



Oak Observatory at OHP



institut méditerranéen de biodiversité et d'écologie  
marine et continentale

# O<sub>3</sub>HP : Oak Observatory at OHP (Saint Michel l'Observatoire)



OT-Med meeting, WP2 , November, 2014

# In the context of climate change, we study experimentally the effect of decrease of rainfall on *Quercus pubescens* forest diversity and functioning

T. Gauquelin, PI



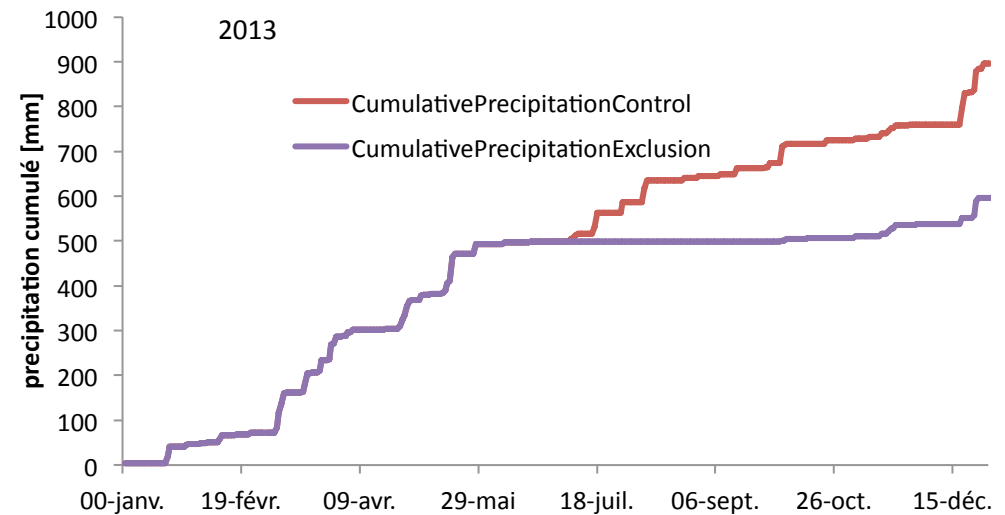
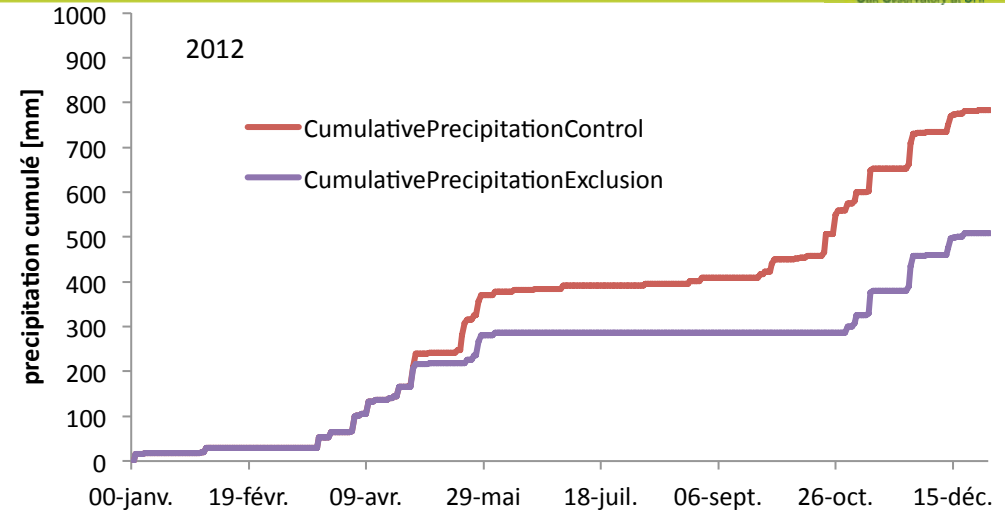
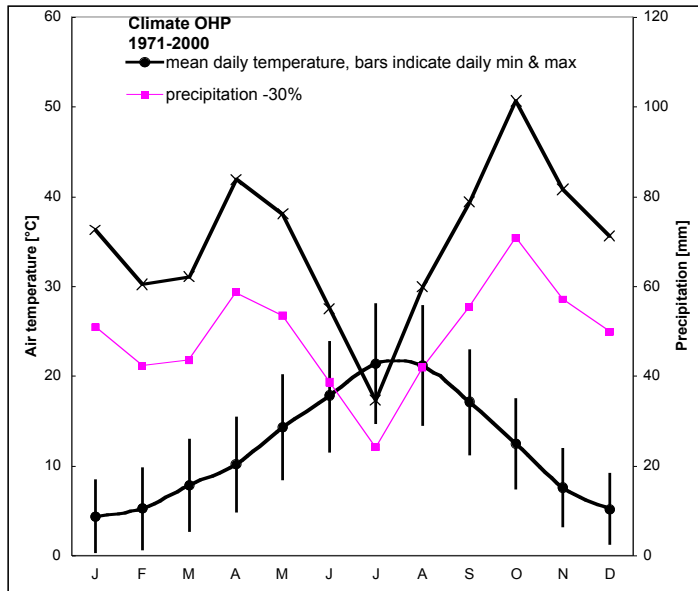
Rain exclusion device: roof covering a part of the experimental site when it is raining

Two levels of gateways: 3.50 m and 0.8 m

For studying forest from the soil to the canopy without disturbing the ecosystem



# Rain exclusion



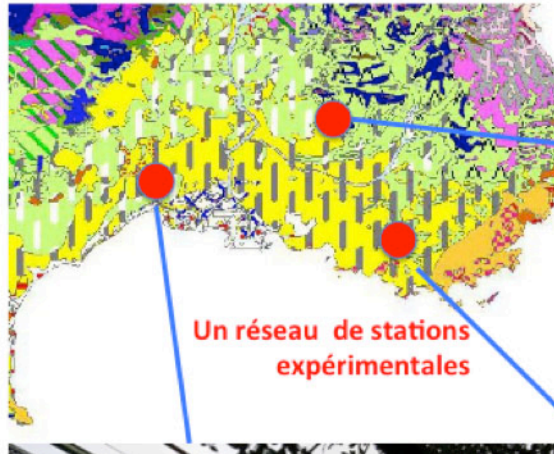
Climatic model:

Decrease of 30% of rainfall

summer drought period of 2 months instead 1 month

=> increase of hydric stress

# National context



Chêne pubescent O3HP



Chêne vert PUECHABON

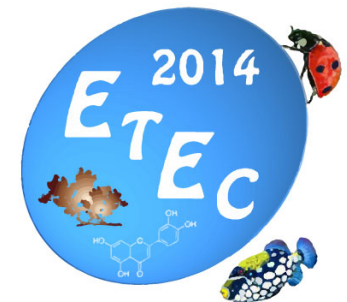
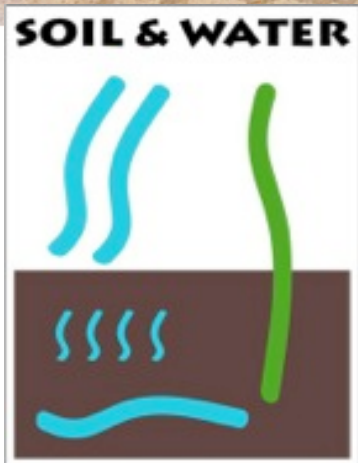


Pin d'Alep FONTBLANCHE

Towards a Mediterranean network... in order to understand effects of climate change on forests (SOERE F-ORE-T)

# Organization of events and training

- european summer school soil and water, summer school in chemical ecology partly funded by **OT-Med**

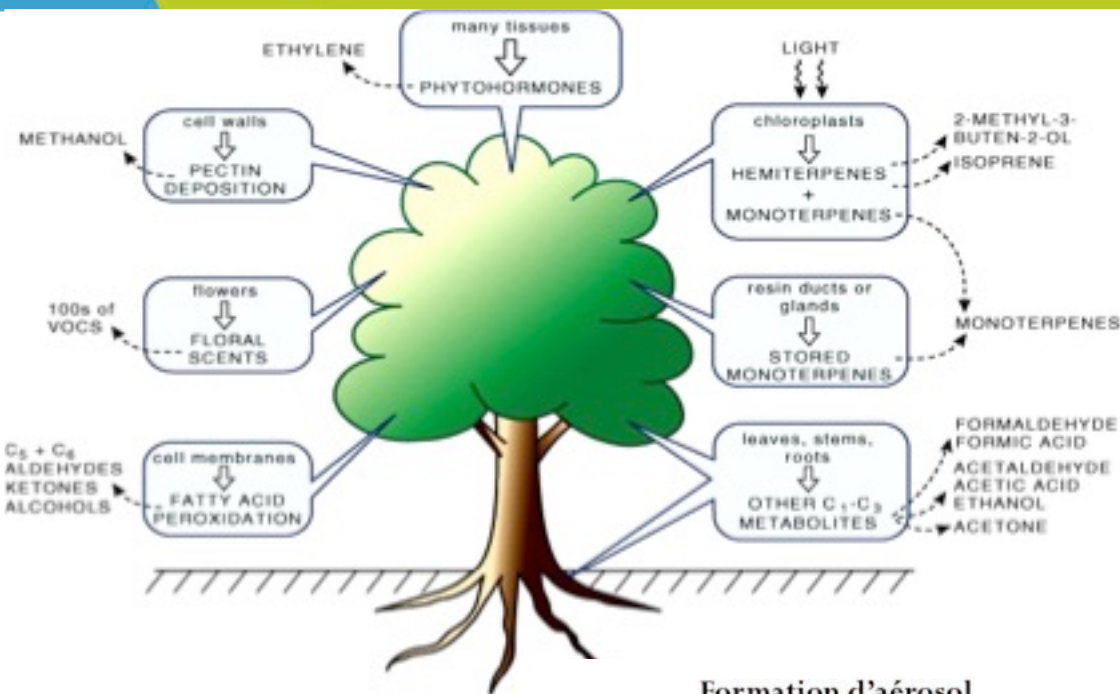


Practical course in chemical ecology

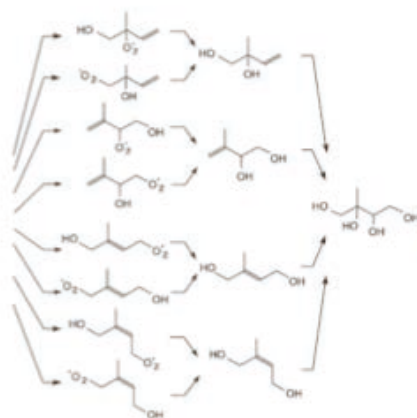
# Research programs

- ECCOREV – COOPERATE 2011 (I. Reiter, Eccorev)
- ECCOREV – Cotinus 2012 (A Bousquet-Mélou, IMBE)
- ECCOREV - Tree size gradient 2014 (I. Rieter, Eccorev)
- EC2CO BIOHEFFECT - LitterDiv 2011-2013 (V. Baldy, IMBE)
- EC2CO BIOEFFECT - ICRAM 2011-2012 (E. Ormeno, IMBE)
- EC2CO ECODYN – O3Com-2014-2015 (M. Proffit, IMBE)
- MISTRALS/CHARMEX - Laboratoire d'aérodologie de l'OMP Toulouse et LSCE
- MISTRALS/SICMED - SEMAFOR 2012-2014 (R. Joffre, CEFE)
- MISTRAL/ENVIMED - STEXMED 2013-2015 (T. Gauquelin, IMBE)
- ANR JCJC – CANOPEE 2011-2014 (J. Latière LSCE)
- ANR Blanc – SecPriMe<sup>2</sup> 2012-2016 (C. Fernandez, IMBE)
- ANAEE CYCABIOCLIM (V. Baldy, IMBE)
- **OT-Med CYCLABIOCLIM (V. Baldy, C. Fernandez, IMBE)**

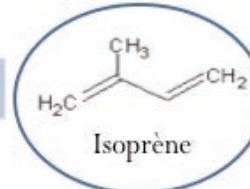
# Trees: Volatile Organic Compounds emission



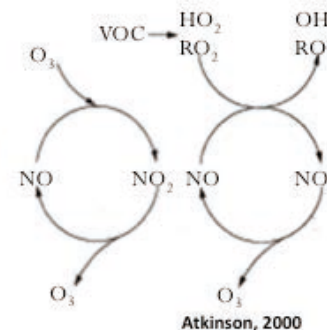
## Formation d'aérosol organique secondaire



$\tau_{\text{isoprène}} = 1\text{h à } 1\text{ jour}$



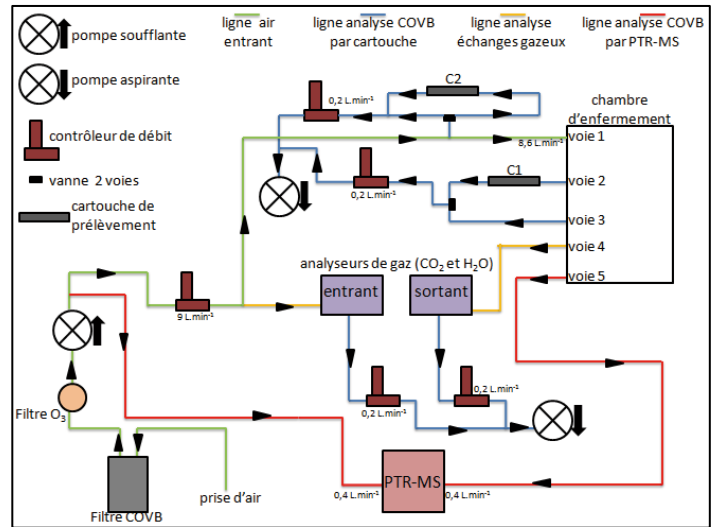
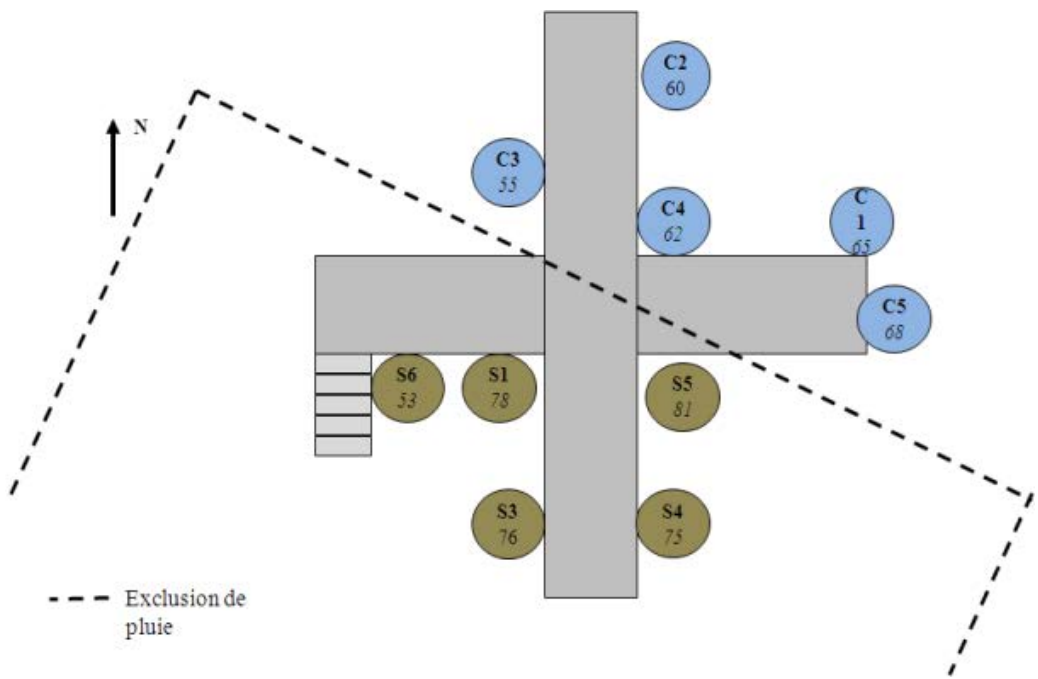
## Impact sur le bilan d'ozone



Atkinson, 2000

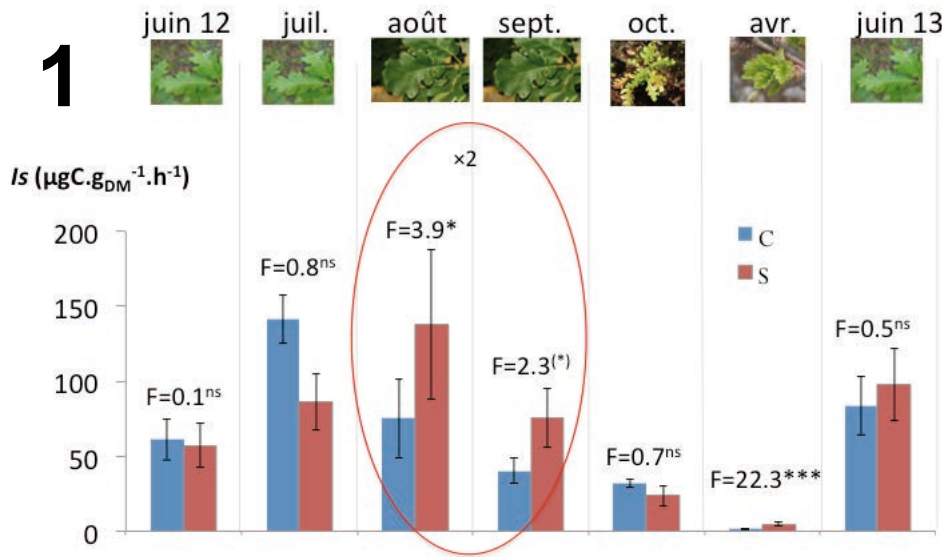
Effect on chemical quality of atmosphere

# Trees: Dynamic chamber measurements

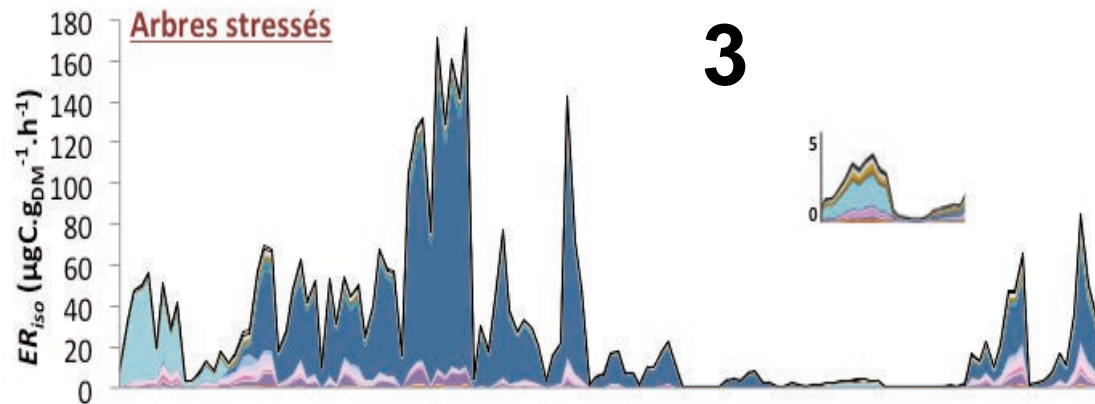




# Trees: BVOC emissions by *Quercus pubescens*

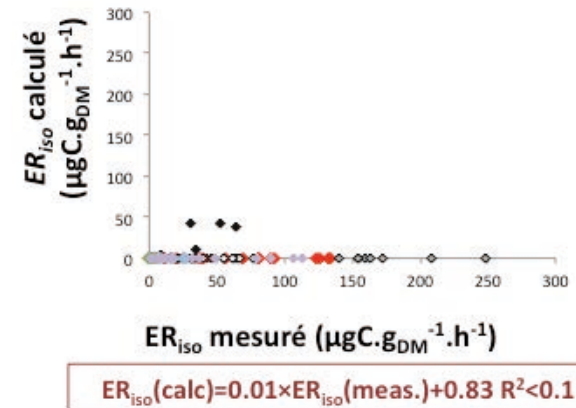
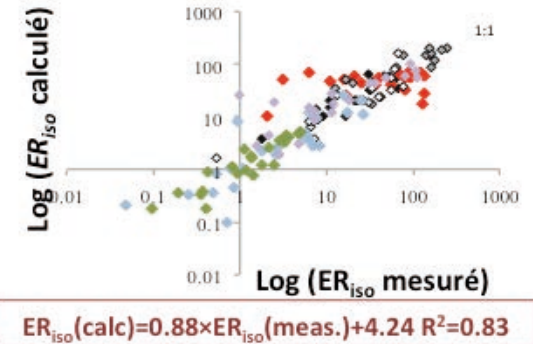


✓ Impact of intensified drought : Increase of BVOC ( $I_s$ ) emission in late summer



✓ Importance of soil water  
 ✓ When drought ↗: frequencies SW ↗

**2**



Lumière	Température	Contenu en eau du sol	Température du sol	Précipitations
■ L0	■ T0	■ SW-1	■ ST-7	■ P-7
■ L-1	■ T-1	■ SW-7	■ ST-14	■ P-14
■ (TM-Tm)-1	■ T-14	■ SW-14	■ SW-21	■ P-21
■ T-14	■ T-21			

Genard et al 2014 (ACP)  
 Genard et al 2014 (PlosOne)  
 Genard et al 2014 (Global Change Biol., in prep)

# Trees

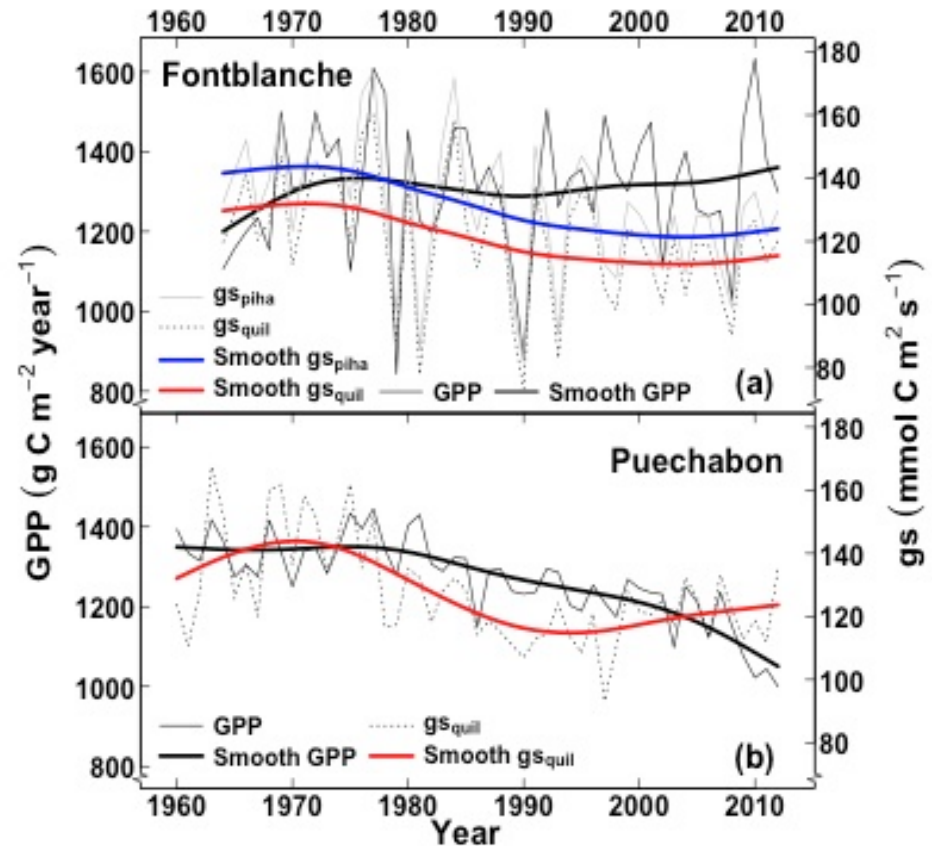
PROJECT G. Gea-Izquierdo/ J. Guiot

Assessing vulnerability to global change of western Mediterranean forests using tree rings and a mechanistic approach

Model simulations by using multi-proxy data, past, future:

reconstruction of spatio-temporal variability in forest productivity and associated functional traits in response to climate change

- Evergreen forests
- CO<sub>2</sub> + growth data



long-term trends that we associate with forest acclimation to climate change.

# Soil/litter: Biodiversity-functioning relationships in the context of climate change - Leaf litter decomposition in Mediterranean Region (Mathieu Santonja PhD)

*Quercus pubescens*



*Acer monspessulanum*



*Cotinus coggygria*



*Pinus halepensis*



## Decomposition of 4 plant species

- 3 species naturally present
- + *Pinus halepensis* in anticipation of a possible rise in latitude with global change

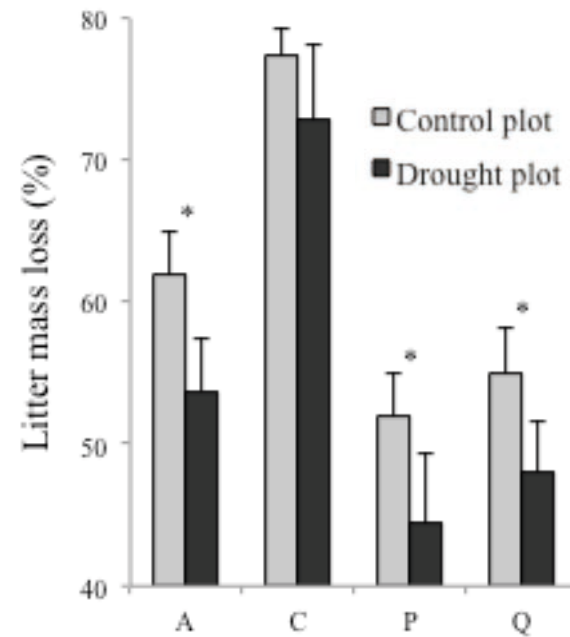
➔ litter mixity effect

## Rain exclusion

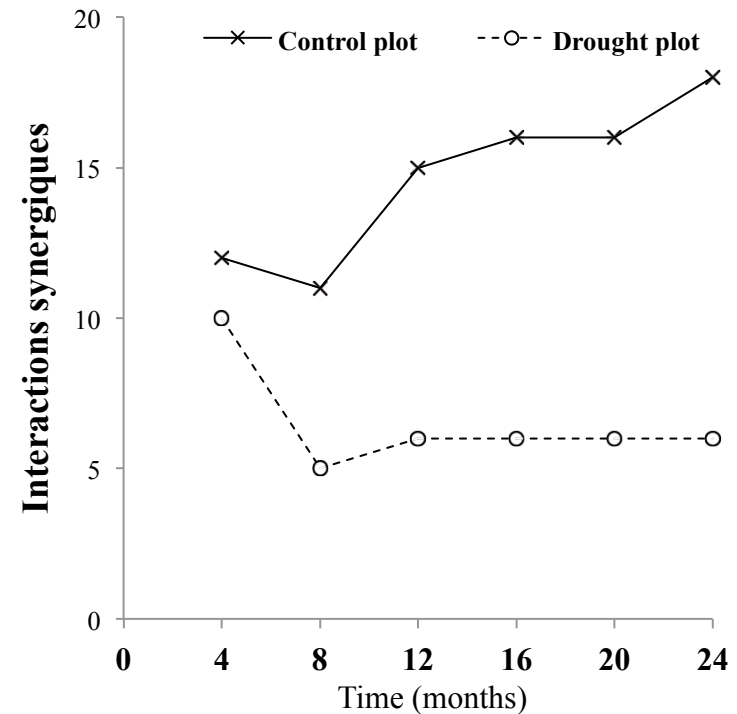


➔ effect of rainfall decrease

# Soil/litter: Litter mass loss and interactions



**Reduction of litter mass under exclusion**



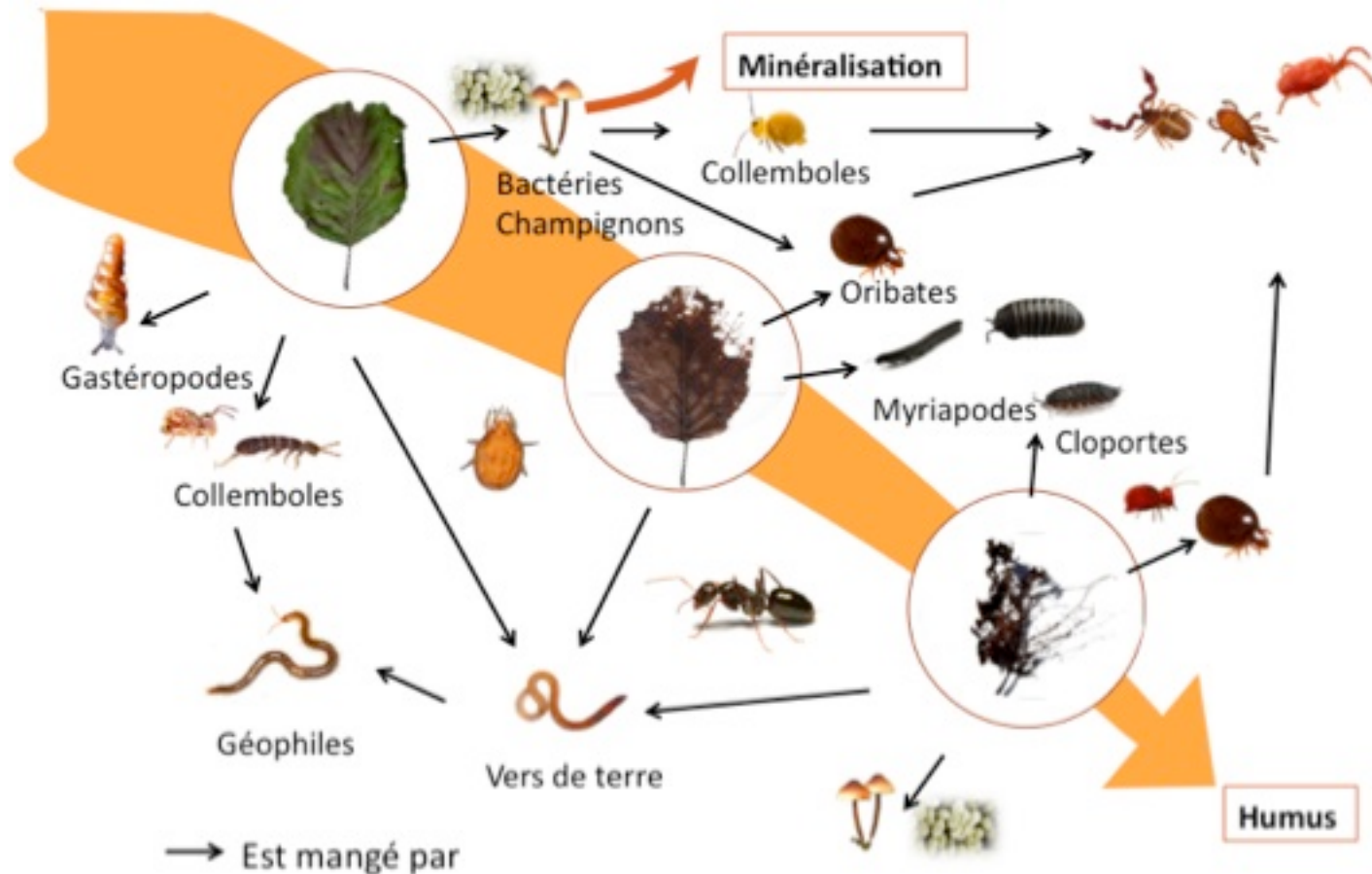
**↘ synergistic interactions (3 times less!)  
↗ antagonistic interactions (5 times more!)**

Carbon cycle and biodiversity in  
Mediterranean oak forest:  
impact of climate change  
(CYCLABIOCLIM)

Susana Pereira

# Objectives

Link predicted climate change scenarios to changes in biodiversity across multiple trophic levels, and quantify their feedback on ecosystem functioning using mainly experimental approaches

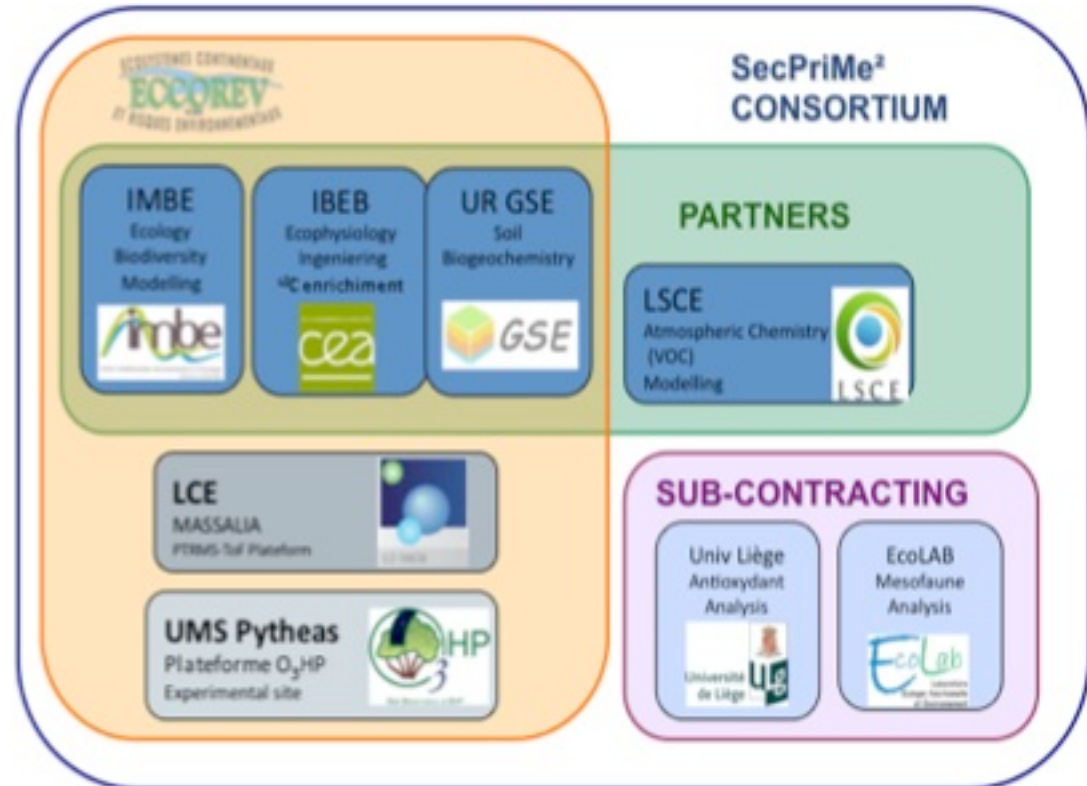


The innovative nature of this project is that it connects biodiversity and functioning through an additional and varied approaches:

- molecular biology
- chemical ecology
- stable isotope tracing
- modelling
- long-term experimental platform allowing ecological research under both field and controlled conditions.

# Partners

- **IMBE** - Institut Méditerranéen de Biodiversité et d'Ecologie - UMR 7263 - DFME, MAcroBio and IDEA teams
- **-ECCOREV** - Ecosystèmes continentaux et risques environnementaux - FR 3098
- **-GSE** – INRA UR1119 Géochimie des Sols et des Eaux
- **-Global change Research group** (San Diego State University)
- **-CRPF** - Centre régional de la propriété forestière : socio-economic partner





# OT-Med priorities concerned

- The impact of climate change on Mediterranean ecosystems through changes in forested soil biodiversity, in biogeochemical cycles and trophic interactions within the « brown food chain ».
- Impact of an increase of drought periods on litter decomposition, a process linking biodiversity and function.
- As this key process of ecosystem functioning is directly involved in carbon cycle, the project will contribute to develop predictive tools for climate change effects on ecosystem carbon sequestration, one of the main ecosystem services.

- TWP2: LPJ-GUESS model in order to simulate ecosystem pattern and processes
- Two original features:
  - the alteration of carbon allocation processes due to the increase of secondary metabolite production driven by a climatic stress
  - the representation of the consequences of changing soil biodiversity on litter decomposition processes and the interactions of biodiversity with climate.