric tonnes of plastic enter the ocean via global riverine system every year. Currently, research on the environmental impacts of microplastics is the main focus and there is a huge gap in the knowledge on the environmental impact of nanoplastics. In freshwaters, plant-litter decomposition is an important ecosystem process linking riparian vegetation with microbial and invertebrate activities. Fungi, especially aquatic hyphomycete, is considered as the main microbial decomposer followed by bacteria. Leaf litter decomposition is sensitive to water chemistry and is a key tool for assessing the function and health of freshwater ecosystems.

In this study, it is envisaged to conduct leaf litter decomposition studies to assess the impact of nanoplastics on stream ecosystem functioning (decomposition rates, reproductive outputs of aquatic fungi, and the carbohydrate and fatty acids profiles under nanoplastic exposition. We expect two master thesis results into a publication in an international peer reviewed journal.

Plastic debris

24. Effect of global warming in Serra da Estrela alpine ecosystems

Contact:

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Alexandra Rodríguez Pereiras (arp@uc.pt)

Description:

Located in the most western part of the Iberian Central Mountain Range, Serra da Estrela is the highest mountain range in mainland Portugal. The alpine ecosystems found in the high plateau are unique in Portugal and they are currently threatened by global warming. Nutrient cycling is essential for ecosystem functioning and in alpine ecosystems follows a marked seasonal dynamic regulated by snow persistence, temperature, and water availability. It is unclear how increased temperatures due to global warming will affect decomposition and nutrient cycling in alpine soils.

This research project will focus in the effect of warming, a main driver of climate change, in soil functioning in alpine grasslands and shrublands in Serra da Estrela. Soil nutrient availability using ionic exchange membranes (IEMs) and extracellular enzymatic activities related to nutrient cycling will be measured in soil samples from an ongoing experiment in Serra da Estrela. In this experiment we have installed Open Top Chambers in several sites above 1500m to test experimentally the effect of warming in alpine ecosystems.

The work will be done in Serra da Estrela and at the facilities of the Centre for Functional Ecology (Department of Life Science, University of Coimbra).

@ecolab_estrela @ecolabestrela

25. Exploring spatio-temporal relationships among coastal and marine Ecosystem Services

Contact:

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Research group: **Sistemas Costeiros e Oceano**
http://www.mare-centre.pt/pt

Description:

Despite the growing scientific literature on ecosystem services (ES) assessment and mapping, ES research still faces a variety of challenges, in particular those related to the multifunctionality of ecosystems and its spatio-temporal relationships. Ecosystems are able to simultaneous perform multiple functions and thus might be able to deliver groups of ES that repeatedly appear together in space and/or time. This exposes a great diversity of research issues to be explored, related to the identification of ES groups; analysis of trade-offs; assessment of scale mismatches between ES supply and ES management/demand; among others.

In this project the we will focus on ES associations and to aspects of ES assessment and mapping that depend on the interrelations between coastal and marine ES and their components. Students enrolling in this project will contribute to widen the knowledge regarding Ecosystem Services research while getting familiar with geographic information systems' processes and tools. Outreach and science communication activities may also be available.

The work will be carried out at the MAREFOZ laboratory in Figueira da Foz, but students may partially work remotely.

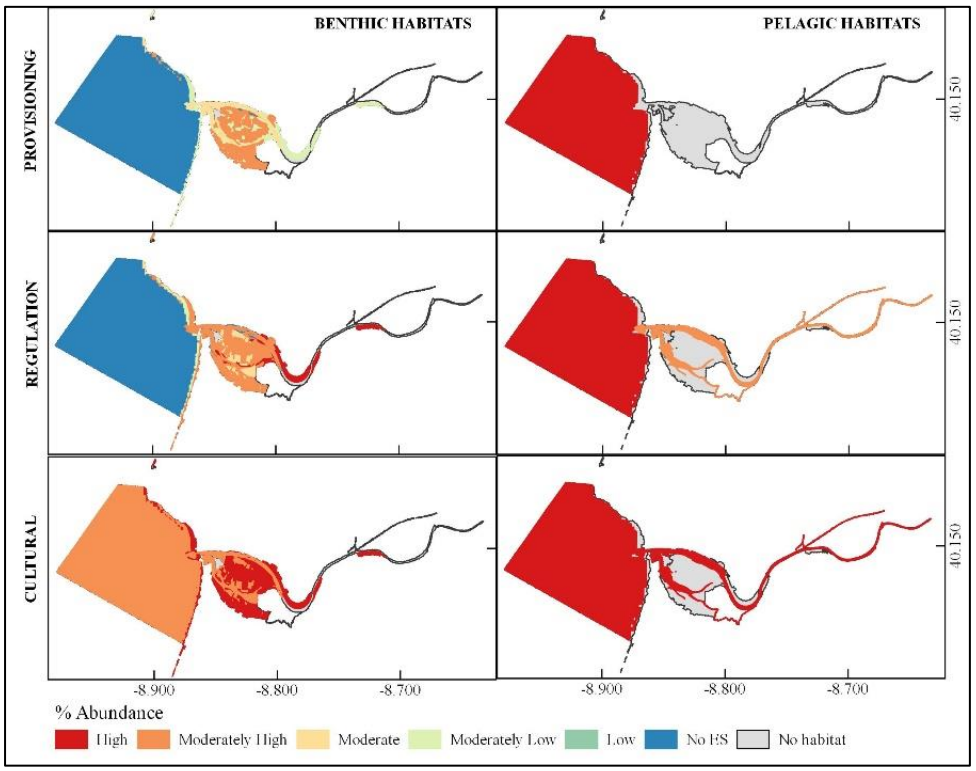

Fig. 1. Abundance (% of CICES types) of ecosystem services per categories and type of habitats in the Mondego estuary (Caro et al. 2020).

26. Botanical inventories of historical gardens in the centre of Portugal

Contact:

António Xavier Coutinho (cafe@bot.uc.pt)

WATCH IT ON YouTube **https://youtu.be/qBk8PTTPaZM**

Description:

In Portugal, and, more specifically in the centre of the country, there are many gardens and particular parks whose botanical inventory, in an environmental and historical education perspective, has not yet been carried out. The work will involve monthly field trips. All the trees and shrubs will be identified and herbarium specimens will be prepared and deposited in the Herbarium of the University of Coimbra. A carpological collection and photographs of all the notable specimens will be made. The tree and shrub height will be taken with a clinometer. Historical records belonging to the owners' families will be consulted. Ethnobotanical information on the uses of each botanical species encountered, such as cooking, making utensils, perfumery, toxicity, and mythological associations, will be compiled and treated.

27. Seaweeds a natural resource to food applications

Contact:

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João Carlos Marques (jcmimar@ci.uc.pt) http://www.mare-centre.pt/pt/joaocarlosmarques

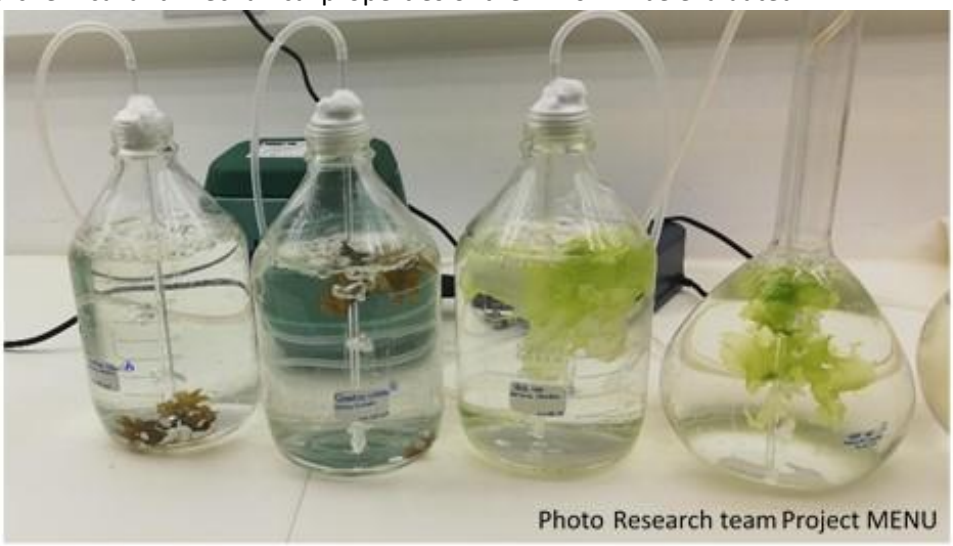
Cláudia Nunes (CICECO-UA) http://www.ciceco.ua.pt/claudianunes

Description:

Seaweeds present a great variety of natural compounds with different properties and benefits to human health. As a way to overcome the lack of food, suppress the nutritional needs of some diets and due to their vast range of essential constituents – minerals (iron and calcium), proteins (with all essential amino acids), vitamins and fibres, absolutely necessary to human primary metabolism, macroalgae arise as a natural food, wild and abundant with a fast growing index with high potential as a source of food nutrition. Algae have been gaining importance in the food industry due to their high nutritional value. In some countries, macroalgae are part of the traditional food culture. Actually, the increase of world population and limitation of natural resources leads to new areas of exploitation, where new non-conventional food sources tend to appear. Thus, seaweeds may would future contribute for global food security in their entire form or by extraction of their nutrients and sub-products. Thus, this topic presents two distinct master themes (and thus two vacancies where each student can choose one of the two topics):

1. A work that aims to collect and cultivate a set of macroalgae defined in preliminary works and determine the biochemical profile (fatty acids, carbohydrates and protein content) to assess the most nutritious macroalgae to develop pre-cooked dishes, sweet and savoury.

2. A work that aims the use of seaweeds derived polysaccharides to develop composites for food packaging due to their biocompatibility, availability and gelling capacity, as well as its renewability and sustainability. Alginate, carrageenan, and agar extracted from algae will be used to produce biofilms. The physico-chemical and mechanical properties of the films will be evaluated.



Cultivation of macroalgae juvenile species

28. Genetically inherited tolerance to acid mine drainange by an impacted zooplankton population: a recessive trait?

Contact:

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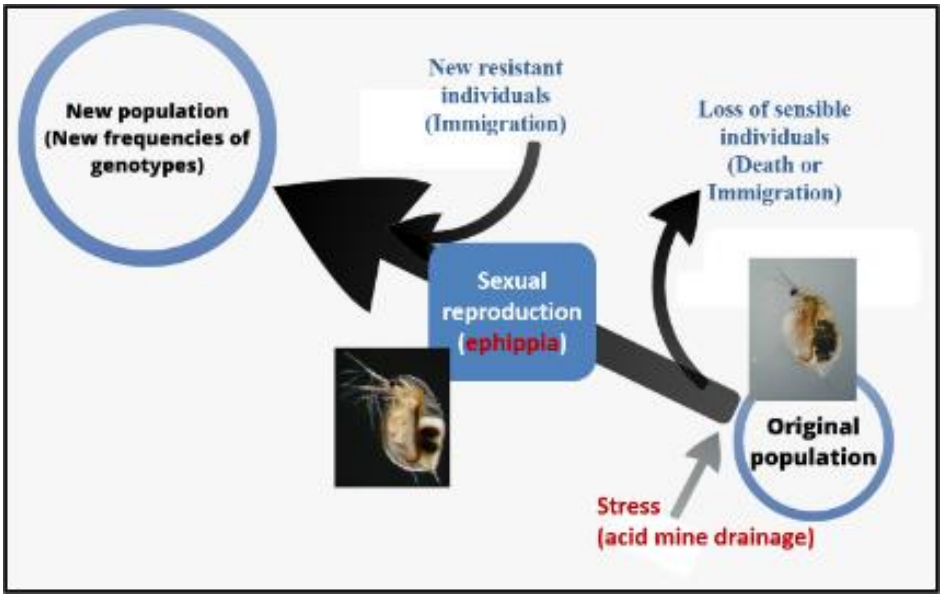
Research group: **Soil and Freshwater Stress Ecology**
http://cfe.uc.pt/profile/lines/4

WATCH IT ON YouTube **https://youtu.be/8fqh4EsjXHk**

Description:

Understanding the tolerance of natural populations to stressors is key for biodiversity conservation. Yet, it has been largely neglected in ecotoxicological studies. Acting as a directional selective pressure, chemical contamination may cause genetic erosion by wiping out the most sensitive genotypes. Of upmost concern is that, if tolerance is a recessive or incompletely dominant trait – the recessive tolerance inheritance (working-) hypothesis, the loss of genetic variability will be irreversible due to contaminant-driven elimination of alleles. Accordingly, the present study project aims to investigate the tolerance inheritance to lethal levels of a metal-rich acid mine drainage (AMD) in a population of *Daphnia longispina* inhabiting the impacted water basin. This species can be easily cultured in the lab. Under optimal conditions it reproduces asexually through cyclical parthenogenesis with each female originating broods of females genetically identical to it. It is thus possible to characterize the AMD tolerance of various clones by estimating their 48-hours median lethal concentration (LC50). Yet, under unfavourable conditions sexual reproduction takes place and genetic recombination occurs (males fertilize eggs enclosed in a shell called ephippium). To study inheritance, ephippia will be produced from clones with different AMD tolerance and toxicity tests will be performed with the new hatched clones to determine their 48-hours LC50 to AMD.

The work conducted within this research project is to be published as a scientific manuscript in a peer reviewed international scientific indexed periodical.



29. The value of second broods in hole-nesting birds in a Mediterranean habitat in a climate change scenario

Contact:

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Jaime Ramos (jramos@ci.uc.pt) http://www.mare-centre.pt/en/user/68

Research group: **EcoTop** - Ecology and Conservation of Top Predators
https://www.facebook.com/ecotop.mareuc/

WATCH IT ON YouTube **https://youtu.be/uxRRyji1n2U**

Description:

Reproduction is a critical phase of an animal's life cycle with high impacts on its fitness. Depending on the environment and local meteorological conditions, insectivorous birds may adopt different strategies to maximize their reproductive success across their distributional range, trying to adapt to climate change- induced alterations of their habitats. Some populations raise only one brood per breeding season temporally matching a well- defined peak in food availability, while others raise two broods. Generally, environmental conditions during the nestling period of first and second broods are very different and likely to affect brood size, nestling condition and fledging success. For instance, along the breeding season weather conditions become warmer and drier and this may affect food availability and parasite pressure.

The aim of this study is to characterise the quality of second broods in hole- nesting tits, namely the great tit (*Parus major*) and the blue tit (*Cyanistes caeruleus*) at Mata Nacional do Choupal, in terms of reproductive success, nestling physiological condition, and parasite prevalence, in comparison with first broods, using data collected 15 years apart.

Fieldwork will take place in the breeding season of 2022 and 2023 and laboratory work will be carried out at MARE - UC. The results of this study will originate a MSc thesis and the information gathered will contribute to an international peer-reviewed publication**.**

30. Recolonisation as an ecologically relevant and **ethical alternative to fish lethality** for chemicals registration

Contact:

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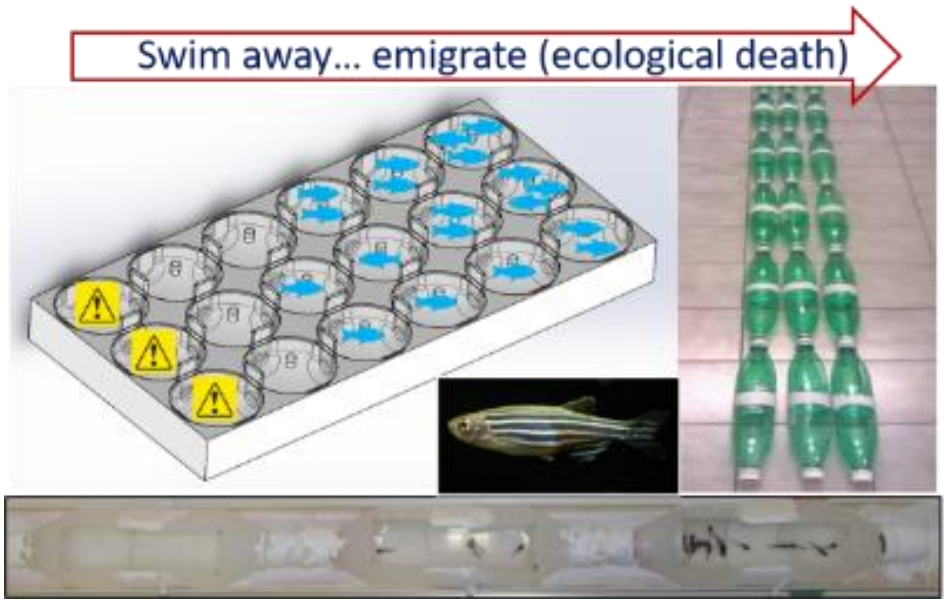
Research group: **Soil and Freshwater Stress Ecology**
http://cfe.uc.pt/profile/lines/4

WATCH IT ON YouTube **https://youtu.be/kOyr1kZxhSo**

Description:

In environmental risk assessment (ERA) for chemicals registration, tier 1 fish lethality tests are the most widely conducted regulatory ecotoxicology tests using vertebrates, with large numbers of animals being used. From an ethical perspective, welfare concerns for animal suffering are raised, as the aim is to determine the concentration required to kill 50% of fish. From an ecological perspective, an unreliable level of risk is most likely produced because many fish species are known to spatially avoid/escape disturbed habitats. Consequently, fish natural populations can become locally extinct, before any organism dies, because fish promptly detect and emigrate. Contaminants act thus as habitat disturbers regulating fish dispersion patterns, by provoking emigration from disturbed habitats while allowing the recolonization of habitats under recovery; but at chemical concentrations well below those that would be estimated in tier 1 ERA as provoking mortality. To gain ecological relevance ERA at the ecosystem/landscape level, while halting animal distress/pain/suffering, the present study project aims to investigate and discuss the value of fish recolonisation tests, to foster their implementation and ultimately ban lethal testing in the ERA for chemicals. Recolonisation tests are thus a key challenge and opportunity to integrate the 3Rs (Replacement, Reduction and Refinement) policy in the tier 1 fish toxicity tests without compromising environmental protection.

The work conducted within this research project is to be published as a scientific manuscript in a peer reviewed international scientific indexed periodical.



31. Seed coating with plant beneficial microbes in agroecology

Contact:

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Ying Ma (cathymaying@gmail.com) http://cfe.uc.pt/profile/members/1716

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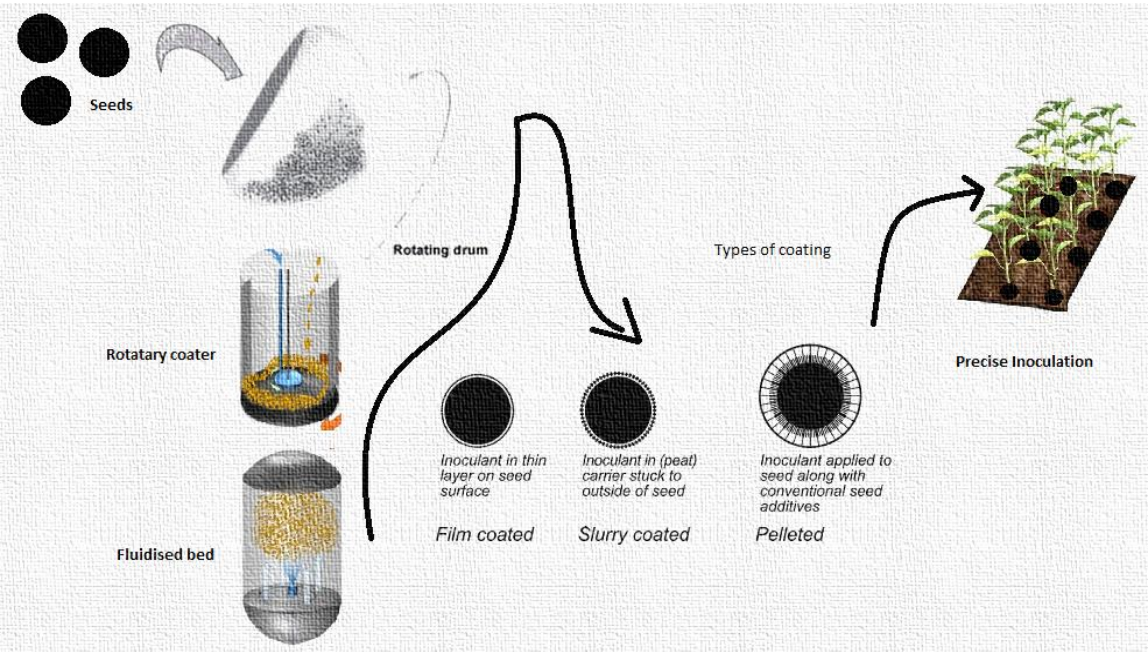
Description:

Plant beneficial microbes (PBM), such as arbuscular mycorrhizal fungi and plant growth-promoting bacteria, can reduce the use of agrochemicals and increase plant yield, nutrition, and tolerance to biotic–abiotic stresses. Yet, large scale applications of PBM have been hampered by the high amounts of inoculum per plant or per cultivation area needed for successful colonization. Seed coating, a process that consists in covering seeds with low amounts of exogenous materials, is gaining attention as an efficient delivery system for PBM. Microbial seed coating comprises the use of a binder, in some cases a filler, mixed with inocula of PBM, and can be done using simple mixing equipment (e.g., cement mixer) or more specialized/sophisticated apparatus (e.g., fluidized bed). Binders/fillers can be used to extend microbial survival. Notwithstanding the promising results of seed coating, there are still challenges mainly related with the scaling up from the laboratory to the field and proper formulation, including efficient microbial combinations and coating materials that can result in extended shelf-life of both seeds and coated PBM. These limitations need to be addressed and overcome in order to allow a wider use of seed coating as a sustainable delivery method for PBM in agroecology. The aim of this project is to study seed coating with PBM to assist crops in improving seedling establishment and germination and achieving high yields and food quality, under reduced chemical fertilization and abiotic stresses.



32. Valorisation of "Sargaço" as a fertiliser

Contact:

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Ana Cristina Rocha (acsrocha@uc.pt) http://www.mare-centre.pt/pt/user/7934

http://www.mare-centre.pt/pt

Description:

"Sargaço" is a mixture of diverse algae that grows on the continental platform of Portuguese north coast, being mainly composed by *Saccorhiza*, *Laminaria*, *Fucus*, *Codium*, *Palmaria*, *Gelidium* e *Chondrus*. The harvesting and use in agriculture of *"sargaço"* date back to the Middle Ages, having been a considerable economic and social activity on the North coast. However, it is currently an almost extinct practice.

As an organic-rich mixture, *"sargaço"* was frequently used, in the past, as a fertilizer, increasing agricultural productivity of coastal lands. Additionally, macroalgae are composed by several minerals and biochemical compounds, such as fatty acids, steroids, terpenes, carotenoids, phenols, amino acids, vitamins, etc, presenting a wide range potential of application.

Students enrolling in this project will be involved in the taxonomical, chemical and biochemical characterisation of *"sargaço"* collected at Vila do Conde, also participating in field campaigns. The student will then participate in the preparation of algae extracts and compost with macroalgae and perform germination bioassays, using algae extracts as biostimulants and the produced compost as fertiliser, with seeds of cultures with local interest.

The work will be carried out at MARE-UC, specifically, at the MAREFOZ laboratory, at Figueira da Foz, and the Marine Macroalgae Laboratory, in University of Coimbra. The most important characteristics is that the students are genuinely interested in the topic and available to work in Figueira da Foz and Coimbra. This work will be performed under the scope of the project ***ValSar – Valorização do Sargaço da Costa Litoral Norte***.

33. The effect of **slash and burn treatments** on the regeneration of *Hakea sericea* and *Acacia dealbata*

Contact:

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Joaquim Sande Silva (jss@esac.pt) https://scholar.google.com/citations?user=NhNy7VkAAAAJ

http://fogoeinvasoras.isec.pt/

Description:

Portugal is heavily invaded by alien plant species and has one of the highest proportions of burned land per year in the world. Prescribed fire has been used as a fuel management tool to reduce fire hazard in invaded areas, but an uninformed use of fire may contribute to increase the problem of plant invasions. However, instead of being a problem, if properly used fire can be a solution to control alien vegetation as it is already done in other countries. Nevertheless, there is still insufficient knowledge on the relationships between fire and alien plants allowing the use of fire as a fuel management tool and as a solution to control the expansion of invasive plant species.

Based on this rationale, the main objective of Aliens & Flames is to fill knowledge gaps on the relationships between fire and invasive alien plant species so as to support the use of fire in invaded areas. Given their importance in Portugal and elsewhere, silky hakea (Hakea sericea Schrad.) and silver wattle (Acacia dealbata Link.), were the chosen species to start these studies.

The basic experimental outline consists on applying a set of slash-and-burn treatments (using prescribed burning) in different areas, to measure the basic fire behavior parameters and to monitor the associated effects. Studies will include the assessment of the ecological response both at the individual as at the population and community levels.

If you're interested in working with eucalypt, get in touch. There is also the possibility of discussing a thesis plan on that topic.

34. Genomics and quantitative genetics of vocal learning in Harzer Roller canaries

Contact:
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Jaime Ramos (jramos@ci.uc.pt) http://www.mare-centre.pt/en/user/68

Research group: **EcoTop** - Ecology and Conservation of Top Predators
https://www.facebook.com/ecotop.mareuc/

WATCH IT ON YouTube **https://youtu.be/FPay7bGmYs0**

Description:

This main goal is to map individual genes implicated in vocal learning differences in a song canary – Harzer Roller. We propose an integrative approach grounded on an appropriate model system, which combines the power of genetic mapping approaches with comparative and functional genomics. We will employ state of the art approaches by the linkage mapping for studying the genetic basis and architecture of vocal behavior on Harzer Roller canaries. This project represents an excellent opportunity to understand the evolution of complex vocal behaviors, including the fascinating diversification of song in birds. The master student will take the advantage of records regarding canaries' ancestry information started to be taken in 2018 to 2020 breeding seasons.

This project is open for one student interested in genetics and molecular evolution. He/She will perform captivity experiments with song canaries in MARE UC facilities. The genomic work will be performed at the laboratories of Cibio/InBIO of University of Porto with support of all supervisors. Data gathered will be used conjunctly to describe the mode of inheritance and find the genetic basis of song traits on a song canary – Harzer Roller (which will be conducted at MARE-CIBIO/InBio by specialized human resources). This will result in one master thesis to be concluded in 2022, which would be expected to be published in a scientific journal.

35. Fish-Omics: Unveiling fish nutritional quality by NMR-Metabolomics

Contact:

Mariana Palma (mpalma@uc.pt) http://cfe.uc.pt/profile/members/1722

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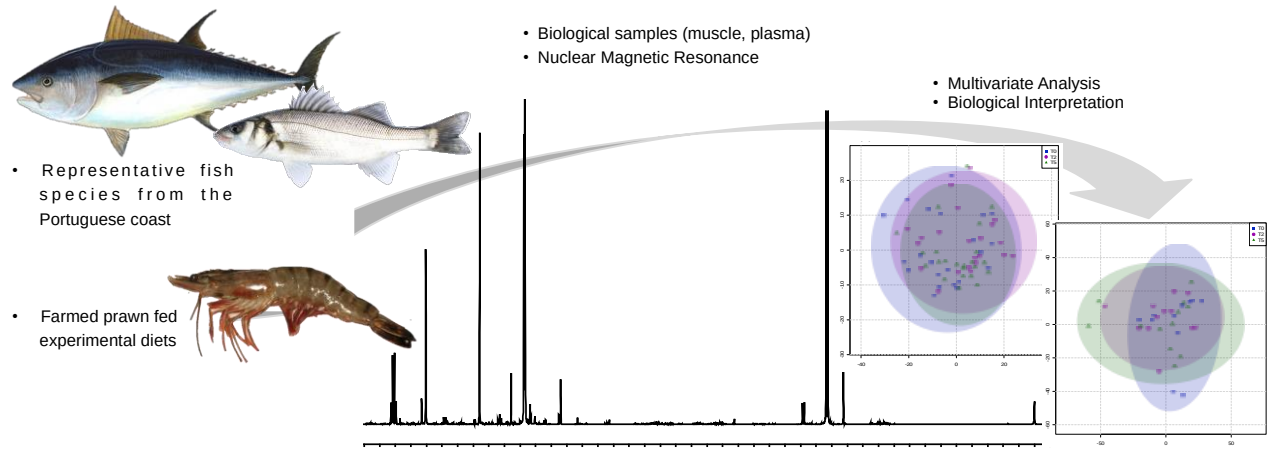
Research group: **Marine Research Lab**
http://cfe.uc.pt/profile/lines/3

Description:

Studies on animal science often require assessing physiological information, either to establish baseline profiles or to evaluate changes promoted by experimental conditions. Some tools, like Metabolomics have proved to be a reliable approach to address the multivariate and large-scale analysis of the metabolome, as a final expression of the environment (natural or experimental) on the biological systems. We use this approach, specifically the Nuclear Magnetic Resonance (NMR)-Metabolomics, to assess research question on the Aquaculture and Seafood Quality fields.

We are at the moment developing projects on i) seafood species from the Portuguese coast, and how their fillet composition vary between the coastal regions, and ii) on how experimental diets affect the composition of farmed prawn species. Get in touch and embrace a challenging MSc project on Marine Biology and NMR technologies.



36. Protection of **estuarine native fauna** – Testing innovative methods

Contact:

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Helena Veríssimo (helena.verissimo@uc.pt) http://www.mare-centre.pt/pt/user/62)

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Description:

Global warming is a prevailing challenge to humankind, with the increasing frequency of extreme wheatear events and the sea level rise, the areas that are occupied by humans are at risk of being destroyed. This problem is of particular concern to the costal and estuarine ecosystem, which will be highly susceptible to the impacts of climate change, such as increased erosion and higher risk of flooding in the coastal areas, can result in alteration, fragmentation or loss of habitats. Leading to instability in the management of water resources that could have a negative impact not only in the environment and biodiversity but also on economic and social activities.

A pilot study is being performed in the Mondego estuary to test and validate techniques for restoration of saltmarsh habitats and protection of native fauna, in order to develop innovative solutions – sustainable, environmental-friendly, and with low visual impact. Students enrolling in this project will contribute to the evaluation of these new methodologies, assessing: i) the effectiveness of plant transplantation; ii) the potential of different eco-engineering structures on saltmarsh restoration; iii) the success of using an adapted aquaculture thank as a nursery for the native ichthyofaunal.

The work will be carried out at the MAREFOZ laboratory in Figueira da Foz and the field work in the Mondego estuarine saltmarshes and experimental sites. It will be developed and supported within the scope of an ongoing project: “ReSEt – Restauro de Sapais Estuarinos com vista à Sustentabilidade (MAR-01.04.02-FEAMP-0026)” https://www.facebook.com/reset.uc.

37. MicroaLiBi - Microalgal Lipid Biosynthetic potential

Contact:

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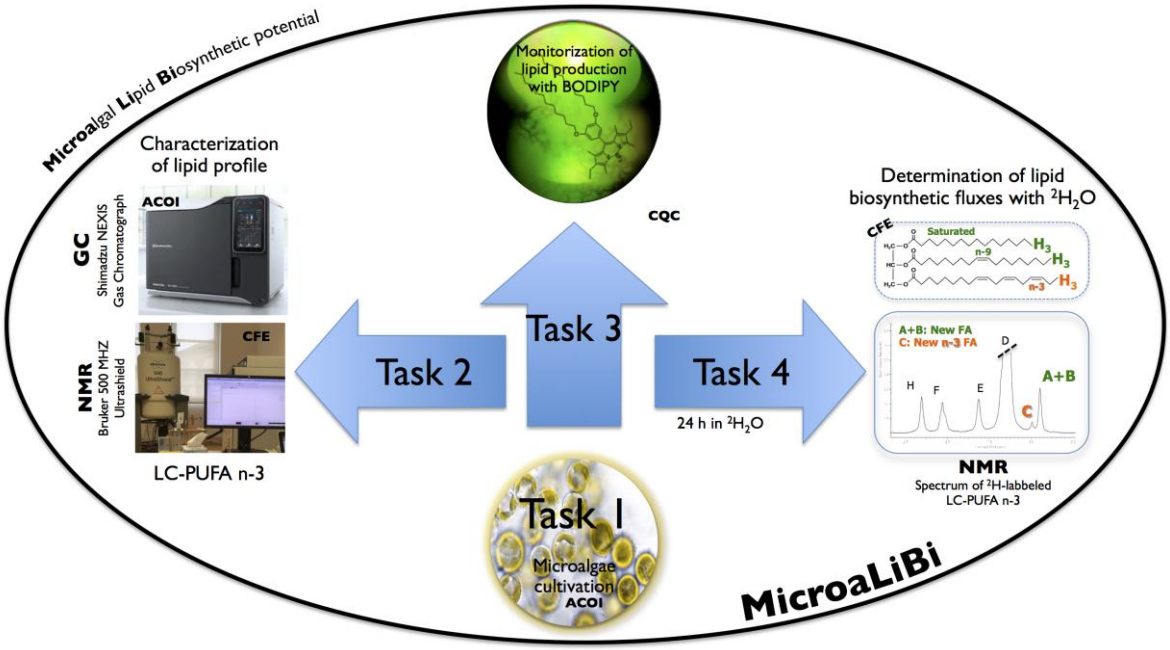
Research group: **Marine Research Lab**
http://cfe.uc.pt/profile/lines/3

Description:

Fish is a highly nutritious source of protein and long-chain polyunsaturated fatty acids (LC-PUFA), particularly omega-3 (n-3) which are extremely important for human health. Nonetheless, fish have a limited capacity to synthesize LC-PUFA relying extensively on dietary provision through their feed. While most feed formulation are nowadays shifting towards more sustainable plant ingredients, the levels of n-3 are becoming critically limited for feeds formulations. This is a major bottleneck for the growth of aquaculture and has a direct impact on the nutritional value of the final product. The supply of n-3 fatty acids in natural marine food webs is guaranteed by microalgae, therefore identifying and maintaining the species and/or strains that accumulate harvestable quantities of LC-PUFA may improve the supply of this high-value nutrient. This should be accompanied by an assessment of the cultivation conditions that maximize LC-PUFA yields as well as the development of reliable probes and tools to monitor lipid biosynthetic capacity of these microorganisms. We aim at i) characterizing the lipid profile of the most promising to assert the n-3 LC-PUFA content (in collaboration with ACOI - Coimbra Collection of Algae UC); and ii) improving on a new, simple and reliable method for lipid detection and quantification (in collaboration with CQC - Coimbra Chemistry Centre). Questions? Doubts? Get in touch!



38. Are tracheids better than tree rings when it comes to detecting climate change?

Contact:

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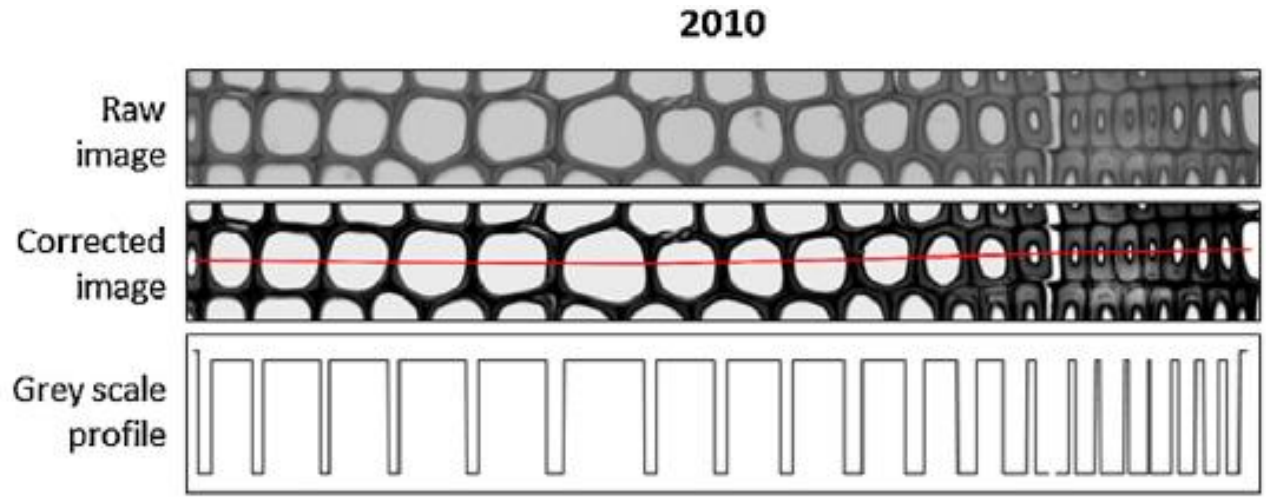
Research group: **MedDendro Lab**
https://www.uc.pt/fctuc/ID/meddendro

Description:

Forests represent 31% of the Earth's land surface and are the main terrestrial ecosystem. They provide ecosystem services, are home to several species, and have high biodiversity. Forests account for 75% of the gross primary production of the Earth's biosphere and are an important carbon sink. Carbon is stored in trees through xylogenesis, which is responsible for wood formation and consists in the division and differentiation of cambial cells into xylem cells. Every year the cambium produces a new tree ring, and its width reflects seasonal variations in environmental conditions. Besides the tree-ring width, the variation of the anatomical properties of the cells along the ring may allow a deeper understanding of the response of trees to climatic conditions, by increasing temporal resolution. In this research project we propose the student to analyze the intra-annual variation of tracheid's features in maritime pine (*Pinus pinaster*), to model the kinetics of tracheid formation and to understand how wood formation and carbon fixation in trees are being affected by climate change.

The master student will learn dendrochronology methodologies, to identify and date tree rings, and to use and program in R.



From Campelo, Nabais, Carvalho and Vieira 2016. tracheideR-An R package to standardize tracheidograms. Dendrochronologia 37, 64–68.

39. Assessing **effects of bio-pesticides** in non-target terrestrial organisms

Contact:

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Research group: **SEEL** - Soil Ecology and Ecotoxicology Laboratory
https://www.facebook.com/labsolos/

WATCH IT ON YouTube **https://youtu.be/xuozYb78Cvo**

Description:

The current European Farm to Fork (F2F) strategy aims at a reduction of 50% in the application of the most hazardous pesticides by 2030. This goal prompted the boost of a new research field linked to the development and risk assessment of novel bio-pesticides, having either a microbial, plant or animal origin. The existing regulation in Europe is vague regarding the data requirements (i.e., the type of tests to be performed to assess effects in non-target organisms) for the ecological risk assessment of these compounds. This project, to be developed in collaboration with the SME CloverStrategy Lda and Ascenza Portugal aims to test new hybrid and bio-PPPs containing microbial and animal proteins as active substances on different species of non-target terrestrial organisms, namely honey-bees (*Apis mellifera iberiensis*) , parasitoid wasps (*Aphidius rhopalosiphi*) and soil collembola *Folsomia candida*.

The outcome of this study will contribute not only for the developmental phase of these products, but also to select the best ecotoxicological tests to incorporate in the future data requirements for these products.

By being partially conducted in a consulting laboratory, this project will allow students to enter in contact with a “working environment” from a private laboratory, gaining useful experience when entering the employment market.

40. Land use and land management effects on soil fauna and their ecosystem services

Contact:

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Research group: **SEEL** - Soil Ecology and Ecotoxicology Laboratory
https://www.facebook.com/labsolos/

WATCH IT ON YouTube **https://spoti.fi/3xqPQwN**

Description:

We have around 25% of the planet biodiversity in our soils. The organisms living in soil have important functions and provide ecosystem services that sustain the environment, through essential supporting (e.g. soil formation and aggregation, nutrient cycling) and regulatory services (e.g. carbon sequestration). Land use and land management are key drivers on how the soil biodiversity responds. Activities with high input of chemicals and intensive soil management reduces soil biodiveristy and consequently decrease the services provision. In other hand much of this biodiversity is still unknown and is in constant threat due to anthropic impact. Human action also spreads species more adapted to variations in the environment, expanding their distribution and which can impact populations of native species. In this way, we propose four research projects:

- Effects of land-use and land-management on earthworm and soil macrofauna communities: comparative study between Brazil and Portugal
- Role of soil fauna in delivering ecosystem services in a topoclimatic gradient in inland central Portugal region
- Assessing earthworm populations in urban parks of Coimbra
- Assessing soil fauna and their perception through farmers in the region of Idanha-a-Nova, mainly in organic farming systems.

To assess soil fauna and chemical and physical attributes, soil samples will be taken in field work. The surveys are performed using standard methods for soil organisms' samplings (monoliths with 25 x 25 cm length per 20cm depth and/or Pitfall traps). The species will be identified using classical taxonomy and genetic barcoding techniques and the results of each project are expected to produce a paper in an indexed journal.

41. Plant-parasitic nematodes - a threat to Mediterranean agriculture

Contact:

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Carla Maleita (carla.maleita@uc.pt) https://www.uc.pt/fctuc/deq/ciepqpf/people/integrated_phd_researchers/carla_maleita

Research group: **NEMATO-lab** & **CIEPQPF**
https://www.facebook.com/NEMATO-lab-429239727651127/
https://www.facebook.com/Ciepqpf/

Description:

Root knot nematodes (RKN, *Meloidogyne* spp.) and root lesion nematodes (RLN, *Pratylenchus* spp.) are amongst the world's most damaging agricultural plant-parasitic nematodes, attacking nearly all crops grown. They are distributed worldwide and are parasites of a wide range of economically important plants. In Portugal, *M. chitwoodi* and *M. enterolobii,* included in the European and Mediterranean Plant Protection Organization (EPPO) A2 List of pests recommended for regulation as quarantine organisms, and *M. luci*, added to the EPPO Alert List, were found associated with important crops and/or ornamental plants and weeds, representing a potential threat to several crops. Several species of RLN were also found, namely *P. crenatus*, *P. neglectus*, *P. penetrans* and *P. thornei* associated to potato crop.

Research topics:

1) Host suitability of plant crops associated with Mediterranean agriculture *to Meloidogyne* sp. and biological interactions with *Pratylenchus* sp.;

2) *In vitro* screening of plant-delivered metabolites against *Pratylenchus* spp.

The project is open for up to 2 MSc students. The work will be funded by the project KnowLuci (PTDC/ASP-PLA/31946/2017). The information gathered will contribute to international peer-reviewed publications.

Infected tomato and potato roots with RKN and RLN, respectively.

42. Tools for the ecological assessment of rivers

Contact:

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https://www.mare-centre.pt

Description:

Freshwater biodiversity is declining at a higher rate than terrestrial or marine biodiversity. The main drivers of those changes are alterations in the land use, water pollution, longitudinal barriers, non-native species invasions and climate change. Particularly, the urbanization has been causing dramatic alterations in streams and rivers through channelization, impermeabilization or elimination of riparian vegetation (see https://rb.gy/lomahx). In this context, the ecological monitoring of rivers, i.e. the evaluation of the ecosystem health through their aquatic communities and processes, is essential to prevent further degradation and to design effective restoration measures. This is a complex process that requires the characterization of rivers, field sampling of aquatic communities, taxonomic identification of species and effective metrics to assess the deviation from reference condition.

Presently only aquatic biological elements are used (e.g., invertebrates, algae, fish), according to the Water Framework Directive, but birds could also constitute important bioindicators due to their use of the riparian vegetation for nidification, protection and feeding.

The use of DNA of communities is also being explored as a faster and cost-effective alternative to the use of biological indices based on the taxonomic/morphological identification of species under the microscope (see: https://www.youtube.com/watch?v=kub4beC0eng).

Urban streams also require a special attention and the development of specific methods for their ecological assessment and rehabilitation that consider their context within the urban planning, their historical transformation and the ecosystem services provide by them, that can contribute to more sustainable cities.

These are some of the topics that can be developed by a Master student. The ideal student is willing to work in a variety of environments (field, lab, computer), collaborate with a team but also be autonomous, dedicated to research and enthusiastic. Depending on the topic, the thesis may have the collaboration of other co-supervisors from UC (Jaime Ramos), Centre for Neuroscience and Cell Biology (Conceição Egas), University of Aveiro (Salomé Almeida) or University of Lisbon (Francisca Aguiar).

43. Biological control of plant pathogens

Contact:

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Isabel Conceição (luci@zoo.uc.pt) http://cfe.uc.pt/profile/members/1589

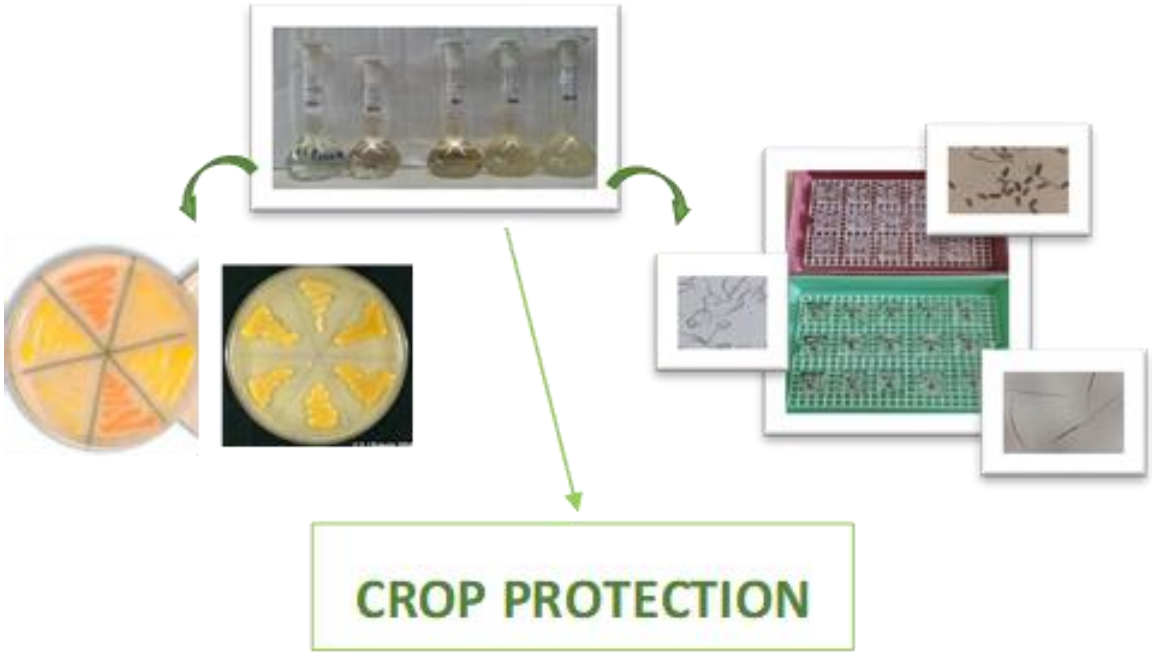
Research group: **NEMATO-lab**
https://www.facebook.com/NEMATO-lab-429239727651127/

https://youtu.be/lEAYuh88JC4

https://youtu.be/VS6qindLLZ8

Description:

Plant pathogens causes heavy losses in agriculture worldwide. They are an important problem especially in development countries where the agriculture is familiar and there is no money to use expensive tools like, for example, chemical pesticides or solarization. The development of natural products from soil organisms like bacteria and fungi can be an economical and heathy friendly alternative. Several products will be tested at several concentrations against plant pathogen organisms like, for example, bacteria and phytoparasitic nematodes. Hatching, mortality, viability, infectivity and reproduction of the plant pathogens organisms will be evaluated under different conditions. The plant pathogens organisms will be identified using morphological, biochemical and molecular methods before the in vitro bioassays. Inserido na investigação do projecto Internacional Ecostack: "Stacking of ecosystem services: Mechanisms and interactions for optimal crop protection, pollination enhancement, and productivity". (https://www.ecostack-h2020.eu/)



44. Searching for **pinewood nematode** pathogenic determinants

Contact:

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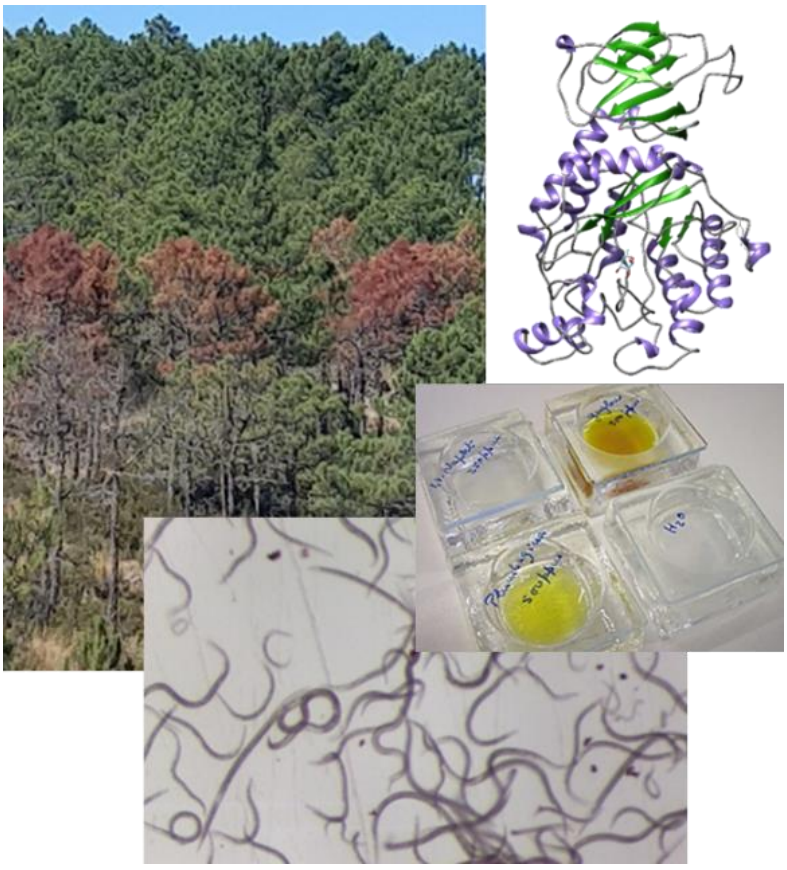
Joana M. Sá Cardoso (joana.cardoso@uc.pt) https://www.cienciavitae.pt/E813-1BD9-134C

Research group: **NEMATO-lab**
https://www.facebook.com/NEMATO-lab-429239727651127/

Description:

The pinewood nematode (PWN), *Bursaphelenchus xylophilus*, is the causal agent of Pine Wilt Disease and is a serious threat to Asian and European forests. The international ecological and economic impact caused by this pathogenic nematode highlight the need of further research on PWN pathogenic mechanisms and development of new control strategies. Secretome and proteome profiles of *B. xylophilus* are being obtained in order to identify the specific/differentially expressed proteins. These proteomic data will be analyzed, and proteins related to PWN pathogenicity and with potential to be considered as targets for nematode detection/control will be selected and molecularly characterized. Additionally, the effects of naturally occurring phytochemical compounds, in PWN morphological and physiological parameters and in the expression profile of genes involved in plant-PWN interaction will be evaluated.



45. Pelagic seabirds as sentinels of Ocean health

Contact:

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Jaime Ramos (jramos@ci.uc.pt) http://www.mare-centre.pt/en/user/68

Research group: **EcoTop** - Ecology and Conservation of Top Predators
https://www.facebook.com/ecotop.mareuc/

WATCH IT ON YouTube **https://www.lifeilhasbarreira.pt**

Description:

Our sense of the ocean's power and omnipotence contributed to an assumption that nothing we did could ever possibly impact it. However, reality dictates that the world's oceans are in peril. Overfishing has dramatically reduced fish stocks and thousands of tons of rubbish dumped in the oceans wreak havoc on marine life. Thus, finding suitable sentinel species of the Human impacts on the Oceans is pivotal to applied biological conservation.

Using recently developed tracking technology (radar detector GPS-tags) on seabird species belonging to different ecological guilds, the project aims to accurately map (1) their foraging distribution and diet, (2) fishery activities and, (3) hotspots of plastic pollution, to help understand the impact of those two Human stressors on Key Biodiversity Areas (KBAs) and Marine Protected Areas (MPAs).

Main tasks during the project will include: (1) fieldwork on islands of the Portuguese or Cabo Verde archipelagos; (2) using individual tracking devices on seabird species; (3) collection of biological samples; (4) lab work on processing biological samples, (e.g. stable isotopes analysis); (5) data processing and statistical analysis, within the R environment (specially analysis of spatial data and modelling routines through the use of remote sensing information).

The project is open for two MSc students. The logistics of this work will be funded by projects from the LIFE EU program (shorturl.at/kmnJO) and the Conservation Foundation MAVA (https://avesmarinhasdecaboverde.info). The information gathered will contribute to two international peer-reviewed publications.

46. AquaCSI - **AquaCulture** using Stable Isotopes

Contact:

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Mariana Palma (mpalma@uc.pt) http://cfe.uc.pt/profile/members/1722

Research group: **Marine Research Lab**
http://cfe.uc.pt/profile/lines/3

Description:

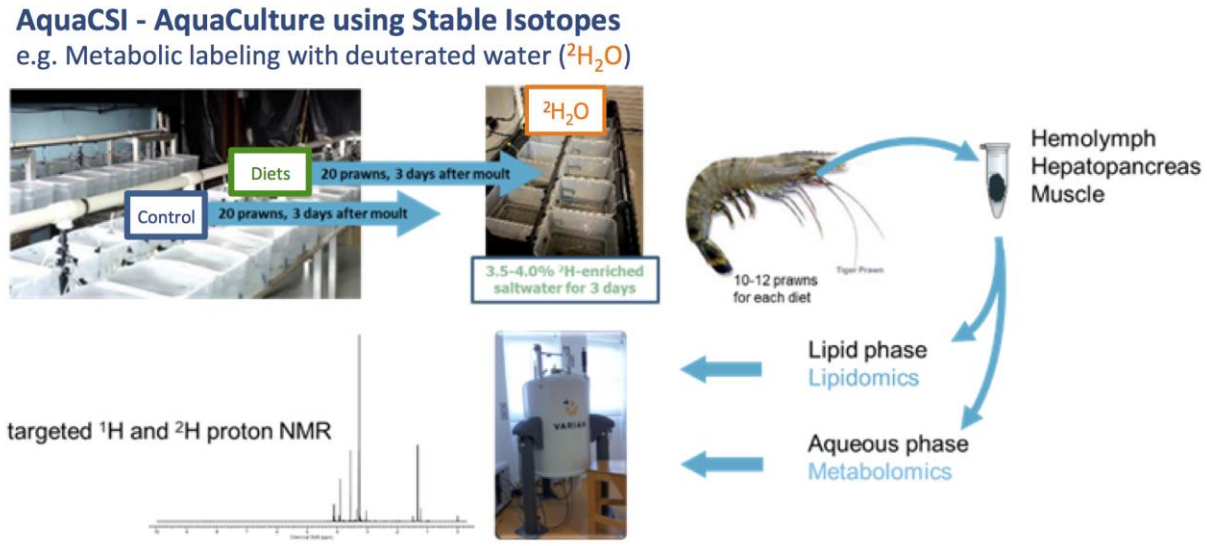
Aquaculture of carnivorous fish and shrimp remains highly dependent on fishmeal protein and its procurement still relies on exploiting wild fisheries. Any reduction in its utilization, especially if substituted by less expensive plant-derived ingredients like carbohydrates, would reduce the ecological burden of this industry and improve its sustainability. Our lab focuses on using the delivery of stable isotopes to understand nutrient utilization and evaluate the efficacy of novel ingredients. We are conducting several International projects with different contexts but that engage in using different stable isotopes and NMR (Nuclear Magnetic Resonance) technology to address the challenges of modern aquaculture:

i) subjecting Tambaqui, an Amazon fish species (*Colossoma macropomum*) with frugivorous feeding habits, to doses of 13C-glucose and 13C-fructose (with UNESP, Brazil);

ii) optimizing diets for Asian tiger shrimp (Penaeus monodon) after a 3-day residence in 2H2O (with CSIRO, Australia);

iii) using 13C-butyrate to assess if tributyrin improves nutrient utilization in rainbow trout (Oncorhynchus mykiss) (with CIIMAR, Portugal; and INRA, France).

Questions? Doubts? Get in touch!



47. Dynamics of plant growth promoting rhizobacteria and arbuscular mycorrhizal fungi associated with hyperaccumulator plants

Contact:

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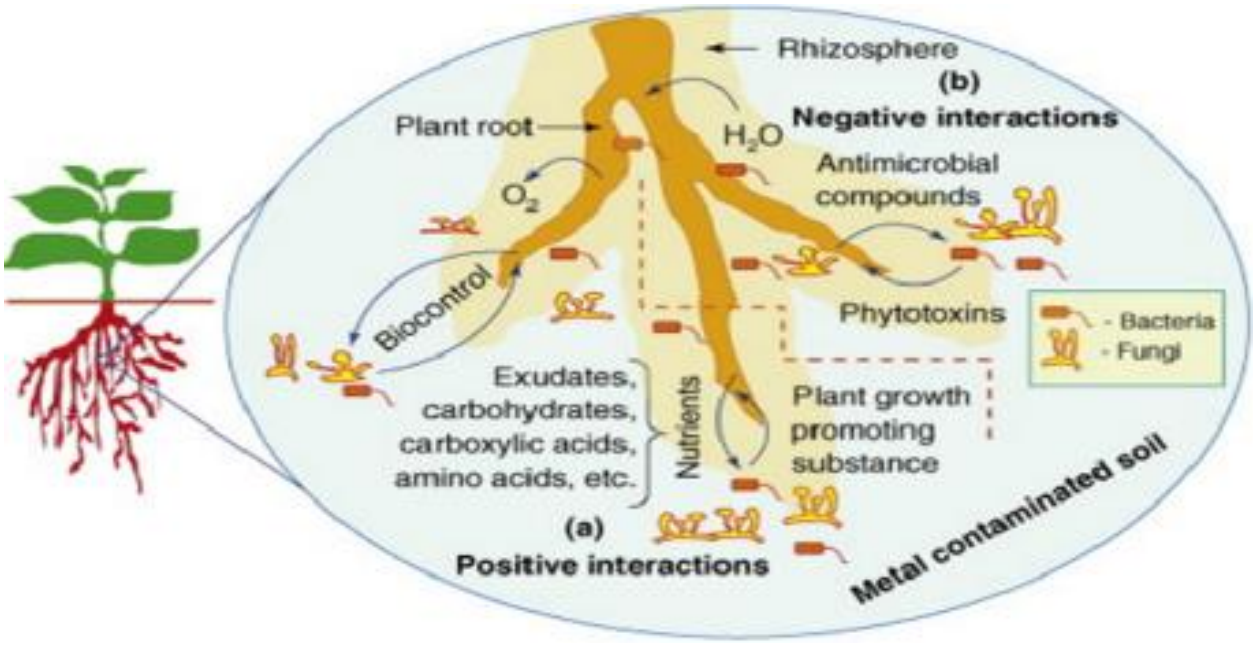
Rui Oliveira (rsoliveira@uc.pt) http://cfe.uc.pt/profile/members/1688

Helena Freitas (hfreitas@uc.pt) http://cfe.uc.pt/profile/members/1581

Description:

Plant growth-promoting bacteria (PGPB) and arbuscular mycorrhizal fungi (AMF) are used to improve phytoremediation of metal contaminated soils. However, one of the main limitations of microbial-assisted phytoremediation is the poor colonization capacity of PGPB and AMF. Although modern marker genes have been used as environmental tracers in the microecology of bacterial and fungal colonization, the mechanisms behind AMF-PGPB-plant interaction are poorly understood. The objectives of this project are to i) study the colonization dynamics of PGPB in the rhizosphere and tissue interior of hyperaccumulators and ii) clarify the mechanisms of AMF-PGPB-mediated plant growth promotion under metal stress. Experimental microcosms will be established where hyperaccumulator will be inoculated with PGPB and AMF. Plants will be challenged with concentration gradients of Zn and Cd for simulating multimetal contaminated environments to determine growth parameters (e.g. vigour index, photosynthesis, and antioxidant enzyme activities) under metal stress, and to explore the effects of PGPB and AMF inoculation on plant metal uptake. In vivo colonization, the distribution and dynamics of PGPB and AMF in the rhizosphere and tissue interior will be assessed through marker genes. It is expected that the results obtained in this project will originate from a scientific paper to be submitted to a peer-reviewed journal.



48. Exploring **bionematicides** delivery systems against root knot nematodes

Contact:

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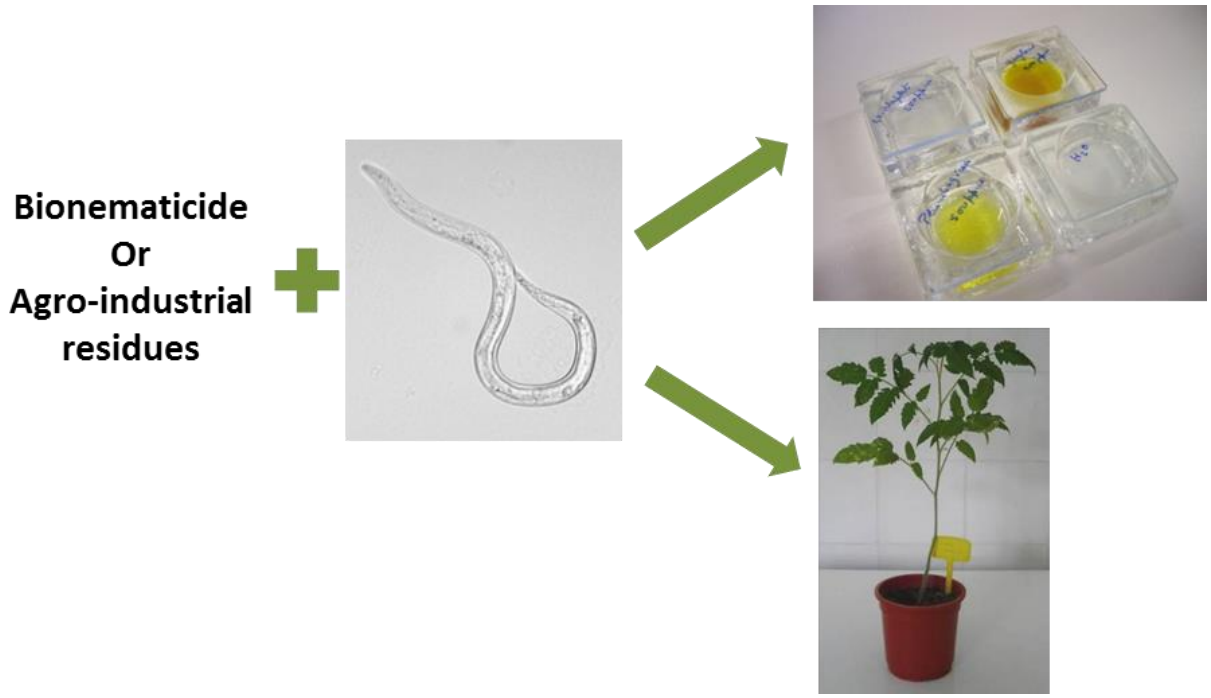
Research group: **NEMATO-lab** & **CIEPQPF**
https://www.facebook.com/NEMATO-lab-429239727651127/
https://www.facebook.com/Ciepqpf/

Description:

Root knot nematodes (RKN), *Meloidogyne* spp., are amongst the world's most damaging agricultural pests, attacking nearly all plants. They are distributed worldwide and are parasites of a wide range of economically important crops. RKN are generally controlled by chemical nematicides, however, since they include some of the most hazardous compounds used in agriculture, there is scope for the search of natural-origin nematicides that present lower environmental burdens and risks. This project includes research on novel sustainable and integrated strategies for RKN management, through the use of degradable-in-soil bionematicide delivery systems, nanoparticles with phytochemical compounds and/or the use of agro-industrial residues, with known nematicidal activity, directly in the soil, leading to an eco-friendly crop protection. The objectives of the study will be 1) to contribute to the development of a bionematicide delivery systems (BDS); and 2) to assess the impact of BDS on RKN mortality, penetration, reproduction, and/or gene expression.

The project is open for up to 2 MSc students. The work will be funded by the project BioNem Mulch (https://www.uc.pt/administracao/dpa/investigacao/proj_cof/BioNemMulch), and/or in the context of a collaboration with a company. The information gathered will contribute to international peer-reviewed publications.



49. Biological control of the invasive Acacia longifolia

Contact:

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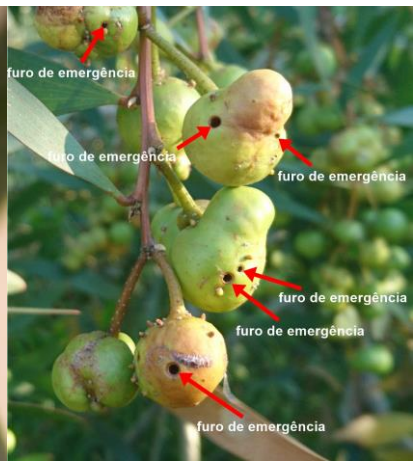
Description:

Acacia longifolia is one of the most widespread invasive plants along the Portuguese coast, decreasing plant diversity, drastically changing plant communities, altering soil and ecosystems dynamics, reducing forestry productivity and implying thousands of euros each year in control costs. Control methods used so far are not efficient, namely because the areas are quickly re-invaded through germination of the long-lived seeds accumulated on soil. Biological control of *A. longifolia* with the Australian gall wasp *Trichilogaster acaciaelongifoliae* (Hymenoptera, Pteromalidae) has proven to be an excellent option in South Africa and was introduced in Portugal, in 2015. In this context, we want to follow up not only the establishment of the biocontrol agent (BCA) but also its impacts on *A. longifolia* and native communities of plants and galls.

The work will involve field trips to monitor the areas where the BCA was introduced, and eventually greenhouse and lab work. The output of this study will contribute to the sustainable management of *A. longifolia* in Portugal and to increased knowledge of the BCA as well. Additionally, will be part of an innovative way of managing invasive plants in Europe. The results may contribute for a paper to be published in an international peer reviewed journal.

We are looking for someone with an interest in ecology, entomology or botany, who enjoys working with a team but also capable of carrying out independent field work if needed.

More information: https://invasoras.pt/controlo-natural-da-acacia-de-espigas & https://youtu.be/5GpjRQX0lyE (in Portuguese)



50. Heartworm disease in Coimbra: a case study

Contact:

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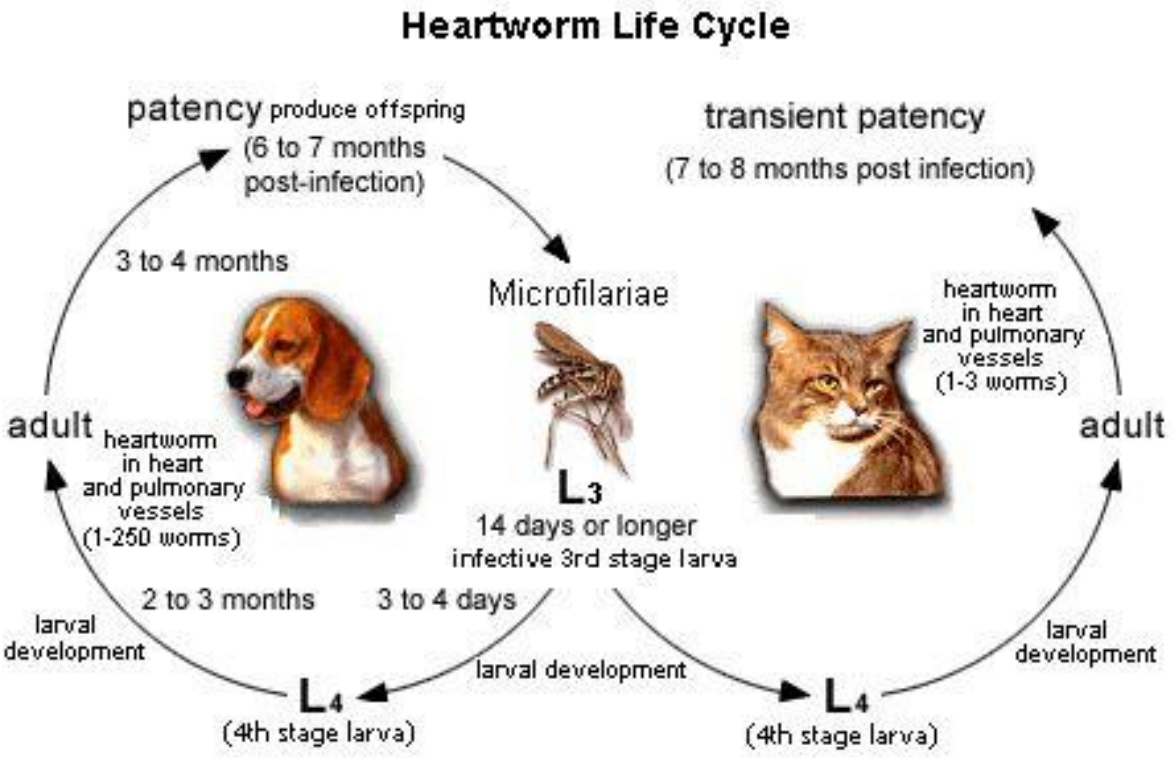
Sérgio Ramalho Sousa (ramalhosousa@gmail.com) https://www.cienciavitae.pt/BF12-584B-51D2

WATCH IT ON YouTube **https://youtu.be/VS6qindLLZ8**

Description:

Culicidae are mosquito vectors of several pathogens of importance in animal health. In Portugal, canine and feline heartworm disease is caused by *Dirofilaria immitis*. However, *D. repens* has been increasingly relevant in the current national panorama. Cases of canine and feline heartworm disease have been reported in Portugal, but the mosquito species present and their infection rates remain unknown. In this work, we intend to carry out prospection of Culicidae mosquitoes in the municipality of Coimbra. The main objectives are to determine the fauna of Culicidae mosquitoes of the country, the bioecological aspects, rates of infection by *Dirofilaria* spp. and the risk factors for vector transmission. The identification of vectors and parasites will be done through morphological and molecular methods.



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51. How does (micro)plastic pollution affect coastal and marine ecosystems?

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Research group: **Sistemas Costeiros e Oceano**
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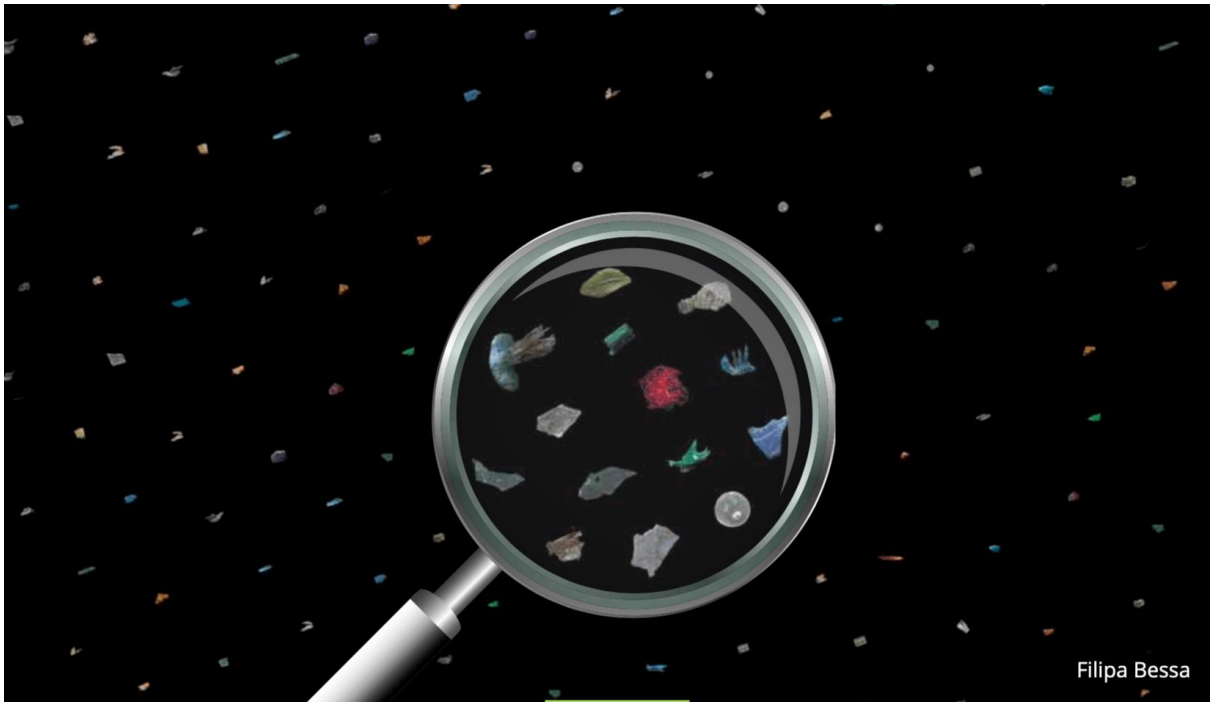
Description:

While plastic pollution is a major, long-term global environmental issue, there is growing concern around small particles of plastics called microplastics (< 5mm) that enter aquatic ecosystems. As well as affecting local waterways, microplastics can be transported and they can enter food webs at various points through accidental ingestion by animals. Furthermore, these plastics can attract and accumulate chemicals on their surfaces, with potential effects on biota. Despite the fact that many marine and freshwater environments, including rivers, lakes and estuaries, are heavily contaminated by plastic waste, the levels and effects of (micro)plastics contamination are still scarce.

In this project, we will investigate the issue of (micro)plastic pollution from marine and/or freshwater habitats, discussing current state-of-the-art research addressing the sources and pathways of microplastics, their accumulation, and potential effects on biota from these ecosystems. Recommendations on monitoring/mitigation will be established to provide managers with important information for policy-making decisions. Outreach and science communication activities will be also available.

Where you'll study: MARE – University of Coimbra and Laboratory MAREFOZ (Figueira da Foz).



52. Toxicity bioassays of **nanoplastics** to model stream biota

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Research group: **Freshwater Ecology (MARE)**

WATCH IT ON YouTube **https://youtu.be/kfphyqLBiFo**

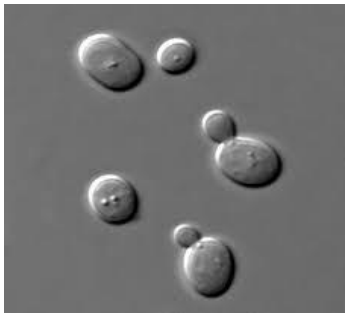
Description:

Until recently, freshwater bodies were mainly regarded as conduits of plastic transport to the oceans but nowadays freshwaters are recognized as reservoirs of plastic (nano)particles. Nanoplastics (NPs) are increasingly being acknowledged as an emerging threat to freshwater ecosystems, with their toxicity being governed by particle size and types. In forested streams, plant litter is the key carbon and energy source, being its decomposition in streams a critical ecosystem level process, driven mainly by fungi followed by bacteria. These microbes are responsible for the energy transfer to invertebrates.

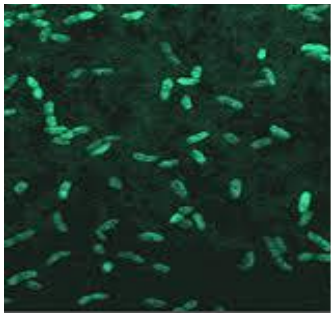
Here we propose to conduct toxicity bioassays using a range of concentrations of different sizes and types of NPs on key model organisms, namely fungi (Saccharomyces cerevisiae), bacteria (Vibrio fischeri) and invertebrate (Daphnia magna), all widely used in freshwater ecotoxicity assessments including at the regulatory level. In addition, three key stream invertebrates from different feeding groups (a shredder caddisfly, collector isopod and a scraper gastropod) will be collected from streams in central Portugal to perform bioassays. We will determine the dose-response curves of the (model) stream biota upon exposure to different sizes and types of NPs, to determine median effective (EC50) and no effect concentrations (EC10 for 10% responses, or NOEC), to explore sensitivity differences among key functional groups in stream communities. This will be the first study aiming to evaluate toxic of NPs to stream biota that can guide future legislations for streams protection. The results of this study would lead to two master theses and two scientific papers to be published in an international peer reviewed journals.

Key functional/taxonomic stream biota

Daphnia Magna



Saccharomyces cerevisiae



Vibrio fischeri

53. How does **climate change** affect soil functioning in drylands?

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WATCH IT ON YouTube **https://youtu.be/jjxNctYuedM**

Description:

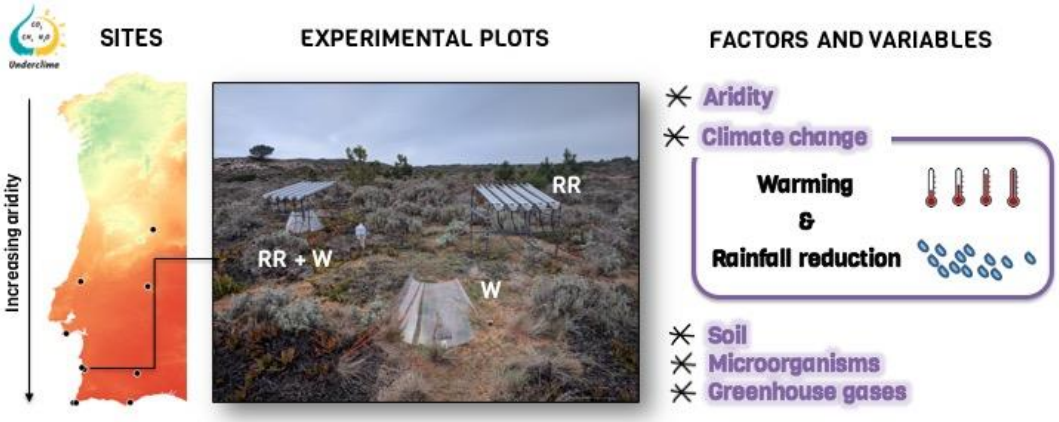
What and why? Drylands are singular and highly important ecosystems that occupy more than 45 % of the terrestrial surface (37% of continental Portugal) and host over 40% of human population worldwide. Climate change is increasing the aridity of many areas of the planet and leading to the expansion of drylands worldwide. However, the ecology of these regions and their response to climate change is still understudied.

Goal The main goal of this master thesis would be to study the links between soil attributes, microbial communities and soil functioning (particularly the exchange of greenhouse gases between the soil and the atmosphere) on a natural aridity gradient, and their resilience to different climate change scenarios.

How? We have different climate manipulation experimental treatments (rainfall reduction [RR], warming [W], and rainfall reduction and warming [RR+W]) running in several Portuguese Natural Parks (UNDERCLIME project) throughout an aridity gradient. We have also designed different laboratory bioassays using soils collected at regional (UNDERCLIME project) and global scales (BIODESERT project), which involve soil incubations, greenhouse gas sampling and laboratory analyses of extracellular enzyme activities.

Where? Field work in several Natural Parks of Portugal. Soil bioassays and analyses at the facilities of the Centre for Functional Ecology (Department of Life Science, University of Coimbra).

Experimental design:



54. Soil fauna of Gorongosa: a biodiversity and ecological survey on soil meso and macrofauna

Contact:

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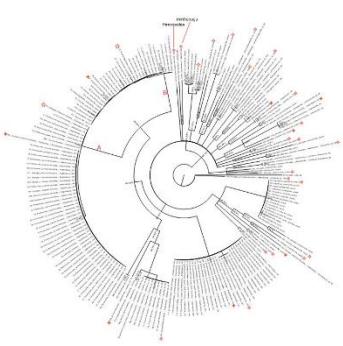
Description:

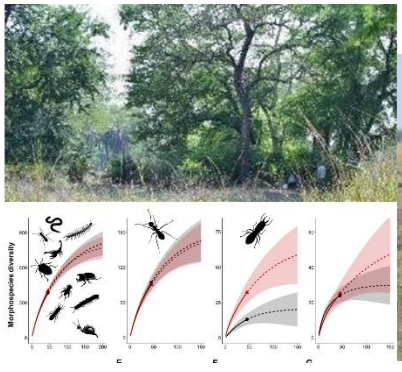
Soil biodiversity support important soil properties and processes. Particularly, soil fauna communities improve soil structure, via increasing soil pore space and soil bioturbation, soil water holding capacity, litter decomposition and nutrient cycling. Therefore, linking land-use type and environmental data with soil fauna structural and functional diversity can provide valuable information on its relevance and importance to the functioning and integrity of ecosystem(s). Yet very few information is available on sub-Saharan soil fauna.

Due to the existing information gap on soil fauna diversity patterns across the main habitat types of Gorongosa National Park (GNP), this project ("ECOASSESS – A biodiversity and ECOlogical ASSESSment of soil fauna of Gorongosa National Park (Mozambique") aims to contribute to increase the knowledge of biodiversity of this region, focusing on edaphic and epigeal soil fauna at the GNP.

A field sampling campaign in pre-selected dominant habitat types of the park (miombo forest, dry mixed forest, transitional forest and savannah) was carried out in 2019. In each habitat type 25 sampling points were established and at each point the distinct sampling procedures were setup to collect different soil fauna groups, namely microarthropods (Collembola) collected by soil cores and TSBF soil monoliths to collect in-soil macrofauna (earthworms). Sorting of the organisms collected by the different sampling methods has been carried out and these samples are available for further study.

The main task of this proposal is to assess and describe the biodiversity of collembolan and earthworm communities in the GNP. This will be done through the use of molecular tools, including DNA barcoding and metabarcoding techniques, and by targeting pre-selected specimens made available for this project. You will gain experience in molecular techniques such as DNA isolation and PCR assays, but also in data analysis.





55. Identifying cohort-specific growth variability in juvenile flatfishes

Contact:

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Miguel Pardal

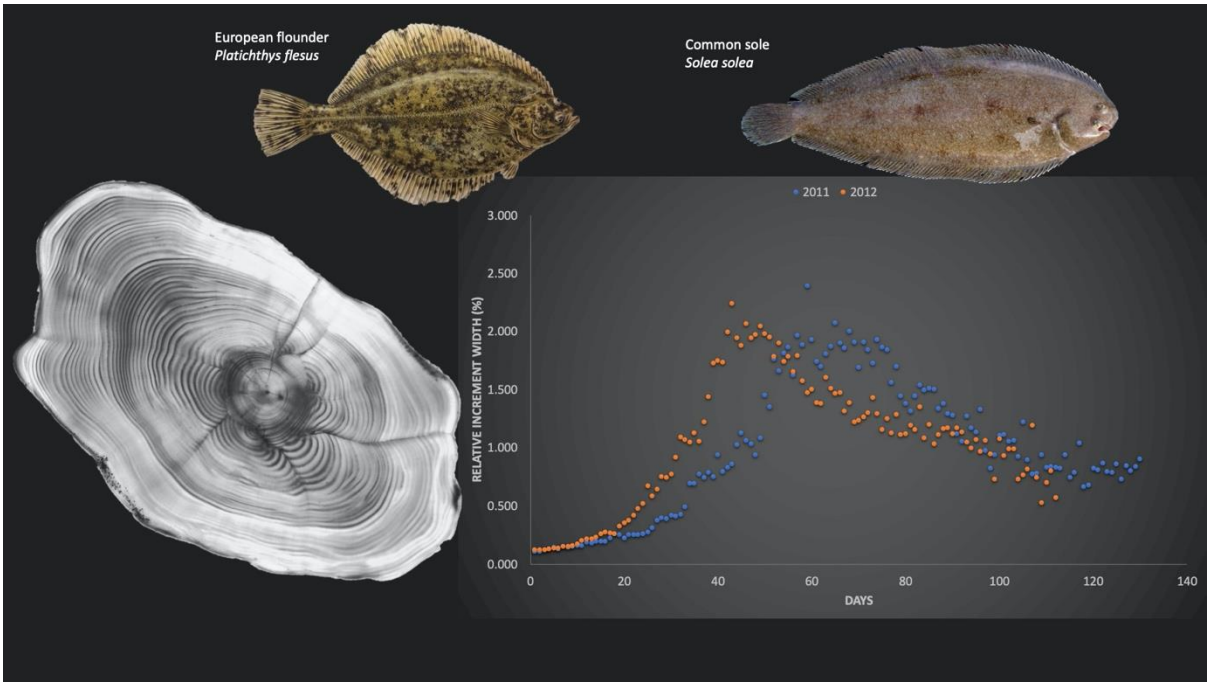
Research group: **Marine Research Lab**
http://cfe.uc.pt/profile/lines/3

Description:

Flatfishes display some of the most extreme changes in ontogenic development and habitat use in the marine environment. In particular, migrations between spawning and nursery sites requires their larvae to develop, metamorphose, acquire sufficient size to avoid being predated, to be able to swim and feed themselves.

In this project, we will assess cohort-specific growth variability in two flatfishes – European flounder (*Plathichtys flesus*) and common sole (*Solea solea*) in the Portuguese coast. Available data includes a 10-year dataset (2010-2020), and you will use otoliths as sources of temporally resolved information at a daily scale. Specific growth patterns will be compared against the main climatic and oceanic drivers (North Atlantic Oscillation, Eastern Atlantic Pattern, Atlantic Multidecadal Oscillation, Sea water temperature).

You will be able to perform field sampling in the Mondego estuary, learn laboratory work on fish biometrics, otolith extraction and preparation, digital imaging analysis to determine fish age, birth date and daily growth rates, and finally, data analysis using cutting-edge modelling approaches.



56. Can landscape topography affect the interpretation of honeybee "waggle dances"?

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Research group: **SEEL** - Soil Ecology and Ecotoxicology Laboratory
https://www.facebook.com/labsolos/

WATCH IT ON YouTube **https://youtu.be/fE81g_uqXA4**

Description:

Forager honeybees communicate to other bees the best sites for foraging by performing a waggle dances inside the hive. The analysis of these dances is widely used by researchers to measure foraging activity and thereby landscape use by honeybees. Nonetheless, most of the developed models for decoding waggle dances were developed in flat landscapes, ignoring the landscape topography. Thus, researchers might have been misreading the waggle dances in areas with irregular topography, such as mountain areas. Proving that these dances are correlated with field topography this study can be a game changer on honeybee behaviour analysis.

The student would do field work with honeybees in the Lousã area (mountainous region) and Idanha-a-Nova (flat agricultural landscape) followed by laboratory analysis for decoding the honeybee' waggle dances.

This project is framed into the European Food Safety Authority (EFSA) project OC/EFSA/SCER/2017/02, currently running at the Centre for Functional Ecology-UC, where the main goal is to acquire field data collection for a honeybee colony model evaluation. Besides the work devoted to waggle dance data collection and analysis, the student will collaborate with the work developed by the team developing this project, having the possibility to acquire different skills in honeybee ecology and behaviour.

The results are expected to produce a paper in an indexed journal.

57. Characterization of the **bacterial diversity** inhabiting **extreme environments** such as deep-groundwater, biofilms and lava tubes

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Description:

The main objective is to establish the diversity of the bacterial populations inhabiting extreme environments. These kinds of extreme environments are considered analogues to those existing in early Earth, and possibly existing in other planets, thus having importance in the beginning of life on Earth and as astrobiology subject. Samples, to be analysed, were collected in several springs in Portugal (biofilms, lava tubes, deep-aquifers), Spain (lava tubes, deep-aquifers) and Greece (deep-aquifers). The importance of this works resides on geo-ecology. Establishing the bacterial diversity of environments with similar geo-hydrological-chemical characteristics but located in different geographic locations; will provide good evidence to:

- determine if the environment and/or the geographic location or neither has influence on the microbial populations detected and its diversity.
- sustain discussion about different niches in early Earth where life might have occurred.
- Identify and characterization of novel species/genera.
- Identify isolated bacterial strains and/or bacterial consortium with enzymatic activity (with industrial applicability) towards specific substrates.

Possible thesis:

Biofilms bacterial cultured populations as source for biotechnologic enzymes.

Lava tubes: bacterial cultured populations as source for biotechnological enzymes.

High alkaline Deep-aquifers – metagenomic data screening in search for astrobiological and biotechnological answers.

Keywords: astrobiology, biotechnology, metagenomic screening