UNIVERSITI TEKNOLOGI MARA

DEVELOPMENT OF ALLOMETRIC MODEL FOR MIXED AND SHOREA TREE SPECIES THROUGH SYNERGISTIC ANALYSIS OF REMOTE SENSING DATA

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Thesis submitted in fulfillment
of the requirements for the degree of
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CONFIRMATION BY PANEL OF EXAMINERS

I certify that a panel of examiners has met on 19th January 2017 to conduct the final examination of Nafisah Binti Khalid on her Doctor of Philosophy thesis entitle "Development of Allometric Model for Mixed and Shorea Tree Species through Synergistic Analysis of Remote Sensing Data" in accordance with Universiti Teknologi MARA Act 1976 (Akta 173). The panel of Examiners recommends that the student be awarded the relevant degree. The panel of Examiners was as follow:

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AUTHOR'S DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the results of my own work, unless otherwise indicated or acknowledged as referenced work. This thesis has not been submitted to any other academic institution or non-academic institution for any degree or qualification.

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ABSTRACT

There are currently 153 species of Shorea listed in the International Union for Conservation of Nature and Natural Resources (IUCN) Red list 2013 where Shorea leprocula (Meranti tembaga), Shorea pauciflora king (Meranti nemesu) and Shorea resinosa (Meranti belang) that are found in the Ampang Forest Reserve are listed as endangered species. Due to the current list, mapping and monitoring the forest inventories of this species is necessary to provide the regular report for Reducing Emissions from Deforestation and Degradation (REDD) program especially concerning the accurate estimation of total aboveground biomass in calculating the carbon stock. However, uncertainties in tropical forest remain high because it is costly and laborious to measure the tree variables accurately in relation to quantify the aboveground biomass. Thus, recent remote sensing technology that allows for accurate operational and managerial inventories in a cost effective and timely manner is constantly in demand. In this study, the pan-sharpening Worldview-2 imagery is used to extract the tree crown parameters using object-based image analysis. Three image segmentation methods have examined which are image filtering, combination of image filtering with inverse watershed and multi-resolution with local extrema image segmentation. The segmentation result is classified using rule-based image classification method. The results showed that multi-resolution with local extrema produces the most accurate result with 100% of success rate in detecting and delineating the tree crown. The overall classification accuracy using is good with 86.11%. In addition, the results from synergism of WorldView-2 imagery and LiDAR data showed that the RMSEz for tree height was 2.763m and above the tolerance. The finding from the proposed allometric models using tree parameters measured from field showed that the coefficient of determination (R^2) ranging from 0.905 to 0.980, indicating strong correlation amongst the examined variables. Finally, the total aboveground biomass (TAGB) estimated for entire training and test area was found to approximately 3000 tonnes for each site. The proposed allometric models for Shorea and mixed tree species were proved to be applicable for this study area and fulfil the research objectives. The study has demonstrated that high resolution remote sensing datasets in the likes of Worldview-2 and LiDAR are viable substitution in complementing and increasing the efficiency of remote sensing technology for forest application.

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