EGU2020-21403
https://doi.org/10.5194/egusphere-egu2020-21403
EGU General Assembly 2020

A three year study on the soil water availability at roadside trees in Hamburg, Germany

Alexander Schütt, Alexander Gröngroeft, Selina Schaaf-Titel, and Annette Eschenbach
Institute of soil Science, University of Hamburg, Center for Earth System Research and Suistainability, Hamburg, Germany
(alexander.schuett@uni-hamburg.de)

The benefit of urban roadside trees to provide ecosystem services and wellbeing of human in expanding and compacted cities gets more and more attention. For northern Germany it is predicted that climate change rises summer temperatures and that precipitation patterns shift to drier vegetation periods. In cities, those impacts will intensify water (soil sealing) and heat problems (urban heat island) even more. Furthermore, roadside trees have to deal with several specific site limitations like extreme soil compaction and soil sealing, low water infiltration rates, sandy and anthropogenic deposited substrates, and soil volume restrictions. The consequences for the trees are drought stress combined with reduced vitality and life expectancy.

Our research is based on soil water monitoring at 17 roadside plantation sites across the city of Hamburg. We focus on the water availability of prepared planting soils and the development of the trees root systems. Sensors for soil water tension and soil temperature were installed in different soil areas of each site: topsoil, root ball, tree pit substrate, lateral space, and subsoil. The general goal of this study was to characterize the soil water availability at roadside planting pits during the first years after plantation (here: 2017, 2018 and 2019). Based on these results the long-term objective is to elaborate recommendations for the soil-related technology of future urban tree planting sites. The Creation of more suitable conditions in the planting site enhances roadside tree vitality and provides ecosystem services by the trees on a higher level.

The data analysis focused on two main aspects. First, the effect of weather conditions, especially the extreme wet and dry vegetation periods, on the soil water availability in the tree pit. Second, the three-year temporal development of soil water distribution in the different soil areas within the planting pitafter plantation.

We found that soil water availability in the vegetation period (VP; April-October) at the investigated roadside plantation sites are highly correlated to weather conditions (air temperature (aT) and precipitation (P)). During a cold and wet VP (aT: 14,0 °C, P: 631 mm), soil tensions reached a critical value on average at 24 ± 18 days (11 ± 9 % of VP). In a hot and dry VP (aT: 16,0 °C, P: 222 mm), soil tensions reached a critical value on average at 115 ± 22 days (54 ± 10 % of VP).

Furthermore, the results showed that soil water scarcity in the first VP occurred mainly in the root ball, whereas during the second VP water scarcity developed in all soil areas within the planting

site, except for the subsoil. Although the amount of precipitation during the last vegetation period was more than doubled compared to the second, the subsoil reached higher water tensions. This finding leads to the conclusion that root development after plantation took place from the root ball over the prepared planting soil into the surrounding soil within depths of up to 1 m.