
Understanding oak-animal ecological interactions for implementing biological pest management in dehesas/montados: new technological applications

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One of the major human challenges is to produce enough food for an increasing population in an environmentally friendly way. The so-called “*ecological intensification*” responds to this challenge and consists in taking profit of the services offered by certain organisms with quantifiable effects on the agroecosystems. In this talk I will explain how we are following this approach to increase the productivity of oak dehesas/montados with a livestock management aimed at reducing the impact of oak pests.

To apply ecological intensification in agroecosystem management it is essential to have a profound knowledge of the ecological interactions and trophic networks. We have assessed by long-term field monitoring and experimental approaches the negative effects of oak pests (i. e. acorn borer insects –mainly weevil larvae Coleoptera Curculionidae- and leaf-feeding caterpillars) on acorn production. Many species are, however, vulnerable to trampling and/or intraguild predation by large herbivores –wild ungulates and livestock- in those life-stages that they spend immobile the ground (i. e. larvae within prematurely dropped acorns or pupae among leaf-litter).

Intraguild predation by large-herbivores reduces acorn infestation rates by weevils and the presence of livestock also changes the abundance and community composition of leaf-feeding Lepidoptera. A grazing scheme that concentrated large herbivores on different sectors of the farms when insects are more vulnerable to predation could thus serve to reduce acorn predation rates by *Curculio* weevils. Moreover, using molecular markers to assess gene-flow among trees, we assessed that the dispersal abilities of weevils are limited, what would reduce the intensity of recolonization of those trees in which weevils numbers had been artificially reduced.

In our ongoing project we are going a step forward to upscale the significance and applicability of these results. We are relating multi- and hyper-spectral images taken by drone with fine measures of pest insect abundance, defoliation and acorn infestation rates in focal study trees. In addition, we are remotely tracking livestock (cows, pigs, goats and sheep) using GPS collars. Doing so we aim to re-analyse the relationship between pest abundance and livestock presence using the same georeferenced

system at the scale of whole dehesa/montados rangelands. Our final goal is to develop a potential grazing scheme (intensity and calendar) as a tool to mitigate oak pests.

Short Bio of Raúl Bonal:



PhD in Biological Sciences (Universidad Autónoma de Madrid). After working at different institutions (Universidad de Castilla-La Mancha, Spanish Research Council -CSIC- and the Natural History Museum -London-) I am currently a researcher at the University of Extremadura. My research line is fundamentally based on the study of plant-animal interactions and forest ecology and management under a wide perspective. My main study models are the insects that feed on the foliage and seeds of oaks *Quercus* spp. I have investigated the factors promoting their diversification and their effects on plant productivity. Besides, I have studied seed dispersal by small mammals and its effects on oak natural regeneration in dehesas/montados. The methodology I use is heterogeneous, including regular field monitoring, laboratory experiments and the use of molecular techniques.

I am currently leading a project entitled “Control of oak pest damages through livestock management: biological basis and new technological applications”. Our objective is to assess the interactions between the most frequent livestock species (cows, pigs and sheep) in the Iberian oak dehesas/montados and the most common oak pests. The project implements molecular techniques for pest molecular diagnosis and dispersal estimation. It also involves the use of new technologies (drones, remote sensing and GPS tracked livestock) for real time assessment of livestock spatial distribution and tree vigour.