FOREST RESOURCES SURVEY, MONITORING AND PREDICTION USING REMOTE SENSING AND GEOGRAPHIC INFORMATION SYSTEM (GIS)

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Introduction

Forestry land use and cover mapping is a prerequisite for the planning of any development activities, especially in high risk environments. With the onset of the information age, it is essential that Malaysian forestry sector utilise technologies associated with acquisition, storage, extraction and dissemination of information in appropriate ways to enhance management and planning efficiency as well as effectiveness (Kamaruzaman and D'Souza, 1997). New techniques and/or technology related to forestry, such as inventory using stratified sampling and the use of Synthetic Aperture Radar are discussed (Kamaruzaman, 1998). Active microwave remote sensing is being tested here because such system is able to provide information about the land surface and forest canopy that would otherwise be unobtainable in regions where cloud cover and darkness prevail.

Materials and Methods

Several optical satellite data were used, namely LANDSAT Thematic Mapper and SPOT, and one airborne microwave system-AIRSAR. The study area covers the whole of Malaysia. These data were processed using integrated remote sensing/GIS software with the application of prediction models in the case of soil erosion risk assessment and flood prediction in Selangor. Standard procedures include spatial and spectral filtering, georeferencing, image to vector digitizing, unsupervised and supervised classification, on-site verification, and finally hardcopy outputs. Supervised classification required study areas to be accomplished based on unsupervised classifications and thereafter verified on-site. Confusion matrix was also performed to determine the accuracy of classification. Final results were produced as hardcopy images on the scale of 1:50 000.

Results and Discussion

With the aid of ground truth data and sound digital image processing techniques, all the optical data used provided sufficient spatial information for mapping/classification accuracy to be in the order of between 82 to 93% (Kamaruzaman and Zulhazman, 1997; Kamaruzaman and Aswati, 1999). Such high accuracy is particularly beneficial whereby areas of particular importance and/or land use may be calculated precisely. Application of predictive models in the GIS environment and integration with satellite images are able to provide worst case scenarios on particular land use or in the event of a catastrophe. In this way, problems anticipated and mitigation measures can eventually be planned for a specific areas. In addition, specific land use planning such as recreation planning can be implemented by comprehensively classifying land into zones based on land cover, topography and resources available with specialised analytical software. Also, preliminary results using AIRSAR data showed that only a general mapping of land use/cover is possible as extracted polarisation signatures showed no significant difference in terms of value or signature pattern from the different forested areas (Kamaruzaman and Sebastian, 1999). However, further investigative work may still yield important results pertaining to forest type mapping.

Conclusions

These studies imply that remotely sensed data is a useful tool for mapping, monitoring and predicting changes forest resources. Therefore, there is a high potential for the application of remotely sensed data in Malaysian forestry, especially airborne radar. However, it is emphasised that image-processing personnel, i.e. interpreters, have prior knowledge of the study areas before actually beginning with image interpretation.

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