MAPPING MANGROVE SPECIES USING WORLDVIEW-2 SATELLITE DATA

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Abstract: Despite their high ecological and economic values, the total area of mangrove have declined in Malaysia with a rate of 1% (1282 ha) a year since 1990 (Hamdan et al., 2010). Mangrove lands are converted for aquaculture, agriculture, tourist development and some lost due to erosion as a consequent of intensive development along the coastline especially along the west coast of Peninsular Malaysia (Suhaili, 2012). Therefore, the demand for accurate mangrove maps that indicate the location and types of mangrove species is increasing for assisting in mangrove resource biodiversity management, protection and monitoring the potential variation of mangrove trees in tolerating environmental disturbances such as increased salinity. Monitoring and assessing mangrove trees quickly and continuously can be achieved using remote sensing techniques.

Mapping mangrove species is highly dependent on the resolution of the sensor and image processing or classification methods adopted in the mapping process. While sensors like IKONOS and QuickBird offer high spatial resolution images, they have limited number of spectral bands (i.e. 4 bands) which impose problems to classify many mangrove species (Kanniah et al., 2007). These limitations are however expected to be resolved with the latest availability of WorldView-2 imageries which combines high spatial (0.5 meter) and sufficient spectral resolutions (8 bands). Various image classification techniques have been used successfully in mangrove classification to increase the accuracy of classification in complex

environments (Adam et al., 2009). ANN has been proven to be a robust classification technique because it is a non-parametric statistical measure that requires less or no prior knowledge of the input data distribution model. It is also able to estimate the non-linear relationships between input parameters and output, tolerate noise and distortion in data, has a fast generalization capability (Foody, 1995) and it learns spectral discrimination behavior from multispectral bands and spatial variation (texture) of different features from panchromatic bands, thus resolving misclassification. In this study high resolution (0.5 m) Worldview-2 remote sensing image was used to classify different mangrove species at Sungai Belungkor, Johor. During a field visit, Spectral reflectance of nine mangrove species was recorded using an Analytical Spectral Devices (ASD) FieldSpec spectroradiometers. The reflectance measurements were used to build a spectral library which was then used to train the satellite image to classify various mangrove species. First, both panchromatic and multispectral bands of Worldview-2 satellite images were fused using Gram-Schmidt (GS) Spectral Sharpening technique to obtain high spatial (0.5m) and spectral (eight spectral bands) resolution data. Then the fused image was subjected to maximum likelihood supervised and Feed-forward back propagation Artificial Neural Network (ANN) classification techniques. With these techniques five dominant mangrove species were classified. Results show that ANN classification produced only slightly higher accuracy (87.53%) compared to maximum likelihood (84.09%) classifier.

Keywords: Artificial Neural Network, world View 2, Fusion, mangrove, Malaysia