

Monitoring drought impact on Mediterranean oak savanna vegetation using remote sensing

González-Dugo, M.P. ⁽¹⁾, A. Andreu ⁽¹⁾, E. Carpintero ⁽¹⁾

⁽¹⁾ IFAPA. Consejería de Agricultura y Pesca, Córdoba, Spain. E-mail: mariap.gonzalez.d@juntadeandalucia.es



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INTRODUCTION

A holm oak savanna, known as *dehesa* in Spain and *montado* in Portugal, is the largest agroforest ecosystem in Europe, covering about 3 million hectares in the Iberian Peninsula and Greece. It is considered an example of sustainable land use, supporting a large number of species and diversity of habitats and for its importance in rural development and economy. It is a combination between an agricultural, and a naturally vegetated ecosystem, consisting of widely-spaced oak trees combined with a sub-canopy composed by crops, annual grassland and/or shrubs.

The Life project bioDEHESA aims to **promote the sustainable and integrated management of *dehesas*** in order to improve the situation of biodiversity through the dissemination of demonstrational actions that address the main challenges related to their conservation.

In the last decades this system is being exposed to multiple threats derived from socio-economic changes and intensive agricultural use, which have caused environmental degradation including tree decline, changes in soil properties and hydrological processes, and an increase of soil erosion.

Soil water dynamics plays a central role in the **current decline and reduction of forested areas** that jeopardizes the ecosystem preservation (Pulido et al., 2005). The interaction of soil water dynamic and the main biotic factor involved in oak decline, the invasive pathogen *Phytophthora cinnamomi*, remains little understood. Water stress and pathogen's damage, separately and combined, cause the same symptoms in trees.

OBJECTIVES

This study aims to test a methodology for estimating oak fraction cover under the conditions of low and sparse vegetation of this ecosystem, and to analyze the evolution over the last 20 years of the forested areas in relation to the occurrence of periodic droughts.

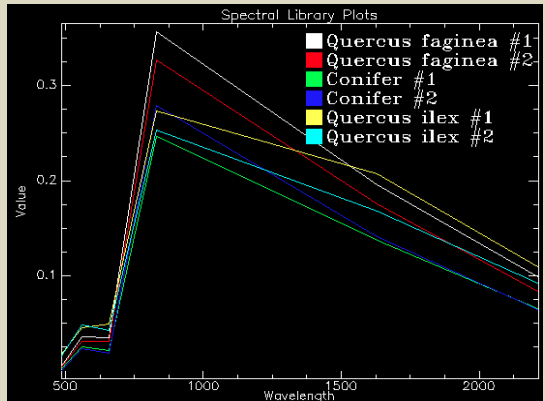
METHODOLOGY

A multiple endmember spectral mixture analysis (MESMA, Roberts, et al., 1998) has been applied to six summer Landsat-4, 5 and 7 images from year 1991 to 2011. Each spectrum is modeled as the sum of *pure spectra* called endmembers, each weighted by the fraction of an endmember required to produce the mixture. MESMA allows the number and types of endmembers to vary on a per-pixel basis.

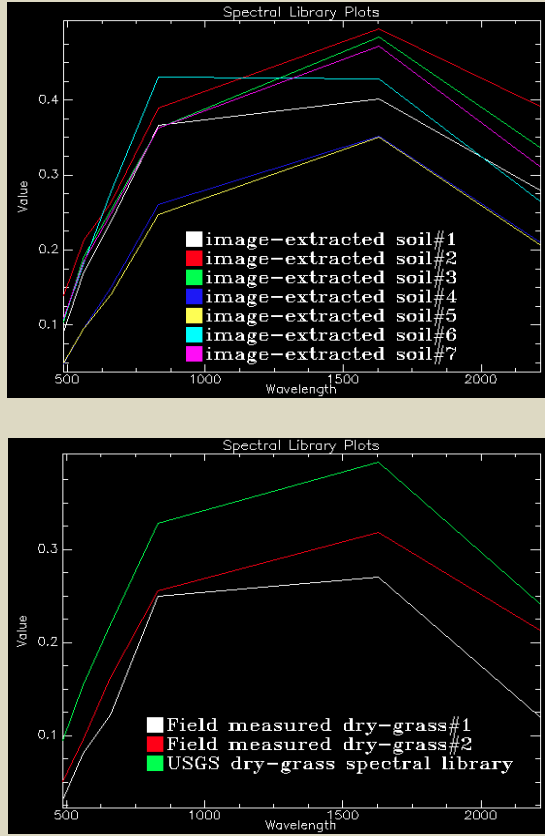
A supervised classification of an infrared aerial photography, acquired during the summer of 2011, has been used to validate satellite estimations of the oak ground fraction cover (Fv) using MESMA.

MULTIPLE ENDMEMBER SPECTRAL MIXTURE ANALYSIS

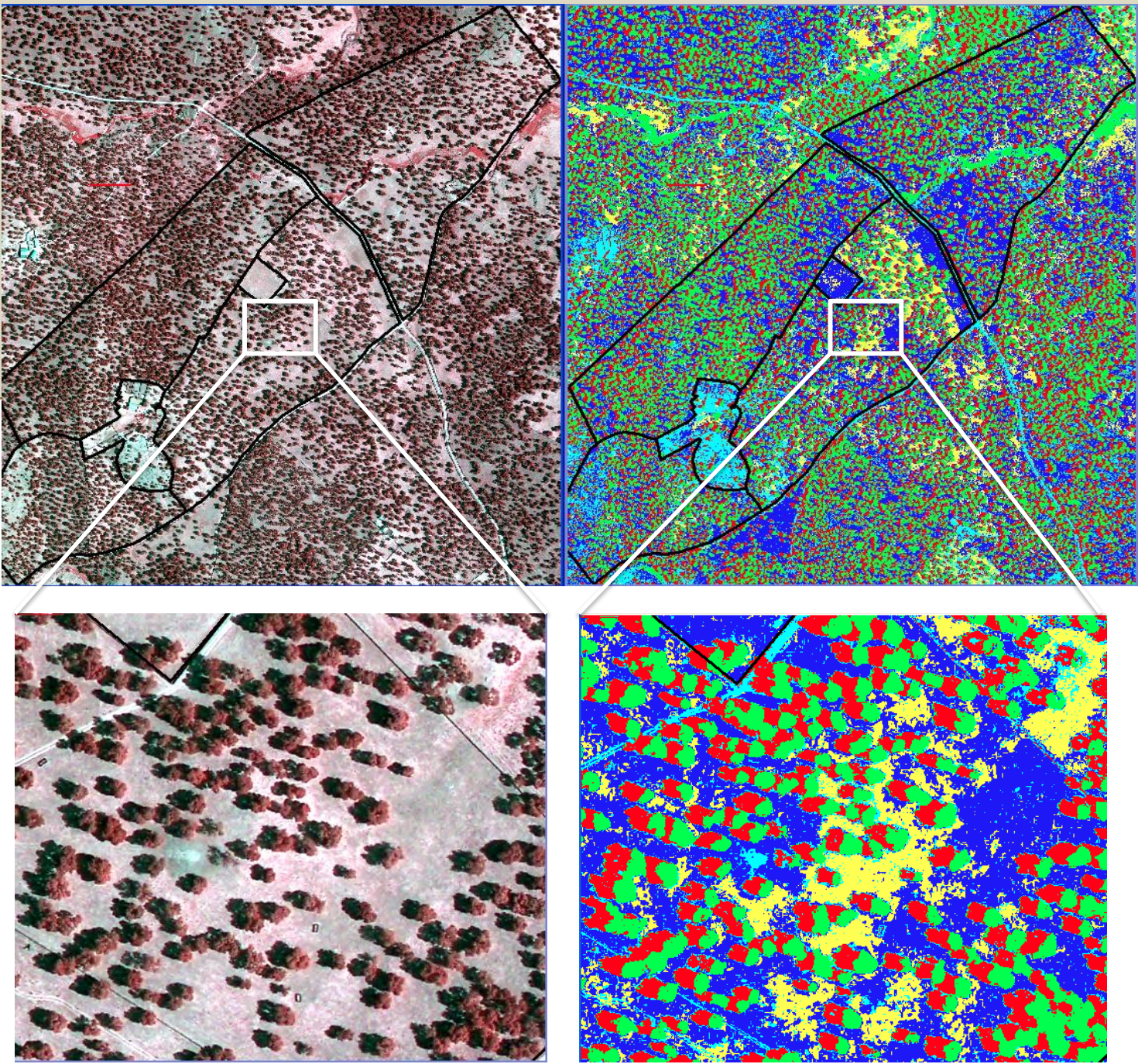
Image endmembers: green vegetation (oaks and conifer) and soil



Spectral library endmembers: non-photosynthetic vegetation, shadow

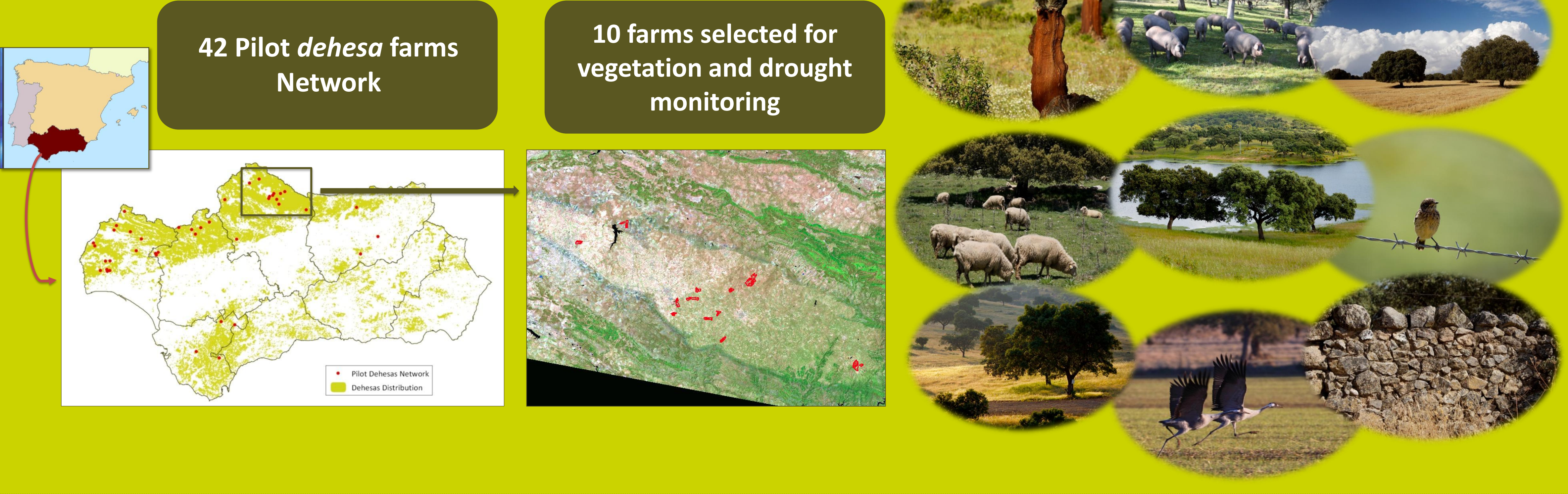


Infrared Orthophotography (Summer 2011)

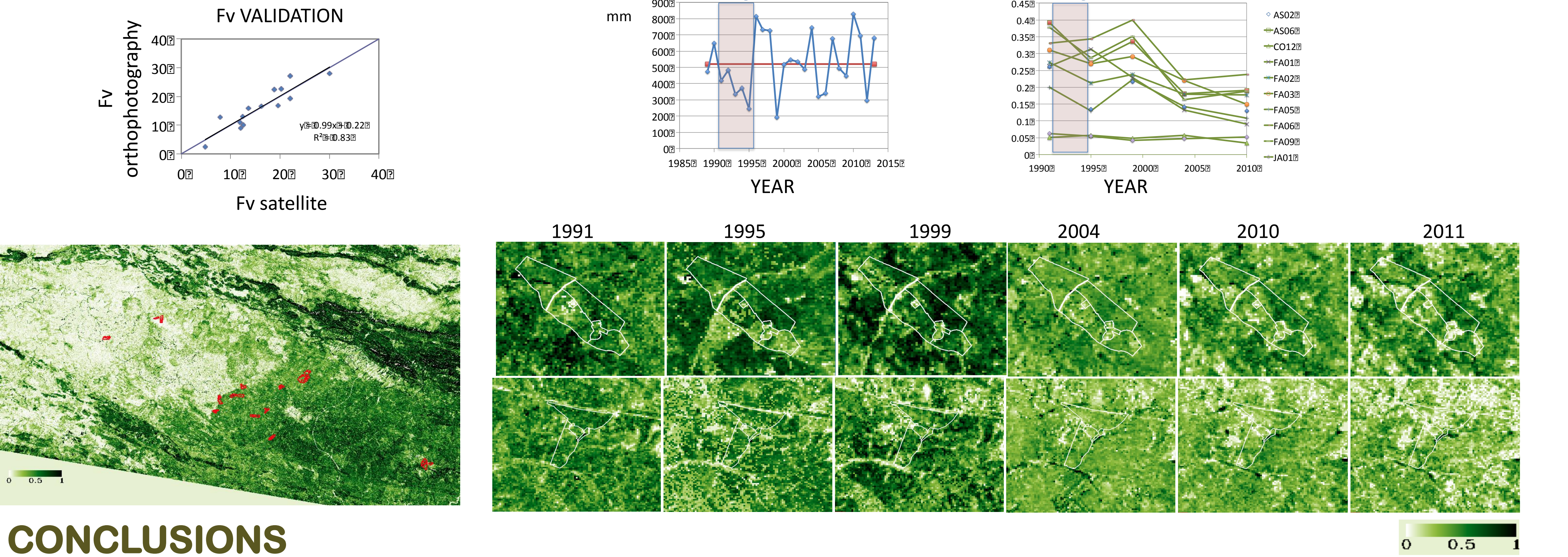


VALIDATION

STUDY AREA



PRELIMINARY RESULTS



CONCLUSIONS

The multiple endmember spectral mixture analysis has provided accurate estimations of oak fraction cover under these conditions, with sparse and dry vegetation. An intense drought (91-95) had a significant impact on holm oak ground cover, with an important reduction (5% on average) in green vegetation fraction cover. Most of the farms recovered the tree cover by 1999, but a continuous decreased since then cannot be clearly explained only by the successive droughts.



FURTHER INFORMATION

www.biodehesa.es

email:

mariap.gonzalez.d@juntadeandalucia.es