Challenges and threats for Mediterranean forests: Le Parc Naturel Régional du Luberon, a nice example!

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Parc Naturel Régional du Luberon
Mediterranean forests?

Above all, forests subject to mediterranean climate.

Therefore, no concept of structure, biological types or functional types.
Mediterranean climate:
Climate marked by a strong deficit of precipitation during the warm season, causing stress for the vegetation which is submitted to a dry summer period.

\[ \text{P<2T} \]

Dry period

... Stress!!!!!
A climate that was not always Mediterranean...
Calcosol OHP
(Saint Michel l’Observatoire)
Pubescent Oak ecosystem

• between 80 cm & 110 cm clayey horizon

• penetration of Sca/Rca down to 70 cm in form of pockets

• Rca - calcarious bedrock, compact and hard, inpenetrable by rooting systems

Soils often superflcial...
Concerning the structure, Evergreen and sclerophyllous but also deciduous forests.

Holm Oak forest
Puechabon

Beech forest,
Gargano, Pouilles,
Italy

Aleppo Pine forest
The Mediterranean region, a major hotspot of plant biodiversity

2.1 millions km² under a Mediterranean bioclimate
10 regional hotspots of plant biodiversity
10% of vascular plants richness of the World on 1.6% of the Earth surface

Europe: 11 500 plant species on 9.9 millions km²

290 tree species vs 135 pour North Europa
On the Northern shore of the Mediterranean basin,

The main trend:

- Increase of forestal areas

But a lot of threats!:

- Climate Change
- Fragmentation
- New forest use demands (timber, wood fuel, recreational activities)
- Invasions

Cédraie of Luberon
Abandonment of agricultural and pastoral lands

For mediterranean area (9% of the whole french forest):

- 1,17 millions ha in 1989
- 1,33 millions ha in 1999
- Increase of 15000 ha by year
Recolonization of restanques by Aleppo Pine
Notice de la carte des forêts anciennes du Parc Naturel Régional du Luberon (1:40 000)
avec référence aux autres usages du sol

Aline Salvaudon et Arnoul Hamel (PNRL)
Audrey Grel, Magali Rossi et Daniel Vallauri (WWF)
14 : Évolution dans le temps, avec ou sans perturbations, pour une séquence allant de la pré-forêt à pin d'Alep, forêt sclérophylle à *Quercus ilex* et à la forêt caducifoliée à *Quercus pubescens*. 
Climate Change???

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**The key role of dry days in changing regional climate and precipitation regimes**

Future changes in the number of dry days per year can either reinforce or counteract projected increases in daily precipitation intensity as the climate warms. We analyze climate model projected changes in the number of dry days using 28 coupled global climate models from the Coupled Model Intercomparison Project, version 5 (CMIP5). We find that the Mediterranean Sea region, parts of Central and South America, and western Indonesia could experience up to 30 more dry days per year by the end of this century. We illustrate how changes in the number of dry days and the precipitation intensity on precipitating days combine to produce changes in annual precipitation, and show that over much of the subtropics the change in number of dry days dominates the annual changes in precipitation and accounts for a large part of the change in interannual precipitation variability.
Figure 2 | CMIP5 multi-model ensemble average mean change in frequency of dry days (days/year) by 2060–2089, relative to the historical period 1960–1989, using the RCP8.5 forcing scenario. Stippling indicates areas where at least 70% of the models agree on the sign of the change. Graph to the right: zonal means values. Map was produced using NCAR Command Language (NCL; Ref. 30).

Discussion

Daily precipitation projections from 28 CMIP5 global climate models forced by the RCP 8.5 emissions scenario are used to evaluate changes in dry day frequency and its effects on annual precipitation mean and variability during the period 2060–2089 relative to 1960–1989. In most subtropical semi-arid regions the number of dry days is projected to increase markedly (10–15%). These dry-day increases are particularly pronounced around the Mediterranean Sea, Central America and Mexico, the Amazon basin, Chile, and western Indonesia. A linearized analysis indicates that projected annual mean
A network of experimental observatories in French Mediterranean ecosystems
In the Parc du Luberon!
Downy Oak (Quercus pubescens): More than 500,000 in the Mediterranean area
Oak Observatory at OHP

From 800 mm/year to 550 mm/Year
O3HP: Understand the Downy Oak ecosystem submitted to Climate Change

Structure → Biodiversity

Functioning → Dynamics
Climate change effects on litter decomposition: intensive drought leads to a strong decrease of litter mixture interactions

Mathieu Santonja · Catherine Fernandez · Thierry Gauquelin · Virginie Baldy
Increased drought strongly decreased litter decomposition but the presence of several plant species in the litter mixtures appeared to mitigate this impact.

Santonja et al. 2015 (Plant and Soil)
Drier conditions affected decomposers negatively, directly by reducing detritivorous mesofauna, but also indirectly by increasing the predation pressure on detritivorous mesofauna by predatory mesofauna. Some taxa disappear completely as Neelipleona.
What are the Research Challenges for future?

- Study the different biodiversity levels...from the mesofauna to the mycorhizal community... which play a fundamental role in ecosystems functioning
- Linking biodiversity, evolution, dynamics and functioning
- Linking "nature" and productive systems
- Linking "hard sciences" and humanities and social sciences and Linking forestry, agricultural and social approaches and objectives

....For all this, your Workshop on old growth forests!!!!

- and perhaps, linking North and South of the Mediterranean: forest structure, dynamics and threats are very different on the two shores of the Mediterranean and confrontation between these different situations is essential to understand the global evolution of Mediterranean forests