



APPLICATION OF HYPERSPECTRAL TECHNOLOGY IN DISCRIMINATING *GONYSTYLUS BANCANUS* IN MALAYSIA

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**INTERNATIONAL MEETING ON SUSTAINABLE FOREST MANAGEMENT IN CITES 8 – 10 JANUARY
2013 BALI INDONESIA**



MS ISO 9001: 2008



**INSTITUT PENYELIDIKAN PERHUTANAN MALAYSIA
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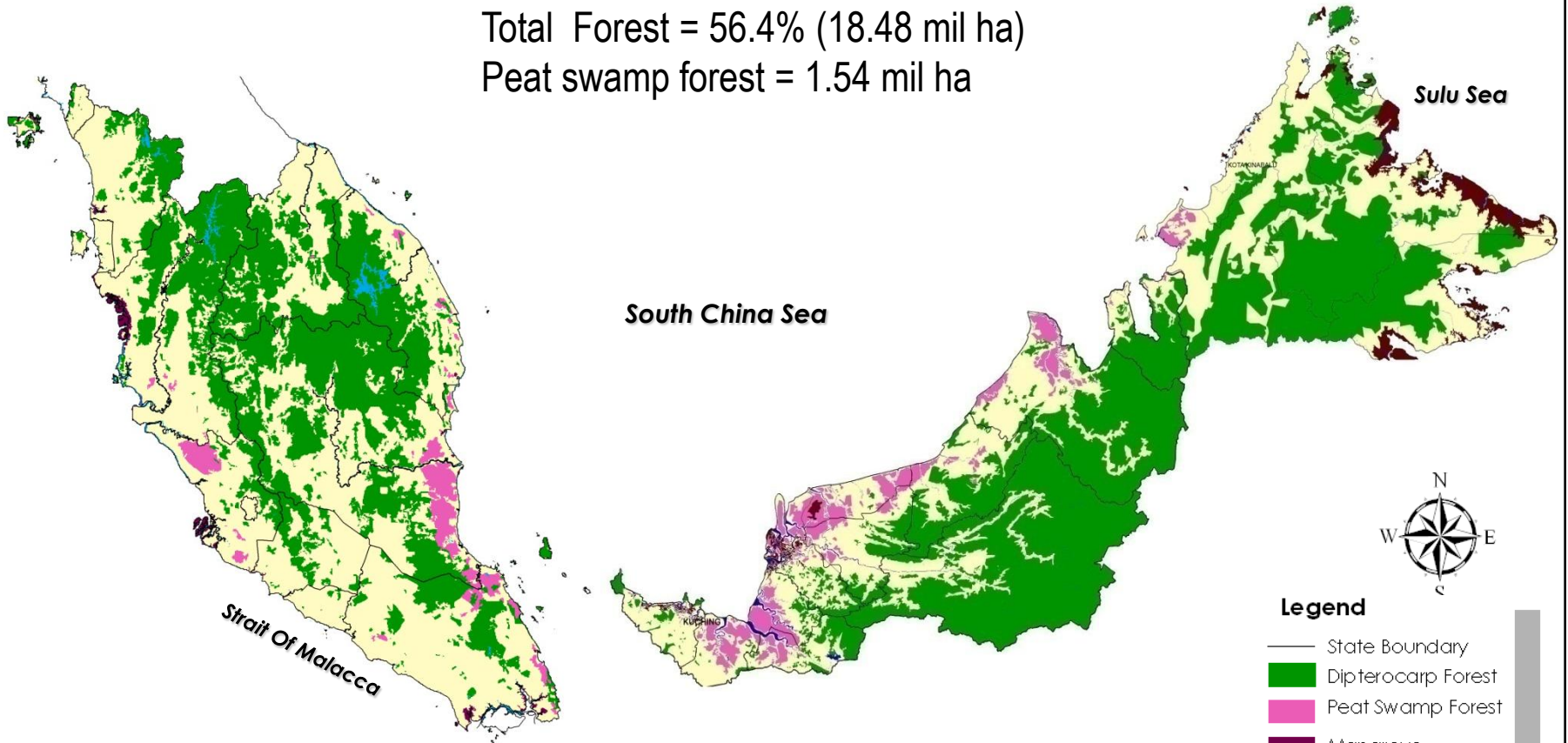
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PRESENTATION OUTLINE

1. Introduction
2. The Activity
3. Results and Discussion
4. Impacts
5. Conclusion
6. Lessons Learnt

MALAYSIA – FOREST MAP

Total Forest = 56.4% (18.48 mil ha)
Peat swamp forest = 1.54 mil ha



THE SPECIES & ISSUE

- Scientific name: *Gonystylus bancanus*
- Family: Thymelaeaceae
- Local name: Ramin
- Brief description: large tree and can grow up to 40 m in height
- Uses: timber for high quality furniture
- Ecology: gregarious in peat swamp forests
- *G. bancanus* is an endangered peat swamp forest species- listed in Appendix II of CITES
- There is a need to identify the ramin population in the natural habitat for management purposes

Ramin – *Gonystylus bancanus*

flower



timbers



tree



fruits



seedling

RESEARCH JUSTIFICATION

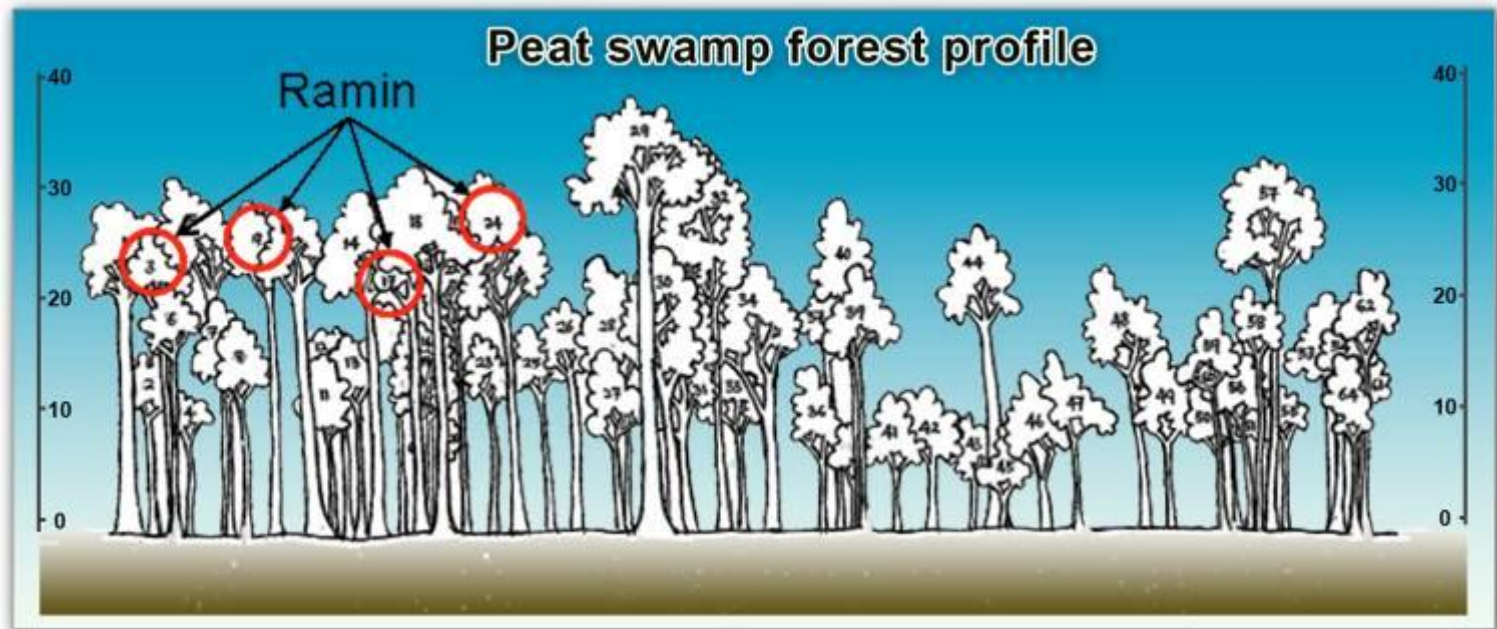
- To identify and locate *G. bancanus* trees in a highly mixed peat swamp forest is a challenging task.
- The ideal way is to inventories the whole population, but this will be very expensive to implement in the field.
- Opportunities on mapping using hyperspectral remote sensing technology

THE ACTIVITY

Title	Generation of spatial distribution maps of <i>Gonystylus bancanus</i> (ramin) using hyperspectral technology and determination of sustainable level of harvest of ramin in production forests of Peninsular Malaysia
Objectives	<ul style="list-style-type: none"> i. To generate spatial distribution maps of ramin through the use of hyperspectral technology in Peninsular Malaysia. ii. To determine sustainable level of harvest of ramin (<i>Gonystylus</i> spp.) that enhances their conservation status in production forests of Peninsular Malaysia.
Duration	2008-2010
Outputs	<ul style="list-style-type: none"> i. Spectral library for <i>G. bancanus</i>. ii. Spatial distribution maps and non-spatial data for <i>G. bancanus</i> iii. Information on population dynamics of <i>G. bancanus</i> iv. Projected sustainable harvest levels of <i>G. bancanus</i> in natural forest stands in Peninsular Malaysia.
Initiated By	Malaysian Government
Executing Agency	Ministry of Natural Resources and Environment, Malaysia
Implementing Agency	Forest Research Institute Malaysia
Source of funding & amount	International Tropical Timber Organisation (ITTO) - CITES USD 131,000.00 Government of Malaysia = USD 52,050.00

G. BANCANUS IN THE FOREST

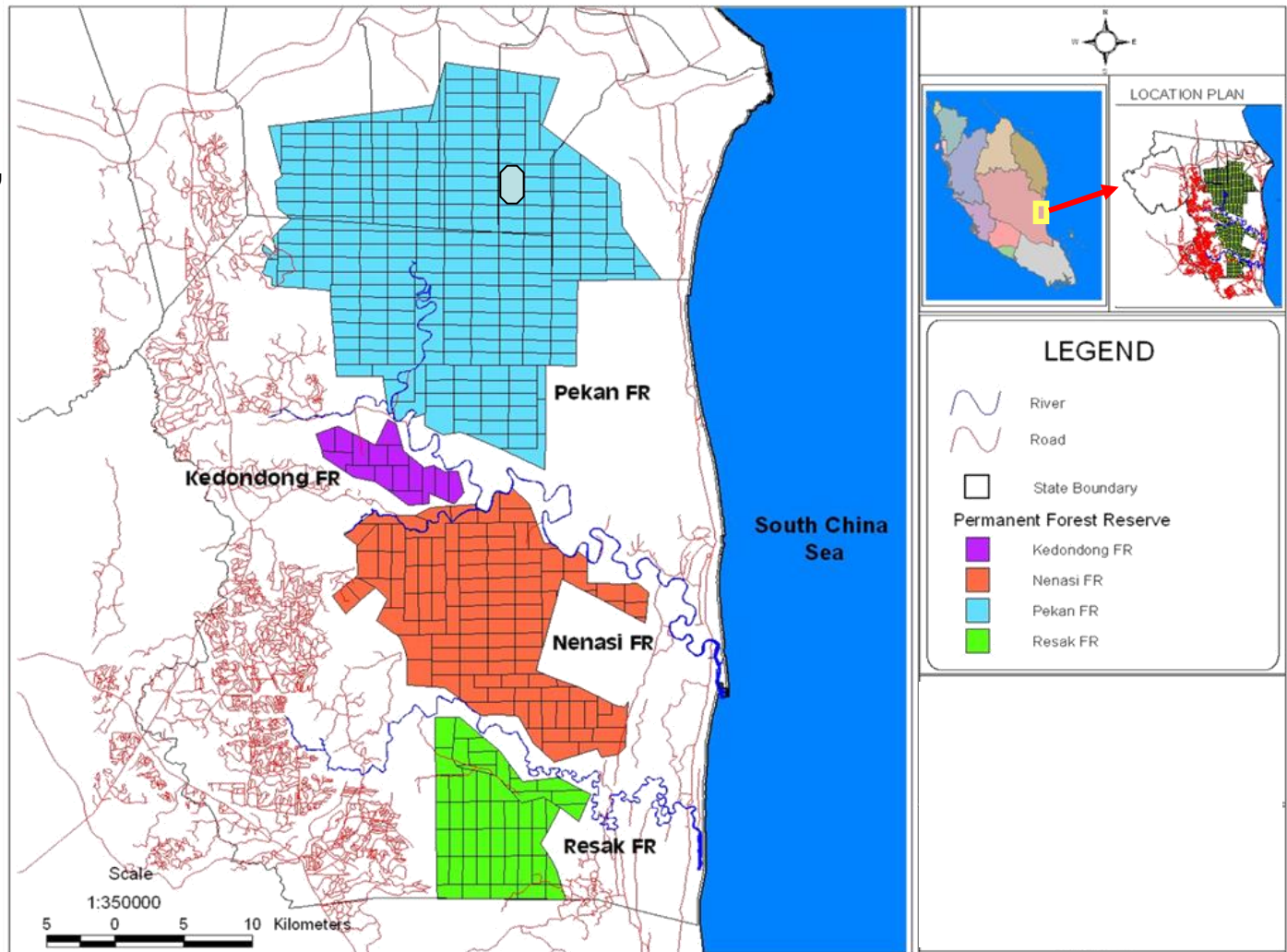
- *G. bancanus* is considered canopy layer tree
- Advantage to use airborne hyperspectral data



Forest profile of Plot E3: 39, *Baccaurea bracteata*; 54, *Blumeodendron tokbrai*; 14, 61, *Calophyllum ferrugineum*; 27, *Calophyllum sclerophyllum*; 47, *Camnosperma coriaceum*; 2, 33, 49, 50, *Diospyros lanceifolia*; 53, *Diospyros maingayi*; 18, 32, *Durio carinatus*; **3,9,17,24, *Gonystylus bancanus***; 21, 29, 40, *Koompassia malaccensis*; 15, 30, *Licania splendens*; 43, 58, *Litsea elliptica*; 36, 38, 44, 56, 60, *Litsea gracilipes*; 51, *Litsea grandis*; 12, 16, 41, *Lophopetalum floribundum*; 45, *Lophopetalum multinervium*; 6, 7, 8, 11, 20, 55, 64, *Neoscortechinia forbesii*; 10, *Palaquium ridleyi*; 22, 37, 52, *Parastemon urophyllum*; 23, 48, *Polyalthia glauca*; 5, *Polyalthia hypoleuca*; 1, 57, *Shorea platycarpa*; 13, *Syzygium cerinum*; 19, 26, 31, 46, *Syzygium inophyllum*; 34, 62, *Syzygium kiahii*; 25, 35, *Syzygium lineatum*; 4, *Tetractomia majus*; 59, *Xantophyllum ellipticum*; 28, 42, *Xylopiya magna*.

STUDY AREA

Peat Swamp Forest, Pekan, Pahang MALAYSIA





PEAT SWAMP FOREST DURING DRY SEASON



PEAT SWAMP FOREST DURING WET SEASON

Site visit of the Mid-term Review Team to the study area in Pekan Peat Swamp Forest, Malaysia

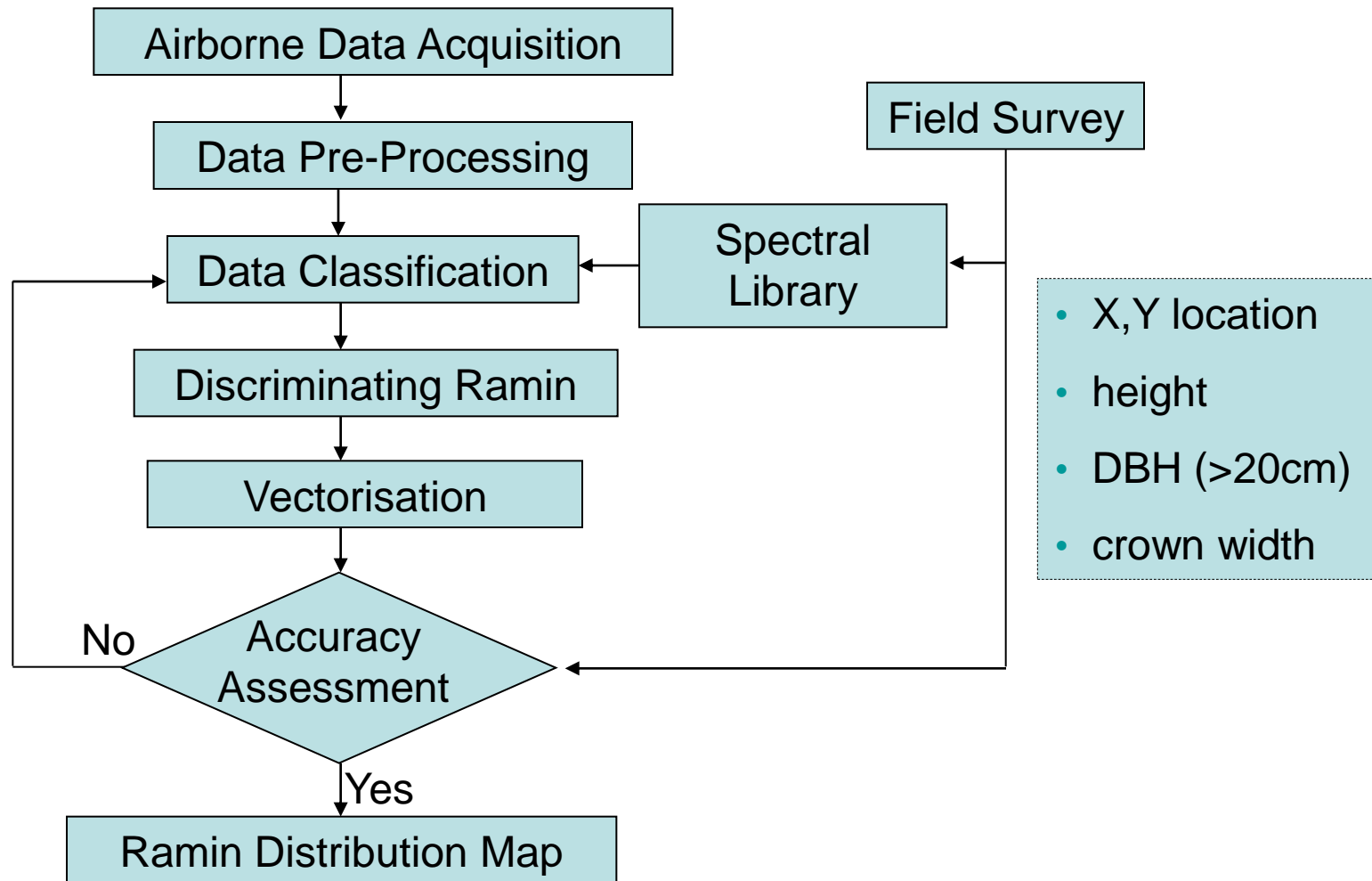


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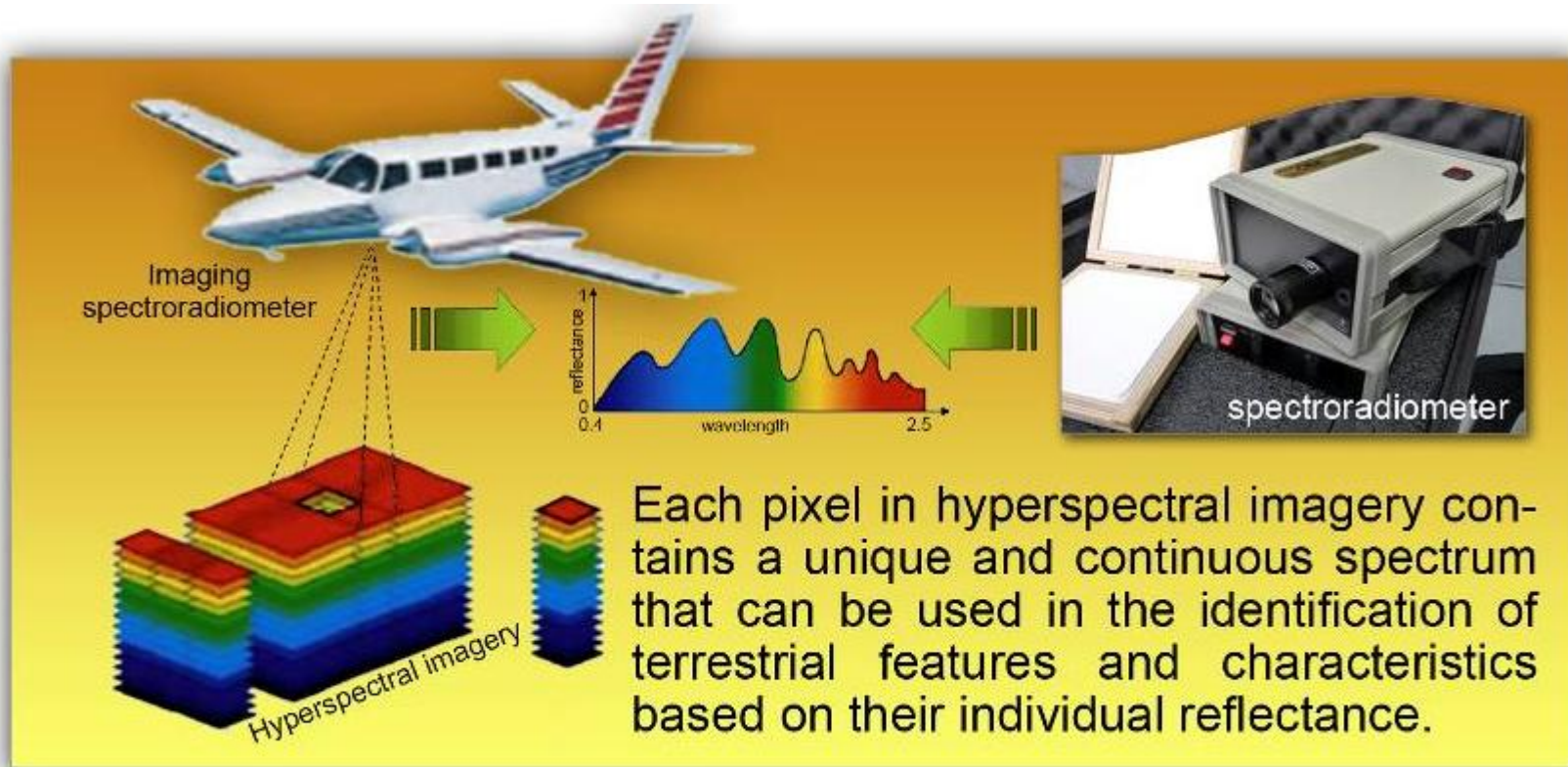
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THE METHODOLOGY



AIRBORNE HYPERSPECTRAL DATA

- Sensor : HySpex VNIR-1600
- Spatial resolution, 0.5m
- Spectral Range : 0.4-1 μ m
- Number of bands, 160
- Swath width, 1km



AIRBORNE HYPERSPECTRAL SENSOR

Acquiring of airborne hyperspectral data in the study area



HySpex V-NIR 1600



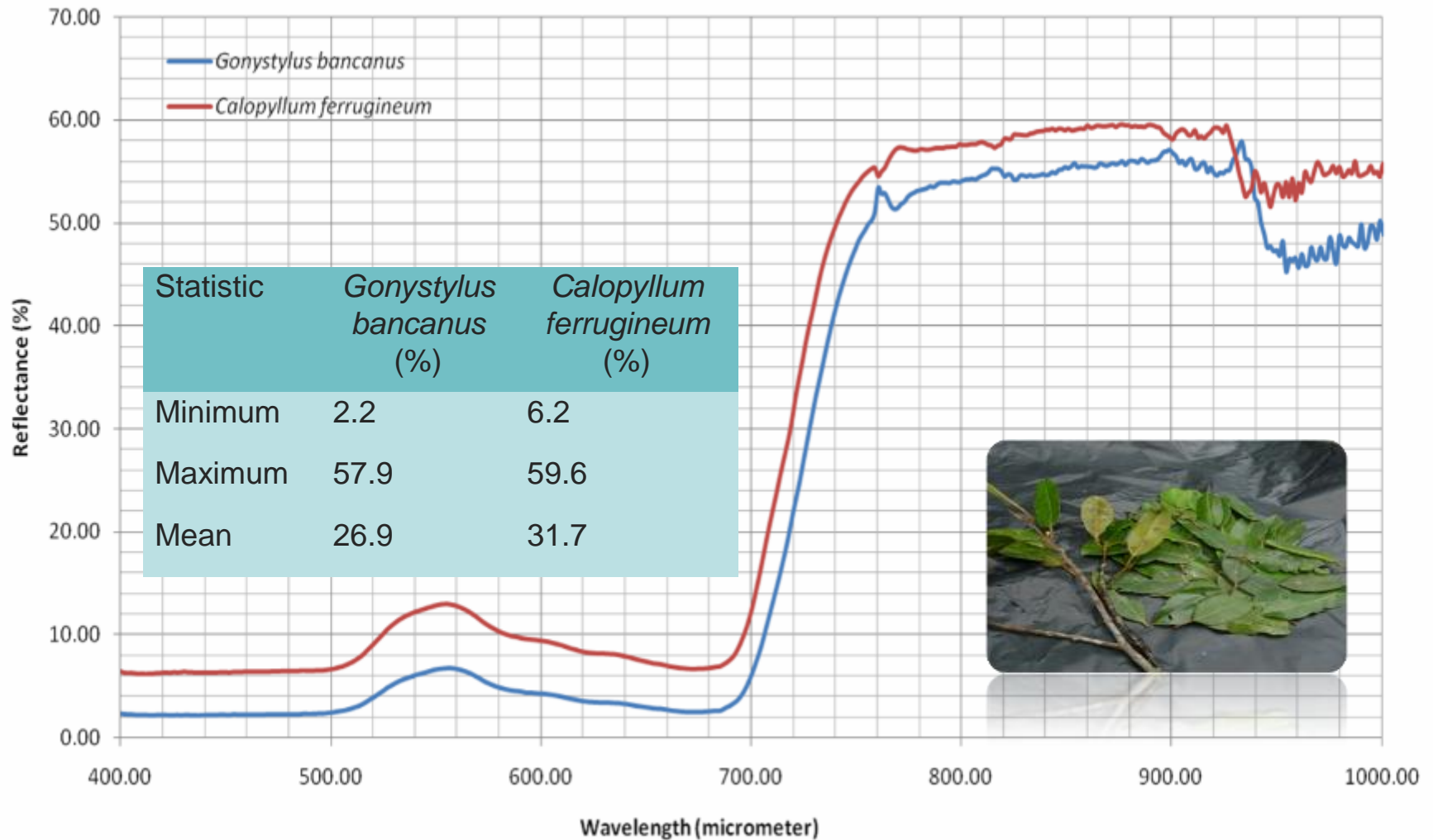
Aircraft (9M - PIH)



Hyperspectral system installations

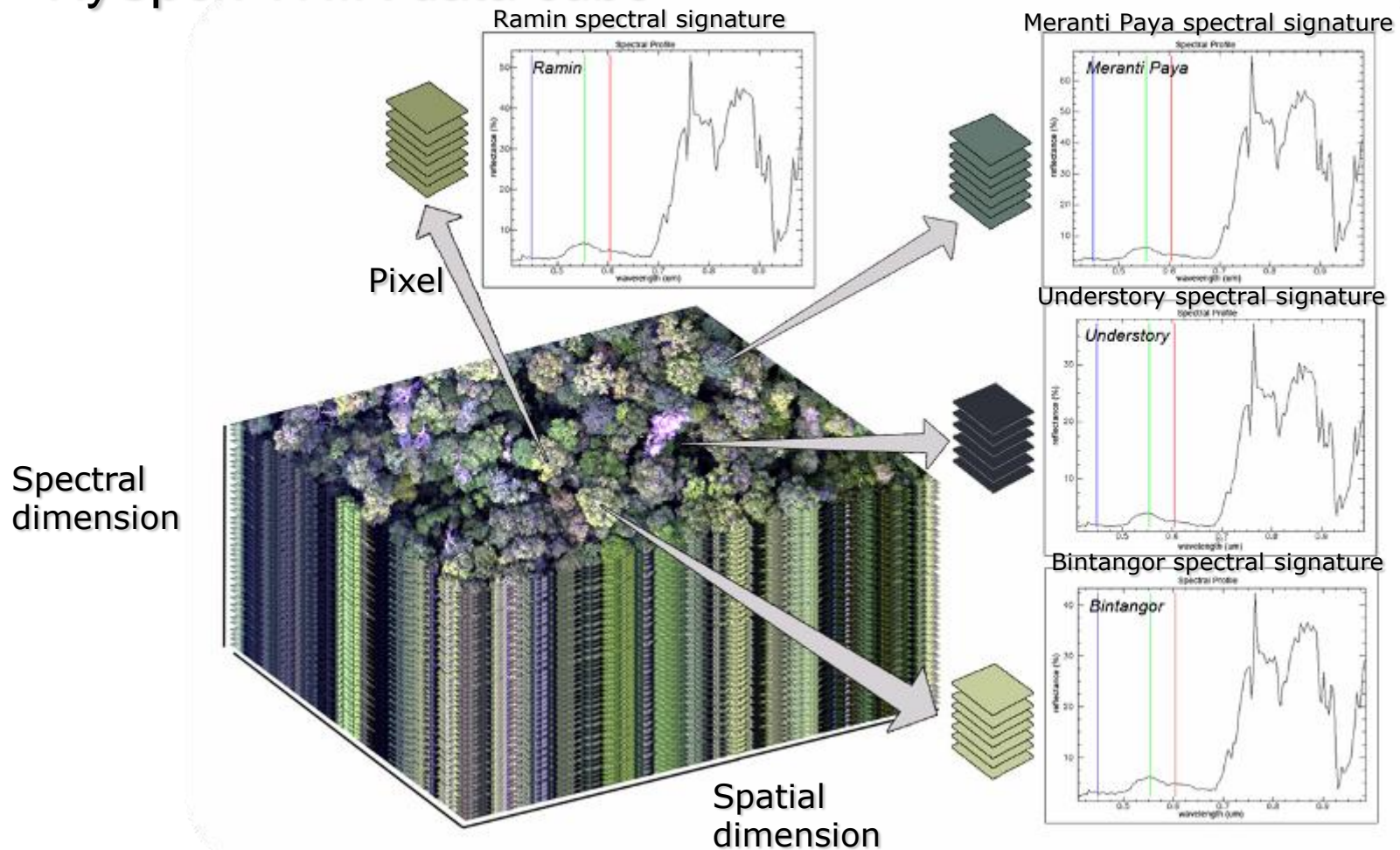
RESULTS & DISCUSSION

SPECTRAL LIBRARY



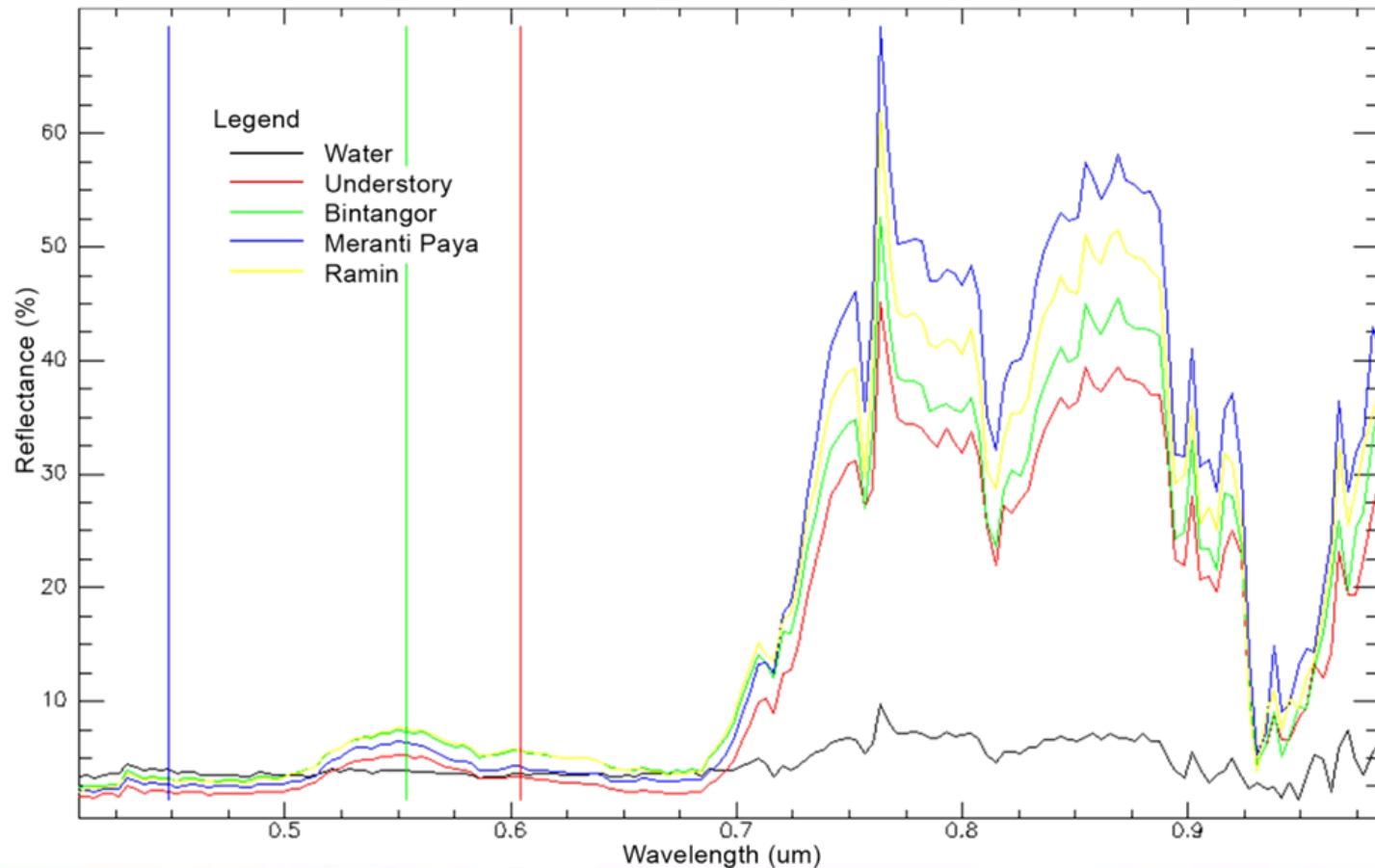
RESULTS & DISCUSSION

- HySpex VNIR data cube



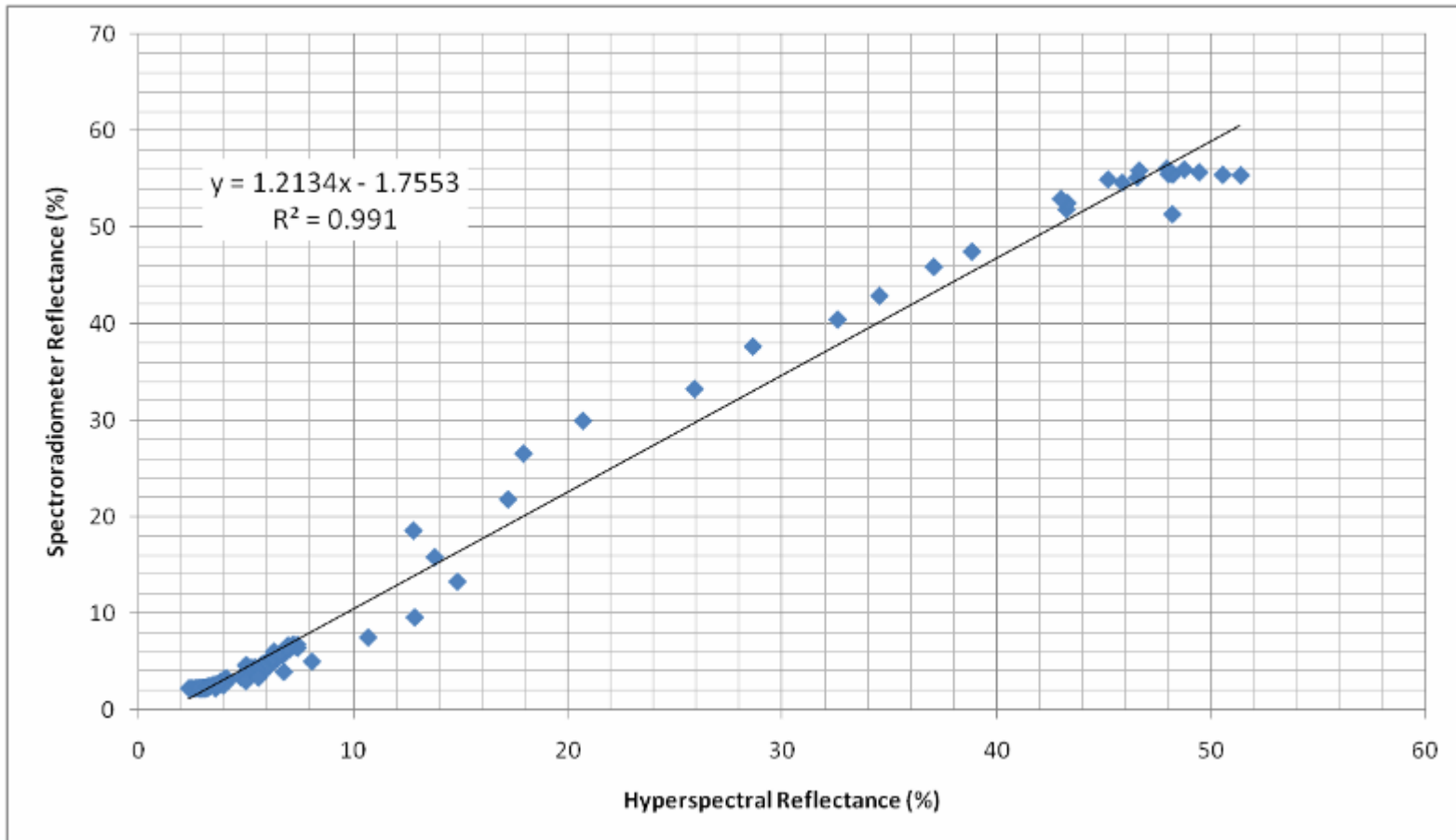
RESULTS & DISCUSSION

- Spectral signature of selected features in hyperspectral images



RESULTS & DISCUSSION

- High correlation (*G. bancanus* reflectance) between hyperspectral data and spectroradiometer measurement

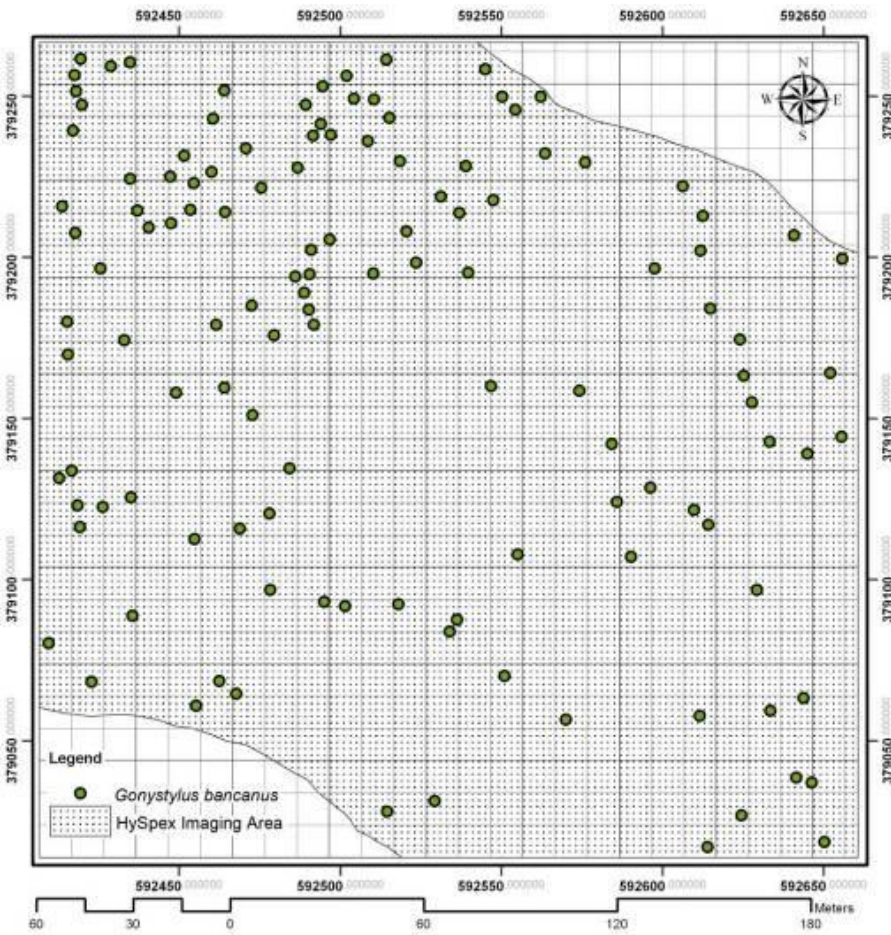


RESULTS & DISCUSSION

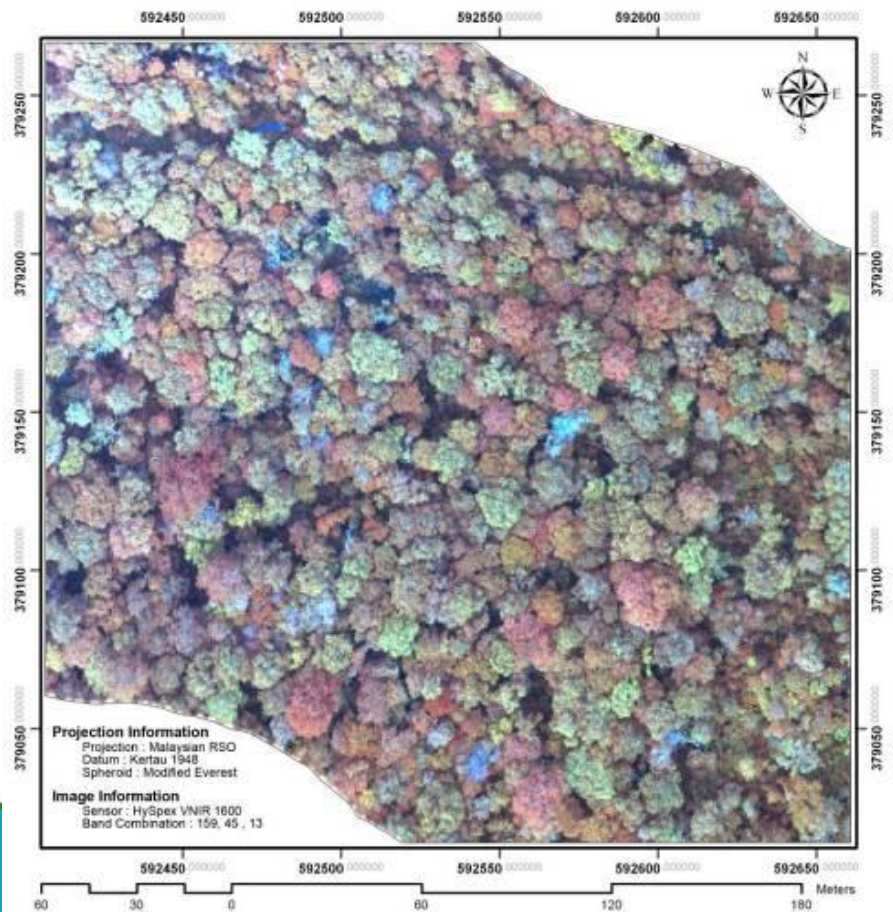
- Using Spectral Angle Mapper (SAM) classification technique the hyperspectral data can be used to map *G. bancanus* distributions

- It was found that the distribution of *G. bancanus* within the study area is about 21 tree per ha

- Mapping accuracy of 86%



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Peat swamp forest



IMPACTS

The outputs produced from the Activity could influence sectoral policies and programs in Malaysia, particularly with regards to the following:

- Mapping procedure for discriminating species of interest such as *G. bancanus* in the natural forest environment
- Procedure in monitoring of forest tree species with special interest such as *G. bancanus* for conservation purposes
- They are necessary to support and enhance SFM and conservation of *G. bancanus* in this country

CONCLUSION

- Spectral library of the *G. bancanus* has been developed and can be used as reference spectral library for the future research project.
- *G. bancanus* trees can be identified using hyperspectral data with an acceptable mapping accuracy (86%).
- The availability of accurate information on ramin population from this study can be used to assist in designing rehabilitation and conservation programs in order to conserve and sustainably manage this species in line with the CITES requirements.

LESSONS LEARNT

SAINTIFIC KNOWLEDGE

- *G. bancanus* density in the Pekan natural peat swamp forest is relatively high = 21 trees/ha
- High correlation (ramin reflectance) between hyperspectral data and spectroradiometer measurement (R^2 0.991) indicates the reliability of the hyperspectral data
- Proper data acquisition time is important in order to get good quality spectral signature tree data

LESSONS LEARNT

ACTIVITY IMPLEMENTATIONS

- Early consultation with relevant authorities and engagement of local people in field survey helps in ensuring continuous support from the stakeholders
- Multi-agencies participation - the Activity benefited a lot from the cooperation and participation of various stakeholders including government agencies, NGOs and local community
- High cost of Hyperspectral data = USD 17/ha, should try other cheap remote sensing data such as WorldView 2 (USD 0.50/ha) - to be proposed for ITTO-CITES Phase II Project.

Thank You

Acknowledgements

This work was made possible by a grant from ITTO under its collaborative program with CITES and Malaysia to build capacity for implementing timber listings. Donors to this collaborative program include the EU (primary donor), the USA, Japan, Norway, New Zealand and Switzerland.