Proposition de Thèse sur Projet : « Biodiversity Monitoring and Assessment in farming systems across time and space » (UMR SENS / IAMM & CIRAD-ES /ED GAIA, Université de Montpellier)

Problématique :

The Quinoa4Med_UP project consortium builds on the successful outcomes of the Quinoa4Med project (2022–2025), which confirmed quinoa as a climate-smart crop diversification strategy with robust potential for higher income generation of small farmers in saline and/or marginal soils. With quinoa cultivation practices now well established across several living labs (LL) across diverse Mediterranean agroecological zones, and with key stakeholder engagement structures in place, including farmer groups (GDAs) and rural women's associations, Quinoa4Med_UP is well positioned to transition from piloting to scaling.

In fact, the project will focus on upscaling the agroecological potential of quinoa-based farming systems and facilitating the emergence of a resilient, inclusive quinoa value chain adapted to Mediterranean contexts. Q4M_UP builds upon the outcomes and lessons learned from the previous Q4M project, which can be summarized here by quinoa adaptation to marginal environment. The project Q4M successfully selected quinoa lines and species adapted to Mediterranean conditions and harsh environments (salinity, drought), promoting crop diversification through intercropping, mixed farming, organic farming and agroforestry systems. In addition, quinoa cultivation practices and techniques are now standardized across multiple Mediterranean demosites, with coordinated LLs and the development of unified phenotyping and yield evaluation protocols, ensuring scalable and efficient production.

Within the sub-Objective SO2, the new project will focus on preserving and enhancing biodiversity by promoting quinoa-based AE practices, such as crop rotation, agroforestry, saline soil and oasis restoration. Working on Living Labs, one goal is to develop a multi-country database of agrobiodiversity in quinoa-based systems.

Crop diversification based on quinoa specie was demonstrated under previous Q4M to serves as a powerful strategy for enhancing biodiversity. In trees (as permanganate, olive), which provide windbreaks, shade, and habitat for pollinators and birds, thereby improving ecological connectivity and building soil carbon. Mixed cropping with legumes, maize, or vegetables not only increases plant diversity and productivity but also fosters habitats for beneficial organisms and enhances nutrient cycling. Similarly, crop rotation involving quinoa and a variety of other crops disrupts pest and disease cycles, promotes diverse soil microbial communities, and restores degraded lands through sustainable nutrient use. Quinoa4Med demonstrated that Quinoa plays a critical role in oasis restoration, thanks to its high drought and salinity tolerance, allowing for the rehabilitation of arid landscapes through traditional water management techniques and polyculture farming. The present project Q4M_UP will continue work on adapting biodiversity assessment tools for quinoa fields (WP2), with a

focus on in-depth evaluation of agrobiodiversity within LL and its distribution across time and space. The project will offer standardized procedures, user-friendly data templates, and biodiversity indicators tailored to quinoa fields, enabling researchers, extension agents, and farmers to conduct ongoing monitoring and support replication in other dryland agroecosystems.

The main research question for the PhD thesis is "*how to assess the impact on wild and cultivated biodiversity of an alternative species (C. quinoa* Willd*.) recently introduced in Mediterranean cropping systems*".

Principal activities:

The PhD thesis is centered on the WP2 for monitoring, assessing, and enhancing biodiversity in Mediterranean agroecosystems by integrating nature through quinoa crop as an alternative and exotic species, into farming systems through agroecological practices. Operating within the 4 Living Labs in Tunisia, Algeria, Morocco, and Spain, this WP will rely on a strong methodological foundation developed and supported by CIRAD and shared with all the partners for working all together across the LLs. Tools for biodiversity assessment will be adapted for quinoa-based systems, with main contributions from the PhD student research program, and developed through participatory approaches involving partners during workshops and fieldwork. The main objectives are:

• To adapt and harmonize biodiversity assessment tools for agroecological quinoa systems.

• To assess agrobiodiversity across spatial and temporal scales in diverse Mediterranean farming contexts.

• To characterize associated wild biodiversity and ecological interactions with quinoa fields.

The French Living lab, in partnership with the 4 others, will play an additional role in experimenting with new crops and varieties to optimize agricultural productivity while generating more resilience to the agricultural systems. Through field demonstrations and multi-stakeholders' workshops, it aims to develop, to test innovative practices and to disseminate knowledge contributing to more sustainable agriculture in the region.

Tools and Methods

Tasks will include the assessment of agrobiodiversity across space and time, with a focus on crop rotation, landscape-level richness, intercropping systems, and quinoa genetic diversity.

WP2 will also examine wild biodiversity in quinoa fields including crop wild relatives, weed communities, insect biodiversity, soil biota, and plant health.

Finally, the agronomic performance of diversified systems will be discussed with a specific focus on quinoa in intercropping settings. At the end, as main result, WP2 will deliver a practical toolbox for biodiversity monitoring and contribute to the scaling-up of agroecology across Mediterranean farming systems.

Task 2.0 – Adapting Biodiversity Assessment Tools for Quinoa Systems

Task T2.0 focuses on the adaptation and methodological development of biodiversity assessment tools specifically tailored to quinoa-based agroecosystems. Biodiversity will be assessed using hierarchical diversity levels and considering two complementary biodiversity indices, the Shannon Index, sensitive to the introduction or removal of species/varieties and indicative of genetic evenness and crop diversity; and the Simpson Index, less sensitive to rare species, emphasizing dominance structures and representing the weight of prevalent varieties in traditional systems.

The toolbox will include guidelines, indicator sheets, and a database structure compatible with Living Lab field data from Tunisia, Algeria, Morocco, and Spain. Tailored training sessions and methodological workshops will be proposed during the project to ensure harmonization of biodiversity monitoring across case studies.

Task 2.1 – Assessment of Agrobiodiversity in Crop Rotations and Farming Landscapes

Task T2.1 aims to evaluate cultivated biodiversity across spatial and temporal scales within quinoa-based crop systems, particularly within agroecological transition contexts. It will be implemented in the Living Labs of Tunisia, Algeria, Morocco, and Spain. Data collection will focus on species and varieties richness, abundance, and spatial distribution across cropping seasons and rotations. The analysis will include structured inventories of crops and their varieties, phenological data, and frequency of occurrence. A cross-site comparison will identify how quinoa varietal diversity contributes to resilience and resource-use efficiency.

Task 2.2 – Assessment of Wild Biodiversity Associated with Quinoa Fields

Task T2.2 focuses on evaluating the wild biodiversity associated with quinoa fields and their surrounding environments, with the aim of better understanding the ecological interactions between cultivated and spontaneous wild biodiversity components in agricultural landscapes. The work will compare biodiversity levels in quinoa plots to adjacent cultivated and semi-natural areas.

The main expected outcomes of the PhD Thesis are:

D2.1: Biodiversity Assessment Toolbox for Mediterranean Quinoa Systems (EN/FR)

D2.2 : Multi-country database of agrobiodiversity in quinoa-based systems

D2.3 : Report on indicators of quinoa genetic diversity at farm level

D2.4 : Report on wild biodiversity associated with quinoa fields (flora, fauna, soil)

D2.5 : Illustrated field guide for species identification in partner countries

D2.6 : Report on Quinoa inter-cropping system

The scientific approach adopted will leverage the structure and governance of Living Labs to gather primary data and generate a shared understanding of the system, and its dynamics for the agroecological transition. This process will draw on methods from agronomy, ecology, and geography.

Détails du Poste :

Référence du poste : QUINOA4MED_UP-Thèse-001

Lieu de travail : IAMM et UMR SENS (CIRAD, département Environnement et Sociétés) à Montpellier

Nom du directeur de thèse, et responsable scientifique, au sein du CIRAD : Dr Didier BAZILE

Nom de la co-encadrante de thèse au sein de l'IAMM : Dr Mélanie REQUIER-DESJARDINS

Type / Durée du contrat : CDD Doctorant/Contrat doctoral à Temps complet de 36 mois

Date de début de la thèse envisagé : Septembre 2026

Rémunération fixée selon les règles nationales pour le doctorat.

Profil attendu pour les candidat-es :

- Connaissances en écologie appliqué au champ de l'agronomie ;
- Maitrise de R avec très bon niveau en statistiques descriptives, ANOVA, Analyse des données (ACP), etc.
- Motivation à étudier l'agrobiodiversité *in situ* avec différents acteurs et intérêt à comprendre et faire dialoguer des acteurs aux profils et objectifs variés
- Première expérience souhaitée en R&D sur écologie en milieu agricole ;
- Connaissance de la région Méditerranéenne ;
- Langues : au-delà de la maitrise du français (lu, écrit, parlé), bon niveau d'expression (oral/écrit) en anglais. La connaissance de l'Arabe sera un atout.

Contexte de travail :

Le/la candidat.e signera un contrat doctoral de droit privé à temps complet l'IAMM. Il/Elle sera inscrit.e à l'Ecole doctorale GAIA de l'Université de Montpellier. L'IAMM et le CIRAD formaliseront son accès à un bureau et aux équipements.

Toute candidature doit comporter un CV, une lettre de motivation, le mémoire de M2, les relevés de notes de Master et une copie des diplômes les plus récents. Elle est à envoyer par mail AVANT le 15 AOÛT 2026 (*bien rester disponible pour les candidats présélectionnés qui passeront devant le jury de recrutement entre le 26 et le 28/08/2026***) à :** didier.bazile@cirad.fr , requier@iamm.fr et belhouchette@iamm.fr

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