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| **Evaluating airborne, mobile and terrestrial laser scanning for urban tree inventories: a case study in Ghent, Belgium** |
| Urban tree inventories rely on accurate structural measurements including tree diameter, tree height, crown projection area and volume for various purposes. These measurements are critical to accurately estimate ecosystem services, evaluate tree growth and make sustainable management decisions. Traditionally, tree measurements are obtained using instruments such as range finders and diameter tape. The accuracy of these traditional methods is highly influenced by the observer's experience, the equipment and the line of sight to tree canopies,  and are labour intensive. Nowadays, integrating these measurements into urban tree inventories can be achieved through the use of 3D laser scanning (also known as LiDAR). Different laser scanning platforms exist, both with their own advantages and disadvantages, including different levels of point cloud precision and noise. For both park and street trees in Ghent (Belgium), we investigated how such platforms perform under different leaf conditions. Therefore, we collected laser scanning data of 95 individual trees. We collected terrestrial laser scanning (TLS), mobile laser scanning (MLS) and airborne laser scanning (ALS) in leaf-on (TLS, MLS, ALS) and leaf-off conditions (TLS, MLS). We not only investigate and present the accuracy of these platforms, but also look at practical considerations of scanning in cities. Our findings demonstrate accurate derivation of DBH using TLS and MLS. Crown dimensions on the other hand, more specifically crown volume (BIAS= -115m², CCC=0.85)  and tree height (H MLS leaf-on: -0.39m, CCC=0.99), were underestimated using MLS compared to TLS in leaf-on conditions. However, platform performance was highly dependent on tree dimensions and the complexity of the surroundings. Our results will help city councils and tree managers choose the most optimal LiDAR platform for urban tree inventories, accounting for their purpose, site complexity and budget. |

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