2024 DOCTORAL INPhINIT FELLOWSHIPS PROGRAMME – INCOMING

WATERLAND - Integrated strategy to boost soil rainwater storage and combat desertification at landscape-scale in Mediterranean pastures

Area of Knowledge: LIFE SCIENCES

Group of disciplines: Agriculture, Veterinary Science, Animal Production, Forestry

Research project

Aim, scientific & societal relevance: Increasingly drier springs result in decreased aboveground biomass for livestock, cork production and overall functional biodiversity loss. Climate change models indicate that pastoral land use in southern Iberia will no longer be feasible from 2050 due to desertification, thereby negatively affecting soil functioning, food security and rural livelihoods. Amending agricultural soils with biochar (carbon-based product of biomass pyrolysis) was shown to increase crop yield, mainly by improving soil pH, structure, water storage and exchange. Such potential benefits to agro-silvo-pastoral ecosystem health remain unexplored. WATERLAND aims to increase the residence time of rainwater in these ecosystems at catchment scale, by increasing infiltration and groundwater recharge, by combining Nature-Based Solutions (e.g. biochar) and other soil-water management and agroecological practices (e.g. tailor-made soil bunds, biodiverse seed mixtures with deeper rooting species, microbiome transplantation). This will be achieved by combining experimental work on soil science, ecosystem engineering and agroecology, with Life Cycle tools (e.g. water scarcity footprint) and hydrological modelling. Such synergism can represent a win-win scenario for pastoral lands, simultaneously securing key provisioning and regulating ecosystem services.

Transversal character & contribution to UN's sustainable development goals (SDG): WATERLAND relies on interdisciplinary collaborations among 5 of CESAM's research groups (SES, RCAT, ABEP, BPP, ECHC), as well as with Instituto Superior Técnico (IST), University of Évora (UE), AFLOSOR (Assoc. dos Produtores Agroflorestais de Ponte de Sor) and Terraprima business group. Its aim aligns with CESAM's strategic mission (current and future) of leading research and knowledge implementation in supporting and promoting functioning, adaptation and resilience of terrestrial ecosystems under the UN's SDGs #2, #13 and #15.

Job position description

The ideal candidate for this exciting project has a background in soil science, agroforestry, environmental engineering or ecology and holds a driving license (EU). Previous research experience with soil and/or modelling are preferential selection factors.

The job includes a large hydrological modelling and water scarcity footprint component, with experimental work in Terraprima's biodiversity pasture or AFLOSOR's Montado. Five interconnected work Tasks [T1-T5] will address this aim and include monitoring of: T1) key soil physico-chemical properties, main mesofaunal groups and microbial communities [months 1-6]; T2) above- and below-ground biomass [months 6-24]; T3) meteo data and water scarcity footprinting [months 18-36]; T4) catchment scale hydrological modelling (SWAT); T5) thesis writing, publication of scientific papers and presentations at conferences [months 6-36].

The candidate will integrate a dynamic transdisciplinary research team, supervised by CESAM researchers Dr Oscar Gonzalez-Pelayo, Dr Frank Verheijen and Dr Ana Catarina Bastos, with complementary expertise in soil science, hydrology and soil-biochar-crop-biota interactions. They coordinate various national/international research projects and an extensive collaboration network with research institutions and agro-forestry stakeholders. Other national/international collaborations will be sought to cover specific expertise, namely with Dr Dalila Serpa (CESAM; modelling), Dr Paula Quinteiro (CESAM; LCA), Dr Marjan Jongen (IST; pasture ecology) and Dr Simon Jeffery (Harper-Adams University UK; meta-analyses). The main risks and mitigation strategies to the project's timely execution will be identified and addressed jointly. Short-term scientific missions to MED-University of Évora will provide further opportunity to acquire new skills (e.g. microbiome transplantation). Throughout the PhD program, the candidate will be encouraged to develop His/Her own research interests within the scope of the workplan.

Supervisor team

Dr. Oscar Gonzalez-Pelayo (oscargonzalezpelayo@ua.pt); Dr. Frank Verheijen; Dr. Ana Catarina Bastos

Additional information

Url: https://www.cesam-la.pt/?menu=198&tabela=membros&language=eng

Website description: CESAM is composed by 12 interlinked Research Groups. The URL provided above summarizes the keywords, main activities and strategic goals of CESAM's R&D group 'Socio-Ecological Systems Analysis, Management & Planning' (SES), which will host and integrate the candidate.

Url: https://sites.google.com/view/biocharcology

Website description: The URL provided above summarizes the main activities and research topics of the Biocharcology R&D team (hosted by SES), coordinated by co-supervisors Dr Ana Catarina Bastos and Dr Frank Verheijen, and where the candidate will be integrated.

Url: https://www.med.uevora.pt/pt/grupos-de-investigacao/

Website description: The URL provided describes the MED-University of Évora Research Groups. There, the Plant Protection research group summarizes the keywords, main activities, and the new strategies for plant protection. This research group will host the candidate for the short-term scientific missions.

Url: https://www.aflosor.com/

Website description: AFLOSOR is the Association of Agroforestry Producers of the Ponte de Sor Region. It is a is a private organization aiming to develop actions enhancing the value of pastures and forests lands. It is active in agriculture and forestry, research and demonstration, and vocational training. This association will provide extensive pasture lands and historical datasets for the research project implementation.

Url: https://www.terraprima.pt/

Website description: Terraprima is a close partner of the Biocharcology team. The business group is dedicated to the design and implementation of integrated systems that compensate for the

environmental impact of human activity, including managing remuneration projects for environmental services provided through good soil management practices (e.g. sown biodiverse pastures). They also manage experimental sites such as Quinta da França, a working farm/pasture which is involved in demonstration projects related to the environment and sustainability.