Characterizing forest properties and microclimate using numerical modelling and remote sensing

June 28 2013

(Phys.org) —Researchers from Universiti Teknologi MARA conducted a highly innovative study which focuses on understanding the spatio-temporal dynamics of the microclimatic conditions in canopy gaps in forests. Furthermore, the combination of numerical modelling techniques and remote sensing is unique in this context. In this way, the project is extremely well placed to make substantive contributions to both ecological modelling and remote sensing science.

The overall aim of the study is to understand the spatio-temporal dynamics of the microclimatic conditions in canopy gaps in forests where combination of numerical modelling and remote sensing techniques was used to achieve the objectives of the study. The objectives were i) to measure the effects of gap size and shape on microclimates in tropical forests, ii) to develop a spatially-explicit model of forest gap microclimates and soil water balance, iii) to drive a model of forest gap microclimates using remotely sensed data (aerial photography, multispectral and LiDAR) and numerical modelling. Newer devices such as Light Detection And Ranging (LiDAR) and multispectral sensors which are capable of finer spatial and spectral resolutions, and new analytical techniques allow increasingly detailed information to be extracted from such imagery.

LiDAR technology provides 3-dimensional information at high spatial resolutions and vertical accuracies. This was achieved by applying a

combination of numerical modelling and remote sensing techniques. A spatially explicit model of forest gap microclimate and soil water balance, FORGAP (FORest GAP) was developed based on previous reviewed literatures and field measurements.

The spatial input variables for FORGAP model were effectively derived from LiDAR and multispectral remotely sensed data. This study will develop robust and extendible approaches for remote sensing of vegetation biophysical parameters of canopy gaps microclimates: leaf area index, canopy structure, tree crown and gaps delineation. This project brings together different approaches to vegetation characterisation and aims to test these simultaneously over a range of contrasting common vegetation types, allowing for inter-comparison and fusion of different techniques. Comprehensive validation was possible based on the extensive ground campaign. Fundamental technical and methodological developments resulting from the research will have significant impacts upon the remote sensing science community.

The results demonstrated that FORGAP driven by remotely-sensed inputs was able to accurately simulate the diurnal fluctuations and spatial distribution of solar radiation and soil water content across the study site. Fundamental technical and methodological developments resulting from this research will have significant impacts upon the remote sensing science community.

Provided by ResearchSEA