

## **COORDINATED PROJECT**

Macroecological and anthropogenic filters on animal biodiversity in Iberian arboreal agroecosystems: multi-scaled effects on ecosystem functions and services (AGRABIES; LR: Pedro J. Rey, Universidad de Jaén)

### **Summary**

Biodiversity-provided ecosystem services are pivotal for human well-being. Land-use changes, especially due to farming intensification -one of the main drivers of the world biodiversity decline- threaten seriously the ecosystem services and farming production sustainability. This concern, and the awareness that an increasing part of biodiversity inhabits human-modified landscapes, is driving scientific attention to understand how to make compatible human land-use and biodiversity maintenance. In turn, worry about ecosystem service sustainability has triggered the interest for re-evaluating the paradigm of biodiversity-ecosystem functioning (BEF) link, by exploring what components of biodiversity (taxonomic, functional, phylogenetics) are more relevant for ecosystem functioning and stability. However, with few exceptions, studies have neglected that the BEF link could be influenced by ecological and macroecological filters (altitude, latitude, seasonality) that constrain local species pool and their functional and phylogenetic diversity. This Coordinated Project seeks to understand how macroecological and human land-use filters interact to shape biodiversity in farming landscapes, and how this cascades into ecosystem functions and services. We will focus on three agroecosystems highly representative of traditional agriculture in Spain, which account for differences between the Atlantic and Mediterranean bioclimatic regions of Iberian Peninsula: Asturian highland woodland pastures; Asturian lowland cider apple plantations; and Andalusian olive plantations. These agroecosystems represent strong gradients of biogeographical differentiation enabling the assessment of macro-ecological filters on animal biodiversity. Besides, these are optimal systems to evaluate the anthropogenic effects on biodiversity, as they differ in area, landscape configuration, spatial distribution of ownerships, common agricultural practices, etc, what translates into within-region gradients of human land use. As general objectives of the project we aim to (1) evaluate the relative weight of macroecological factors (changes in latitude, altitude and seasonality) and human land-use (gradients of landscape complexity and farming intensification) in the expression of different components of animal biodiversity in Iberian arboreal agroecosystems; (2) assess changes in the relationships between animal biodiversity and services that may emerge when considering different animal groups, ecosystem functions, and types of arboreal agroecosystem; (3) develop guidelines for biodiversity conservation and management of animal-provided ecosystem services in Spain. Biogeographical and land-use differences between agroecosystems would justify the differences in the major objective persecuted by each subproject. SP1, conducted in Mediterranean olive plantations, deals with hypotheses around the effects of intensification-landscape complexity interaction on biodiversity patterns and services. SP2, conducted in the Cantabrian agroecosystems, deals with the causal link between biodiversity and ecosystem services, with especial attention to the relative relevance of compositional, functional and phylogenetic diversities.

**Keywords:** birds, environmental gradient, farming, functional and phylogenetic biodiversity, landscape structure, pest control,

## **Subproject CGL2015-68963-C2-2-R**

Disentangling the link between bird biodiversity and ecosystem services in Cantabrian agroecosystems: taxonomic, functional and phylogenetic effects.

### **Summary**

The -Biodiversity-Ecosystem Functioning link- concept has become in a paradigm in theoretical and applied ecology. Nevertheless, we are still far from understanding how different components of biodiversity (composition, functional and phylogenetic) do actually impact in the provision of different ecosystem services in the real world. This gap of knowledge is especially adverse when dealing with agroecosystems, where food sustainable production and biodiversity conservation must be reconciled. Focusing on birds as biodiversity target group, this proposal seeks to evaluate the magnitudes of pest control and seed dispersal in Cantabrian agroecosystems (montane woodland pastures, lowland apple plantations) in relation to the taxonomic, functional and phylogenetic diversities of bird local assemblages. We will take into account the predictable variability in bird biodiversity imposed by different processes of species filtering, both macroecological processes reflected in altitudinal and seasonal (bird migration and wintering) differences, and processes of human impact, translated into losses of semi-natural forest habitats in the farming landscape. Functional diversity effects will be assessed by applying a bird trait-based approach, addressed to identify both the traits responsible of functions (effect traits) and those enabling birds to buffer habitat loss (response traits). We will also evaluate the relevance of phylogenetic history in the emergence of both effect and response traits. Finally, we will estimate the degree of correlation between compositional, functional and phylogenetic diversities, in order to interpret the potential trade-offs between actions for conserving biodiversity and actions to manage ecosystem services at the short and the long terms. The proposal includes an empirical design based on regional-scale intensive field sampling, using standardized methods for ecosystem service assessment across the different agroecosystems. The sampling of life-history, behavioral and morphological traits of birds will be also accomplished, together with the estimation of phylogenetic distances across bird species. The direct collaboration with environmentalist NGOs, environmental managers from the Regional Government, agriculture research centers, and farmer organizations, will make possible to divulgate the value of bird biodiversity, as well as to identify those management actions on species and habitats maximizing the provision of ecosystem services. Our standardized design will also enable to compare results with those from other Iberian agroecosystems in a biogeographical context, as facilitated by the other Subproject of this Coordinated Project.

**Keywords:** Asturian apple plantations, Cantabrian woodland pastures, biodiversity conservation, bird migration and wintering, bird traits, food production, landscape complexity, pest-control, seed dispersal