



Assessing the microclimate of urban forests using a low-budget temperature and humidity measurement system

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Urban forests located in inner cities are characterized by special climatic conditions affected e.g. by the heat island effect of the surrounding dense urban structures. On the other hand, these forests offering a cooling ability for the urban inhabitants and, are therefore, of high importance for the local climate of the cities. Unfortunately, setup of microclimatic measurement systems in these forests is prone to vandalism due to frequent visitors. Measuring the microclimate conditions is therefore challenging and the instrumentation has to require certain conditions such as a) the costs of the measurement system should be low due to vandalism, b) the size of the measurement system should as small as possible to be installed without being discovered by visitors, and c) the precision of the recorded temperature and humidity must be match the same accuracy as conventional measurement systems.

In our study, air temperature and humidity in eleven urban forest sites in the metropolitan area Ruhrgebiet (Western Germany) was measured, to assess the cooling potential of different urban forest types in comparison to surrounding urban areas. The aim of the study is to identify factors that influence the microclimate in urban forests, such as leaf area, water content of leaves and soil, and fraction of sealed surfaces surrounding the forest stand.

As a measuring system, we used iButton Hygrochron Temperature/Humidity loggers (DS1923) (Maxim Integrated). The iButtons have an integrated circuit with a one-wire interface and meet the requirements described above: With a diameter of 16 mm they are very small, sturdy and with a price of around 100 € they are low in price. Typical applications of these instruments are temperature and humidity measurements in food preparation and processing, in transportation of sensitive goods, warehouse monitoring, or in medical studies. iButtons have also been used in some environmental studies (e.g. GILLNER et al. 2015, GREISER et al. 2018), focusing on microclimate under street trees or in forests.

In general, iButtons are not protected against rain and solar radiation, and therefore, a low-cost protection was build out of commercial goods. In the poster presented, we will show the recorded air temperature and humidity in comparison to a commonly used climatic station to analyze their ability to record realistic results. The results indicate, that the iButtons in combination with constructed protection shields can be a smart and low cost alternative to high-cost temperature- and humidity measurement systems

Literature

- Gillner, S.; Vogt, J.; Tharang, A.; Dettmann, S.; Roloff, A. (2015): Role of street trees in mitigating effects of heat and drought at highly sealed urban sites. *Landscape & Urban Planning* 143: 33-42.
- Greiser, C.; Meineri, E.; Luoto, M.; Ehrlén, J.; Hylander, K. (2018): Monthly microclimate models in a managed boreal forest landscape. *Agricultural and Forest Meteorology* 250-251: 147-158.