Long term impact of climate on tree-growth patterns in Paris street trees and its consequences on tree cooling potential: a dendroclimatic approach.

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Water availability is widely recognized as being an essential factor for tree survival, growth and for maximizing their ability in mitigating urban heat islands (UHI) through evapotranspiration. In urban areas, where the ground surface is highly impervious and the trees are not regularly irrigated, the reduction of precipitation infiltration into the soils may put the trees face an increased water stress[1,2]. It is also generally predicted that trees in urban sites have higher water losses than trees in natural forests due to increased evapotranspiration demand[3]. There is currently insufficient data to generalize the physiological responses of trees to the complex urban environment, where both climatic and management factors are entangled. Especially, few information is available on the effect of water stress on tree health, and their consequences on ecosystem services such as UHI mitigation. Furthermore, on-going climatic changes make it all the more necessary to anticipate the potential trajectories of urban trees, in terms of (i) risk assessment of tree survival, and (ii) their potential ability cooling services. In this context, a retrospective approach of the long-term relations of trees to urban climate can thus provide a way to both enhance our understanding of current urban tree hydric state and gain insights on future levels of water stress levels under new climates.

It is well known that there is a close relationship between tree growth and climate. Indeed, the size and the state of tree-rings are affected by the yearly sequence of favourable and unfavourable climates[4]. In turn, climate phenomena can be identified and reconstructed through ring-width sequences[5]. Thus, dendrochronology and study of wood structure can be used as informative tools in order to understand the long-term influence of past climate on urban trees growth. Consequently, understanding the past trajectory of trees under past climates can provide insights on their answer to future climate projections. Since tree cooling potential is tightly linked to water availability, negative feedback of water stress to tree cooling potential can be expected.

To further investigate these issues, we are implementing a 3 years project, financed by CDC-Biodiversité and we tested this approach by studying 95 urban *Tilia tomentosa* Moench individuals in Paris (France), selected along a 10- 120-year age gradient. Tree age was estimated by using wood core samples, and the health status of each tree was visually assessed according to the "Visual Tree Assessment". Number of tree-rings and ring-width were measured using a Lintab measurement table and compared to meteorological data at local and regional scales (Paris, Île-de-France region). The xylem vessel diameter and density were used as a proxy of hydraulic conductance efficiency, embolism vulnerability and health status of trees[6,7,8]. The sampling design will enable a comparative approach of trees of different ages, which is used to assess whether chronic water stress is influenced by both tree age and climate history.

The communication will show the current results, and we will use them to discuss the ways future climate change could further impact tree-growth and thus potential tree cooling effects in Paris City.

Key references

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