Canopy Height Model Estimation Using Airborne Laser Radar and High Resolution Image in Borneo Tropical Reserve Forest

Mohd Yussainy Md Yusop (1,3), Mohd Nadzri Md Reba (1,2), Mohd Rizaludin Mahmud (1,2)

[1]Faculty of Built Environment and Surveying, Universiti Teknologi Malaysia, 81310 UTM Johor Bahru, Johor, Malaysia

[2]Geoscience and Digital Earth Centre (INSTeG), Research Institute of Sustainable Environment (RISE), Universiti Teknologi Malaysia, 81310 UTM Johor Bahru, Malaysia

[3]Forestry Department of Peninsular Malaysia, Jalan Sultan Salahuddin, 50660 Kuala Lumpur, Malaysia.

Email: yussainy@forestry.gov.my; nadzri@utm.my; rizaludin@utm.my

Abstract: Forest crown size is one of the important biomass parameters for ecological service study to determine tree growth, carbon stock and shading. The information also serves for site productivity. Yet, measuring the forest crown size is not straightforward in typical field measurement due to the higher cost, limited area accessibility and time-consuming work. It is getting more intense and difficult to sparsely capture the heterogeneity of forest structure in the very large area. Remote sensing permits capability to map such information thanks to its spectroscopic capability from the optical radiation. This study focuses on the application of discrete LIDAR cloud points in measuring the forest tree height and high-resolution SPOT image for crown size extraction. Estimating forest crown and tree height can be presented using canopy height model (CHM) in which upper surface of vegetation canopy in each lidar image grid was considered. The CHM of reserve forest in Lawas Sarawak is determined and this area was chosen due to its higher density of flora and fauna. Two sets of imagery named Digital Terrain Model (DTM) and Digital Surface Model (DSM) were generated from the lidar cloud point by Delaunay interpolation method. By the difference between DTM and DSM represents the relative tree height with respect to the surface height. Several vegetation indeces and texture analysis method were applied to classify the crown size pixels. The non-linear function of CHM model extracted by 3x3, 5x5 and 7x7 kernel sizes was estimated and accuracy assessment was determined by statistics. The result suggests that CHM from lidar and SPOT data gives better estimation with smaller kernel size with low mixed pixel and higher possibility of homogeneous pixel.

Keywords: Lidar, Forest, Tree height, Crown size, Tropical rain forest