Rainwater accumulation on plant leafs

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Rainwater is at the heart of our ecosystems, agricultural and agroforestry practices, as it is the main input of groundwater. Vegetation is known to strongly increase the rate of infiltration of rainwater in the soil. Not only do the roots modify the compactness of the soil. The foliage also plays several roles: it damps the impacts of heavy raindrops, and it serves as a temporary storage that better distributes water in time and space [1]. Nevertheless, plant leafs have multiple reasons to avoid an excess of water at their surface. In addition to be an important structural load, the water accumulated on leafs is a medium of choice for pathogenic development. Rain has been found culprit of propagating these foliar diseases, with dramatic consequences in agriculture [2].

How much water can a given leaf hold? And how much can be retained by the entire foliage of a tree? The maximum amount of water on a single leaf should depend on its shape, its mechanical structure and its hydrophobicity. Leafs display a wide variety of compliance and tip shapes [3]. Nevertheless, preliminary experiments at the Microfluidics Lab revealed that some tip angles yield significantly higher water retention. Some leafs also have gutters that help carrying rainwater away.

Through a combination of experiments and modeling, the master's student will establish the link between the mechanical properties of leafs and their ability to hold water. First, the observation of different water loading scenarios will be made on real plants. Then, artificial leafs with controlled properties will be designed and tested. In parallel, existing biological data on leaf shape and compliance will also be carefully examined.

References

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[3] L. Tadrist and B. Darbois-Texier, *Are leaves optimally designed for self-support? An investigation on giant monocots*, **J. Theor. Biol. 396**, 125-131 (2016)