Institute of Natural Resources and Agrobiology Spanish National Research Council (IRNAS-CSIC)

Seville, Spain

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Head of the SIFOMED (Mediterranean Forest Systems) research group

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The Institute of Natural Resources and Agrobiology of Seville (IRNAS):

- ❑ Belongs to the Spanish National Research Council (CSIC)
- ❑ Conduct basic and applied research focused on:
  - Mediterranean agricultural and forest systems
  - The plant-soil system
- ❑ Involves 40 scientists structured in 13 research groups and 4 departments. Total staff ~ 120 people

Departments

Geoecology, Biogeochemistry and Microbiology	Protection of the Soil-Plant-Water system	Agrochemistry and Soil Conservation	Plant Biotechnology
G1 – SIFOMED (Mediterranean Forest Systems)	G5 – Irrigation and crop ecophysiology	G7 - Agrochemistry	G10 – Propagation and plant nutrition
G2 – MOSS (Organic matter in soils and sediments)	G6 – Sustainable use of the plant-soil system	G8 – Organic and inorganic pollutants	G11 – Salinity
G3 – Environmental Microbiology		G9 – Bioremediation	G12 – Seed biotechnology
G4 – Microbiology of extreme environments			G13 – Lignocellulosic materials of industrial interest

The SIFOMED group is the only one conducting "pure" forest research, but techniques and approaches developed in other groups, particularly those of the Geoecology Department, are of great interest and potential application for the understanding of Mediterranean forests.

Departments

Geoecology, Biogeochemistry and Microbiology

- G1 – SIFOMED (Mediterranean Forest Systems)
- G2 – MOSS (Organic matter in soils and sediments)
- G3 – Environmental Microbiology
- G4 – Microbiology of extreme environments

Protection of the Soil-Plant-Water system

- G5 – Irrigation and crop ecophysiology
- G6 – Sustainable use of the plant-soil system

- **G1- SIFOMED:** dynamics and function of Mediterranean forests under global change

Related groups and topics:

- **G2:** Effects of wildfires on soil organic matter. Implications in carbon sequestration
- **G3, G4:** Microbial diversity and function
- **G5:** Water stress in woody plants
- **G6:** Soil degradation

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The SIFOMED group: main research lines

- To study problems of **regeneration and decline** of Mediterranean tree species, identifying the main abiotic and biotic causal factors under different scenarios of Global Change.

  We are particularly interested in predicting the combined impacts of two global change drivers -climate change and exotic pathogens- on forest community dynamics and structure

- To explore the role of **mutualistic and antagonistic interactions** between plants and soil organisms as determinants of forest dynamics.

  We are particularly interested on the functional role of mycorrhizal fungi and of exotic root pathogens (Phytophthora and Pythium spp.) as determinants of tree growth and survival

- To study **biogeochemical cycles** (C, N, P) and the microorganisms involved in Mediterranean forests under different disturbance regimes.

  We analyse the role played by different tree species in these cycles, and the potential implications for soil diversity and ecosystem function of changes in plant community composition

- To apply research results to the **conservation and restoration** of Mediterranean forests and agroforestry systems.

  We use advanced spatially-explicit modeling and simulations of the impacts of different global change and management scenarios on the abundance and performance of Mediterranean tree species.

The SIFOMED group:

Main past and current projects

- Mainly funded by projects gained in national and regional competitive programs

2011-2014 *The role of plant-soil feedbacks in the community dynamics of declining Quercus forests.* MICINN. PI: Lorena Gómez Aparicio.

2011-2014 *Functional diversity and resilience of Mediterranean forests*. MICINN. PI: Teodoro Marañón.

2011-2014 *Global change, altitudinal migration and colonization of degraded habitats in Mediterranean mountains.* Excellence Research Group Programme of the Andalusian Government. PI: Regino Zamora.

2011-2014 *Comparative analysis and synthesis of the patterns of regeneration, decline and distribution of Quercus species: capacity of resilience to cope with global change*. Excellence Research Group Programme of the Andalusian Government. PI: Teodoro Marañón.

2010-2013 *Cork oak decline and global change in the Doñana National Park: an experimental approach*. Autonomous Organization of National Parks - MARM. PI: Luis V. García.

2009-2012 *Ecological interactions and global change in Mediterranean forests*. MICINN. PI: Dr. Teodoro Marañón.

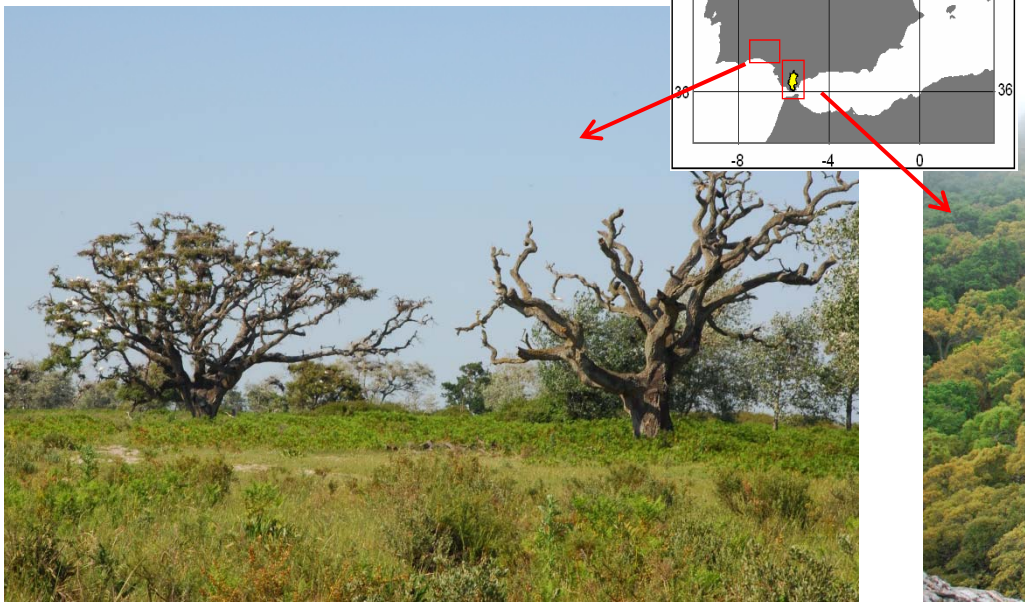
2009-2014 *Spanish woodlands and global change: threats and opportunities*. MICINN. PI: Dr. Javier Retana.

The SIFOMED group:

Main experimental field sites

Doñana National Park

A Biosphere Reserve including a declining cork oak savanna



Main tree species: *Quercus suber, Pinus pinea, Juniperus phoenicea*

Alcornocales Natural Park

The largest and best conserved *Quercus suber* forests of Europe

Main tree species: *Quercus suber*, *Quercus canariensis*, *Olea europaea*, Tertiary relict species (*Frangula alnus*, *Laurus nobilis*,)

The SIFOMED group:

Main experimental field sites

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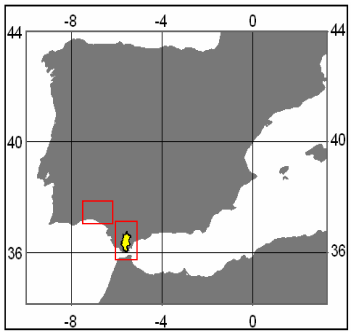

80 geo-referred centenary *Q. suber* trees
Network of 9 experimental herbivore exclusions (3-10 ha in size)

Alcornocales Natural Park

The largest and best conserved *Quercus suber* forests of Europe

Network of 9 permanent 1-ha plots (since 2002)

Processes studied *in situ*

- Regeneration of woody species (seed production, dispersal and predation; seedling emergence, survival and growth; seedling diversity)
- Health, structure and composition of the adult tree community
- Dynamics of litter production
- Ecosystem processes (soil respiration, N- and P-availability using ion-exchange resins)
- Abiotic environment (light, temperature, soil moisture)

The SIFOMED group:

Laboratories and greenhouses

❑ Soil and Plant Laboratory

Analysis of soil and plant physico-chemical and biological properties

e.g. Total C and N, macro- and micro-nutrients, enzimatic activities, PLFAs, soil functional diversity (Microresp), root structural characteristics

Description of instrumentation

- Auto-analyzer Bran-Luebbe
- TOC-V Analyzer with N module Shimadzu
- Spectrometer ICP-OES Varian ICP 720-ES
- High-resolution Continuum Source atomic absorption spectrometer contrAA® 300 Analytikjena
- Multi-mode microplate reader *FLUOstar Omega* working in (UV-VIS) absorbance, fluorescence and luminescence mode.
- WinRhizo (root analysis system)

❑ Molecular Ecology Laboratory

Assessment of abundance and diversity of soil organisms (bacteria, fungi, mycorrhizae, actynocemete, archaea, nematodes)

e.g. DNA sequencing, terminal restriction fragment length polymorphism (T-RFLP)

Description of instrumentation

- Thermocycler (including Real-Time)
- Agarose electrophoresis equipment
- Microcentrifuges
- Multi-mode microplate reader *FLUO*star Omega for picogreen DNA cuantification
- Nanodrop spectrophotometer
- Vortex mixer

The SIFOMED group:

Laboratories and greenhouses

- **"La Hampa" experimental farm and greenhouses**

Greenhouses are mainly used to conduct **plant-soil feedback experiments** and **monitoring the response of woody seedlings to different soil types collected in forests subjected to a variety of disturbances** (e.g. presence of exotic pathogens, presence of nesting/ roosting waterbirds).

→ Our experience in mutual opening and transnational access of infrastructures is limited

→ Our institute has a flexible policy of access to these infrastructures by other national/ international institutes. We are totally open to collaborations.

Transnational collaborations (European and international)

- We have experience of collaboration in international research projects & networks

2013-2018 *Preventing and remediating degradation of soils in Europe through Land Care*. UE. PI: Dr. T. Marañón.

2010-2012 *Combining bottom-up and top-down analyses to test fundamental concepts in invasion biology*. Deutsche Forschungsgemeinschaft (DFG). PI: Dr. Jonathan Jeschke (Ludwig-Maximilians-University Munich).

2008-2010 *Structuring infrastructures for the analysis and experimentation on ecosystems* (ANAEE). EU FP7- (Support Action). PI: Dr. Giles Lemaire.

2003-2006 *Invasion of northeastern forests by exotic tree species: interactions between population dynamics and ecosystem processes.* USDA (United States Department of Agriculture). PI: Dr. Charles D. Canham and Dr. Peter Marks.

→ **Interest for participation in a Transnational Joint Research Unit:** to create a mutualistic network that contributes to maximize the use of existing infrastructures/data and our understanding of Mediterranean forests function under different global change scenarios

→ **Positive outputs we expect:** sharing of data, collaboration in projects and papers, exchange of researchers, increase the spatial scale of our studies