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Estimating urban forest growth by comparing canopy height models generated from bi-temporal airborne LiDAR dataset

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Canopy growth is an important index in evaluating forest health because it is affected by its trees' vigor. Nevertheless, it is hard to measure canopy growth in the forest by field survey methods. This challenge has been advised by researchers by use of airborne LiDAR datasets; still, there is little research about multi-temporal airborne LiDAR datasets which implements a potential approach to evaluate vertical and planar growth rate of the canopy in decimal centimeters. Furthermore, because precedent research about assessing the canopy growth using airborne LiDAR datasets has concentrated on natural forests or conservation regions, there is little research about urban forests. Our research objective is to estimate urban forest growth by applying change detection methods; calculating vertical differences between years of 2012 and 2015 canopy height models. The study site is Mt. Bongseo which is mixed forest located in a metropolitan area (Cheonan city, Republic of Korea) and temperate zone. 85% of the trees in the forest was surveyed as 20- to 40- year-old, and dominant tree species are *Quercus acutissima* (45%) and *Pinus rigida* (30%). Airborne LiDAR datasets were acquired in October 2012 and October 2015, and the point cloud densities are both 9 points/m^2. We compared vertical differences between canopy height models (years of 2012 and 2015) generated from LiDAR datasets. As results of change detection, the overall estimation of the mean of the annual growth rate of high canopy regions is 24.4cm/year, and the mean of the annual growth rate of shrub canopy/open regions is 19.4cm/year. This difference can be considered as one of the site features because most of the classified shrub canopy/open region in the site is shown to be cultivated area or cemeteries. Both growth rates of high canopy regions and shrub canopy/open regions were compared by tree species, age class, soil texture, aspect, and slope, and the mean of annual canopy growth was most noticeable in the comparison of species (*Castanea crenata*: 27.0cm/year; *Quercus acutissima*: 24.7cm/year; *Pinus rigida*: 23.9cm/year). These results can be considered canopy growth rate in the site mainly depends on its tree species. We also estimated areas of the lateral growth regions and disturbance regions in the site and both areas are occupied more than 30% of the site area (Hight canopy region – lateral growth area: 43%, disturbance area: 37%; shrub canopy/open region- lateral growth area: 20%, disturbance area:37%). Although there are further research questions about lateral growth, disturbance area and gap dynamics, our research results can imply that using multi-temporal airborne LiDAR dataset enables urban forest researchers and managers to help to estimate overall canopy changes in a simple way.