MAPPING TROPICAL FOREST FOR SUSTAINABLE MANAGEMENT USING SPOT 5 SATELLITE IMAGE

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Commission VII, WG VII/4

KEY WORDS: SPOT 5, tropical forest, stand volume, supervised classification, unsupervised classification

ABSTRACT:

This paper describes the combination of multi-data in stratifying the natural evergreen broadleaved tropical forest of the Central Highlands of Vietnam. The forests were stratified using both unsupervised and supervised classification methods based on SPOT5 and field data. The forests were classified into 3 and 4 strata separably. Correlation between stratified forest classes and forest variables was analyzed in order to find out 1) how many classes is suitable to stratify for the forest in this area and 2) how closely the forest variables are related with forest classes. The correlation coefficient shows although all forest variables did have a significant correlation with the forest classes, stand volume appeared to have the strongest correlation with forest classes. These are 0.64 and 0.59 for four and three strata respectively. The results of supervised classification also show the four strata of heavily degraded forest, moderate disturbance, insignificant disturbance, and dense forest were discriminated more clearly comparing to the forest stratified into three classes. The proof is that overall accuracy of supervised classification was 86% with Kappa of 0.8 for four classes, meanwhile, these are 77% and 0.62 respectively for forest area classified into 3 classes.

1. INTRDUCTION

The combination of spatial data sources and various non-spatial in the inventory and monitoring of forest resources such as satellite imagery, field data or other digital data sources e.g. topographical map, land use maps and so on known as a multi-data.

Establishment of forest thematic maps using satellite image data is common application in forestry management. Numerous studies have used different remote sensing data with different methods to build the different forest maps. Several studies have attempted to discriminate the tropical forests into distinguishing classes such as floristic variance (Thessler et.al, 2008; Slovaara, 2005); forest status (Nguyen, 2008; Souza, 2003); forest types (Kong et al., 2008); or successional stages (Hartter et al., 2008; Lu et al., 2003). However, there is no ideal classification for all users (Anderson et al., 1976, Brown *et al*., 1999; Lark, 1995) as well as no generally accepted limits on how accurate a classification should be in order to qualify as reliable (Foody, 2002).

There are certain factors that influence the accuracy of a classification result; type of sensor, used method or number of required classes are among them. In order to evaluate the reliability of satellite data, Brockhaus and Khorram (1996) used three different images for classification, SPOT XS, Landsat TM only using bands that are corresponding to SPOT, and Landsat TM with all bands. The overall classification accuracy for seven forest cover types was 74.4%, 70.8% and 88.5%, respectively. When more vegetation classes are involved, the probability of erroneous class assignments increases. In a Brazilian study, Souza et al. (2003) reported an overall accuracy of 93% in a classification of forest/ non-forest in a study in tropical forest, but that was 86% (range of producer's and user's accuracy 66-95%) when classified into three classes including non-forest, degraded and logged class. Even though more vegetation classes are included, the presence of the non-forest class may obtain higher accuracy. Lu et al. (2003) reported an overall accuracy of 78% (range of producer's and user's accuracy 58– 99%) when classifying only three successional and one mature forest class in the Brazilian Amazonia. However, Trisurat et al. (2000) used supervised classification of Landsat TM data to discriminate grassland and six forest classes (e.g., mixed deciduous, dry evergreen and tropical rain forest) with an overall accuracy of 79% (range 50–100%). Mallinis and Koutsias (2008) used logistic regression for broad-scale land cover classification and presented higher overall accuracy (76%) compared to the maximum likelihood algorithm (64%) and Mahalanobis distance (67%), although it was not statistically significant. However, the consideration of the spatial autocovariate in the logistic models significantly improved the fit of the models and increased the overall accuracy from 76% to 81%. Nguyen (2011) classified disturbed natural forest into four classes of dense, medium, poor and regeneration forest using SPOT 5 image. The overall obtained in this study is 82%.

The studies as mentioned above usually focused on land cover forest type, or forest state. There have been not many attempts to combine image classification with a specific characteristics of the forest stand as criteria to quantify forest stands, especially for tropical forests which are inherently complex in terms of species. This is even more difficult when forests have been under mainly impacts from human activities.