

## Mapping the soil water holding capacity at fine spatial resolution to optimize the choice of species in the context of climate change

<b>Level</b>	<b>M2</b>	<b>Duration</b>	<b>6 mois</b>	
<b>Laboratory</b>	UMR SILVA			
<b>Location</b>	AGROPARISTECH de Nancy			
<b>Supervisor (s)</b>	<b>Piedallu Christian and Noemie Pousse (ONF)</b>			
<b>keywords</b>	<b>Soil water holding capacity</b>	<b>Tree species selection</b>	<b>Climate change</b>	<b>Digital soil mapping</b>

### Summary

Over the past ten years, we observed a significant decline of temperate forests, intensifying in recent years, and endangering the multiple ecosystem services provided by the forest (wood production, carbon storage, biodiversity, protection of water resources and against natural risks, mitigation of the effects of climate change, etc.). This decline is mainly linked to the increase in water stress in the context of climate change. Climate simulations centralized by the IPCC predict that the situation will continue to deteriorate in the coming decades. In this context, a good knowledge of the soil's capacity to store water is fundamental to understanding the level of risk and determining the choice of species to use. The zoom50m decision-making tool has been developed and used by the French forest agency (ONF). It allows the choice of species according to the level of water deficit experienced locally. The maximum water storage capacity of soils, is an essential component of this tool, but it is complex to understand, particularly for deep horizons, and can be highly variable in space.

The objective of this internship will be to improve the estimation of the soil water holding capacity maps across the north-east of France. Currently, it is done using estimations on deep pits described for site types catalogs, which are applied uniformly on the maps for each site type units (a site type unit is supposed to represent an homogeneous ecological unit). This method is based on the hypothesis of homogeneity of soil properties for a given site type unit, which is not true in reality. On the other hand, the numerous forest inventory plots from IGN allow the mapping of the soil water holding capacity spatial variability, leading to a digital map produced by AgroParisTech over France, but the depth of prospection with an auger is often insufficient. The combination of these two approaches could make it possible to combine the advantages of these two methods while limiting their disadvantages.

The objective of this intership will be:

- To combine these two approaches using downscaling techniques to produce a new map with fine spatial resolution (50 m), combining the depth information provided by ONF, while taking into account the spatial variability of AgroParisTech maps;
- To compare these three maps (ONF, AgroParisTech, and the combination of the two) to other existing maps, such as those of Globalsoilmap or ESDB
- To evaluate these different maps using an independent dataset collected on more than

100 deep pits, available on the study site ;

- To compare the ability of all of these maps to predict the growth, distribution, or health of different species for which data sets exist (several thousand plots with site indices for different species, the characterization of their health status, or the inventory of species present)

This work in partnership between ONF and AGROPARISTECH will be carried out in different steps:

- Bibliographic synthesis concerning i) data sources, ii) methods of mapping and downscaling, iii) the importance of the soil water holding capacity to determine the choice of the tree species, and data collection (1.5 months),
- Update of the AgroParisTech map using the most recent inventory data (1 month)
- Calculation of a new map by combination between the ONF and the AGROPARISTECH maps for the Grand-est region and if possible for the Bourgogne Franche Comté region (1 month)
- Validation and test of predictive ability (1 month)
- report writing (1,5 months).

The writing of a scientific publication may be considered at the end of this work.



*Student profile : master 2 level, knowledge in pedology, modeling, data analysis, GIS, R software, writing skills,*

Supervisors Christian Piedallu, and Noémie Pousse

Application : send a CV and a cover letter by email to C. Piedallu mentioning the title of the offer, before the end of November 2023.

Contact : Christian Piedallu, Tel 00.33.(0)3.83.39.68.77, fax 00.33(0)3.83.39.68.78, mail christian.piedallu@agroparistech.fr

<b>Beginning</b>	<b>March 2023 (according to the applicant)</b>	<b>Date de fin du stage</b>	<b>August 2023 (according to the applicant)</b>
<b>Gratification</b>	4,05 € /hour (approximately 3600 € for 6 months)		