

INTERDROUGHT



Tree Species Interactions under Soil Drought Conditions

Principle investigator: Damien BONAL – M. SCHAUB (WSL)

Collaboration: WSL

Context — Extreme events induced by climate change will have drastic consequences on forest functions and services and may lead to more drought-induced die-off events. It is well known that biodiversity can promote forest ecosystem productivity and resistance to insect pests and diseases and mixed species forests can be, but are not necessarily, more resistant to drought stress than pure stands. The mechanisms leading to positive or negative effects of plant interactions on ecosystem functioning refer to community ecology concepts and have been mainly studied in grassland communities. Yet, little information is available on mechanisms being involved in biodiversity/ecosystem functioning relationships in forests. These effects may depend on tree species interactions at above- (competition and/or complementarity for light) or below-ground (competition and/or complementarity for the acquisition of water and minerals) levels.

Objectives — The main objective of the present project is to characterize the soil water uptake dynamics and carbon allocation patterns of tree seedlings growing under different species interaction conditions and different soil water regimes (drought vs. well-watered) and to address the mechanisms leading to diversity and interaction effects.

Approach — We planned to assess above- and below-ground biomass allocation, characterize photosynthetic activity and water use efficiency on Pine and Oak seedlings to be grown in mesocosms under controlled greenhouse conditions at INRA. Moreover, we conducted a quadruple labelling experiment (^{13}C in ambient CO_2 and ^2H , ^{18}O and ^{15}N for water) to assess the ability of plants to partition new assimilates and exploit soil water resources when exposed to varying water availability and interaction. Complementing the main experiment in Nancy, C-allocation (^{13}C pulse labelling) will be characterised under different drought intensities (gradient of soil water content) in Pine and Oak monocultures in an experimental set-up at WSL.

To manage this experience, we hired a post-doc in March 2016 paid by the Labex. Despite the rigorous selection of an international candidate with great functional ecology skills, the post-doc resigned on September 9, 2016. This situation made the management of the experiment very difficult (we had to

compensate for this absence by directly being involved in its follow-up) and slowed down the management of sample analyses. To date, we have very little available data as compared to what we wanted to acquire in this experiment. The results of the latest isotope analyses should arrive by the end of the year and we should be able to finalize the analyses of the data from this experiment in 2018.

Key results — Only the results of the 2H and 18O analyses of water in the soil have been obtained to date. The graphs below show the effectiveness of 2H and 18O labelling in soil water. We obtained a vertical gradient of isotopic composition different between 2H and 18O, which will allow us to conclude on differences among plants in water resources acquisition.

