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UTILIZING REMOTE SENSING TECHNOLOGY FOR LAND COVER MAPPING IN PEATLAND AREAS

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SUMMARY

Sarawak peatland covers 1.64 million hectares (ha). Up-to-date land cover information for peat areas is urgently needed to better monitor and understand the changes and developments in such areas. The Department of Agriculture Sarawak, in collaboration with Sarawak Information Systems Sdn. Bhd., have taken the initiative to produce semi-detailed land cover maps using satellite imagery. The tasks involved in this exercise included the collection of ground control points, geo referencing to the local coordinate system, ground sampling, image segmentation, image classification and random result assessments on the ground. A total area of 530,000 ha of land cover information has been updated and 14 categories of semi-detailed land cover maps with a confidence level of 79% were produced under this initiative. This timely and up-to-date information will help management and decision makers better understand the current situation on the ground and will therefore enable better and more accurate decision making in the planning and monitoring of peatland activities.

Keywords*: remote sensing, land cover, Sarawak*

INTRODUCTION

Sarawak peatland covers 1.64 million hectares (ha). The currently available land cover information for such areas, based on conventional methods such as aerial photography or ground surveys, is mostly outdated. The most up-to-date land cover information for peat areas is obtained through satellite remote sensing. Conventional methods to update the land cover information cannot compare with remote sensing satellite imagery either in terms of time taken to update or cost effectiveness. As such, satellite imagery is crucial to better monitor and understand the changes and developments in peatland areas. A collaborative initiative between Sarawak Information Systems Sdn. Bhd. and the Department of Agriculture Sarawak to produce semi-detailed land cover maps using satellite imagery was carried out from 2010-2014. The objectives of the initiative were to determine the accuracy of using Spot 5 Satellite data and spatial distribution of land cover in selected peatland areas in Sarawak, Malaysia.

SITES

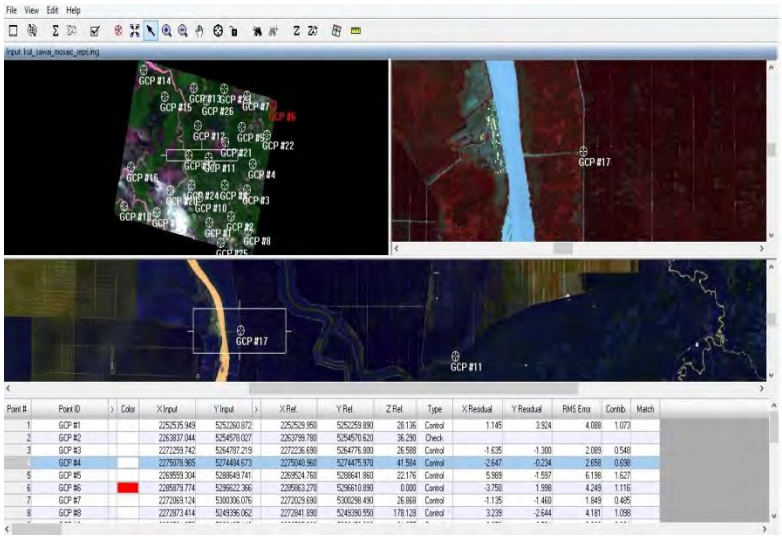
The project areas were located in Balingian, Matu and Daro and Kut Sawai peatland areas and covered a total of 530,000 ha.

METHODOLOGY

Spot 5 Satellite data at 2.5m resolution were used to carry out the land cover classification at the project areas. The methodology used in the processing of the imagery is as listed below:

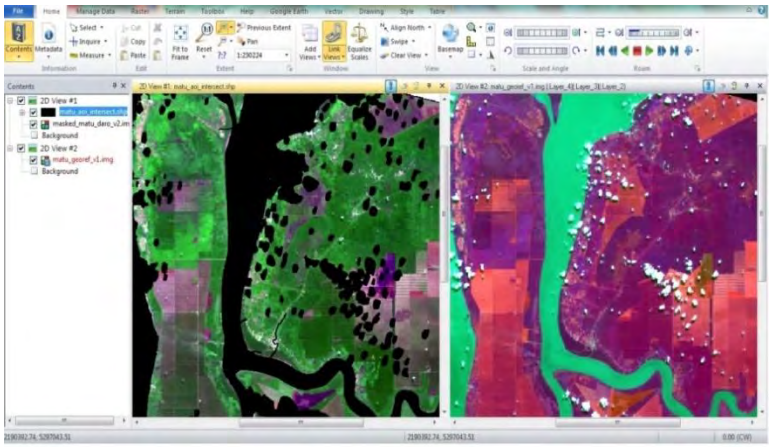
1) Image dereferencing

A number of Ground Control Points (GCPs) were collected to rectify and geocode the imageries into the local coordinate system (BRSO).An RMMS error of 1.5 pixels (4.0m on the ground) was achieved during this process.



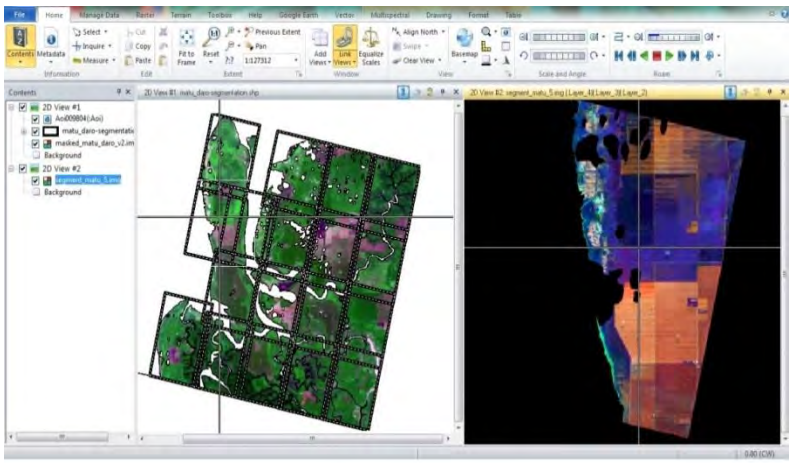
2) Masking process

Areas covered by cloud shadow and the river network were masked in order to avoid confusion and error during the image classification process.



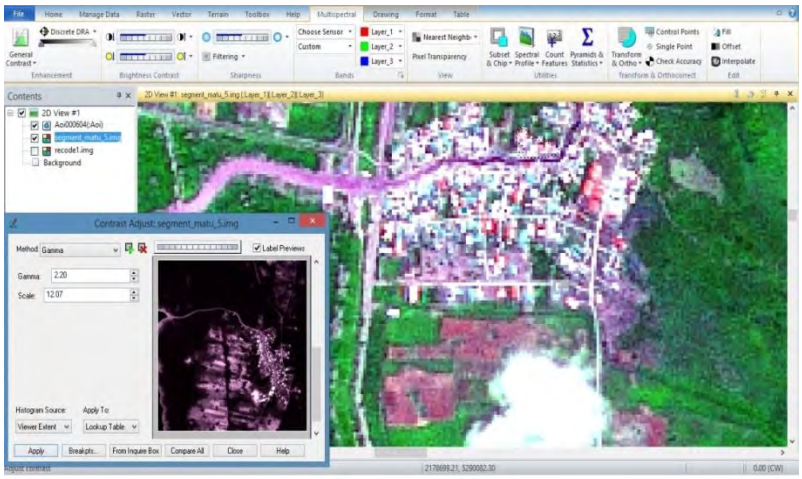
3) Image segmentation

Each image was segmented into areas of 20 km^2 as shown below in order to help improve the accuracy of the final output of the classification result by having a more localized result.



4) Image enhancement process

The Image enhancement process helps enhance the visualisation of the edges of ground objects and thus avoids the collection of incorrect object signatures.



5) Ground sampling data collection

Ground sampling data collection was carried out to understand the land cover types represented on the imagery. Other ancillary information such as topographic maps and old land use maps were used to understand the ground objects before the actual ground sampling collection was carried out.

6) Signature collection

The collected ground sampling points were overlaid with the satellite imagery. Difference image enhancement was applied intermittently during the process of signature collection.

7) Signature evaluation

Collected signatures were evaluated to avoid mistakes in the classification process.

8) Classification process

The Supervised Classification method was chosen to perform the classification process. After the classification process was completed the data were generalized or simplified through the recoding process.

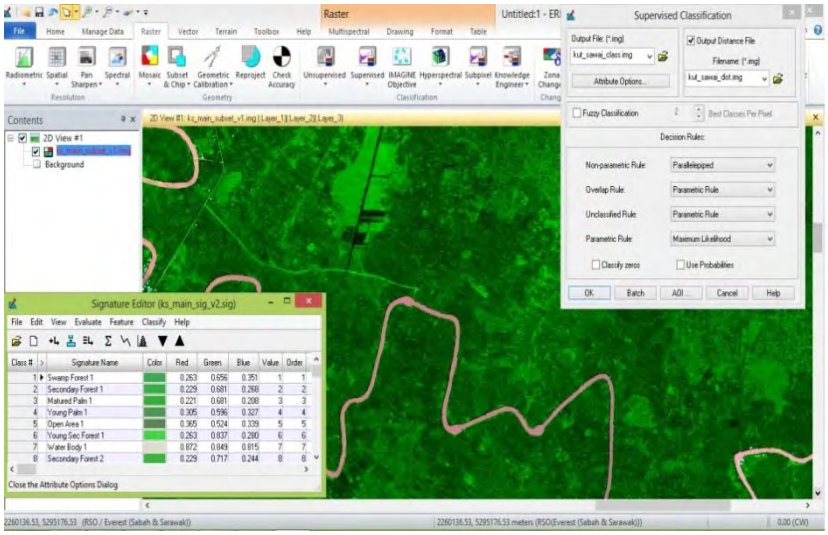
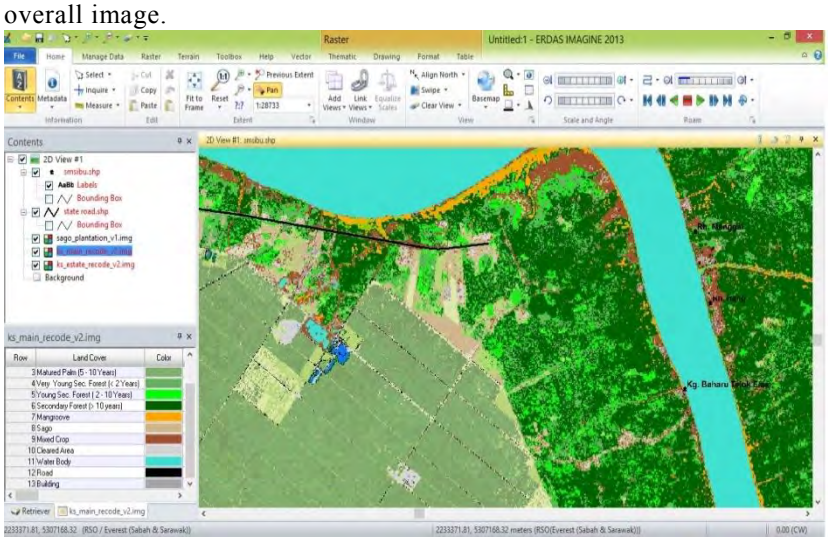


Image mosaic

After all the segments of the imagery were classified all the thematic maps were stitched together into an overall image.



9) Verification process

The classified data were uploaded into the GPS handheld devices to enable them to be verified on site. The on-site verification was carried out by the SAINS Team together with DOA Soil Branch personnel. Verification was performed at randomly selected locations in the project area.

RESULTS

The final output is a semi detailed land cover map with the 14 classes mentioned below.

(i) Very Young oil Palm – Transplant (< 1 year)
(ii) Young oil Palm (1 - 5 years)
(iii) Matured oil Palm (5 -10 years)
(iv) Old Palm (> 10 Years)
(v) Very Young Secondary Forest (< 2 Years)
(vi) Young Secondary Forest (2 – 10 Years)
(vii) Secondary Forest (> 10 Years)
(viii) Mangrove
(ix) Sago
(x) Mixed Crop (Pineapple, Coconut, Rubber, Paddy, Orchard)
(xi) Cleared Area
(xii) Water Body
(xiii) Road
(xiv) Building

The results show that 79% of the classified land cover information match the actual land cover information.

DISCUSSION

Constraints and difficulties faced during this project that affected the accuracy of the final output included:

a) The use of archived satellite data resulted in many changes (environmental, atmospheric and in terms of moisture content) occurred between the time the project started and the time the image was captured.

b) Limitations both in the nature and in the medium resolution of the satellite imagery prevented the production of high accuracy output.

SUGGESTIONS AND RECOMMENDATIONS

a) Satellite imagery less than two months old should be used to ensure that rapid changes on the ground have not altered the classification by the time the inspection is being carried out. DOVES NANOSAT can be considered for this.

b) Higher resolution imagery should be used in order to allow the differentiation of various types of land cover on the imagery and at the same time enable more detailed classification to be performed.

CONCLUSION

The SAINS Geomatics Team in collaboration with officers from the Department of Agriculture, Sarawak successfully conducted the land cover classification. The timely and up-to-date information produced will help management and decision makers better understand the current ground situation. It will therefore enable better and more accurate decision making in the planning and monitoring of peatland activities.