



DepHetre

Study of the beech decline in the Northeastern of France

Principle investigator : Catherine MASSONNET, UMR Silva

In the climate change context, recurrent or extreme heat waves and drought events could induce extensive forest decline and tree mortality in the future. Understanding the vulnerability components and the resilience capacities of species facing the stresses and disturbances is crucial to help foresters in their decisions to manage the crises and to adapt the forest in the future. Since the spring 2019, massive beech tree mortality was observed in a vast (thousands hectares) and unexpected zone: the northern-east of France, the central zone of the *Fagus Sylvatica* distribution area. In 2019, the Forest Health Division installed a network of semi-permanent plots to monitor the evolution of beech tree health. Tree decline is a complex, long and multifactorial process leading either to dieback or to resilience. The main objective the DepHetre project will be to have a better understanding of the vulnerability components and resilience capacities of the *Fagus sylvatica L* species through the identification of factors influencing the switch to one or the other trajectory. Particularly, the DepHetre project will take the opportunity of this large-scale field dieback to investigate resilience traits, tree susceptibility to pathogens or tree capacities to defend against secondary pathogen attacks in relation with the stored carbon (C). In a recent experiment exposing young beech trees to a severe and prolonged drought (Mepib-death project), we observed a high resilience capacity of *Fagus sylvatica* trees in absence of pathogen attack. We observed that maintaining an active C storage function was key for tree survival. In the DepHetre project, we will study at the ecosystem level the large dieback crisis of beech forests in natural sites combining both biotic and abiotic factors. This large natural dieback constitutes a real opportunity to extrapolate researches that have been done on young trees, often in pots, to adult trees in field, rarely studied before. We will investigate if the increasing tree vulnerability to secondary biotic agents would be linked to the decrease of the of C reserves level and to the decrease of tree capacity to contain biotic attack by growth reactions. During three years, through the network of tree health monitoring, we will analyse how the C reserves change in relation with the tree health assessed according to radial growth and crown condition. We will investigate if the C reserves stocks could be used as a trait to discriminate the trajectory of resilience or death.