Hatfield

Independent Report on Mixed Hardwood (MHW) Moratorium Monitoring for April Group Concession in Pulau Padang – Riau and April Supplier (AHL) Concession in North Kalimantan

AHL Block A Baseline Report as at 16 May 2015 and Land Cover Change Analysis as at 9 June 2015

July 2015

Prepared for:

APRIL Group
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Jakarta Pusat 10230
INDONESIA

INDEPENDENT REPORT ON MIXED HARDWOOD (MHW) MORATORIUM MONITORING FOR APRIL GROUP CONCESSION IN PULAU PADANG - RIAU AND APRIL SUPPLIER (AHL) CONCESSION IN NORTH KALIMANTAN

AHL BLOCK A BASELINE REPORT AS AT 16 MAY 2015 AND LAND COVER CHANGE ANALYSIS AS AT 9 JUNE 2015

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AMENDMENT RECORD

This report has been issued and amended as follows:

Issue	Description	Date	Approved by	
1	First version of AHL Block A Baseline & June Change Analysis Report	2015-07-28	Dr. Andy Dean **Project Director**	Agus Salim **Project Manager**

EXECUTIVE SUMMARY

This report updates that first published on 6 July 2015, which reported on PT Hatfield Indonesia's efforts to measure and analyse APRIL Group's compliance in relation to its Sustainable Forest Management (SFMP) 2.0 commitments. In particular, Hatfield was tasked to examine APRIL Group's compliance in relation to its 15 May 2015 mixed hardwood (MWH) moratorium.

The report confirmed policy compliance in the great majority of the area under study. However, seven compartments comprising 151 hectares inside the PT Adindo Hutani Lestari (AHL) concession area required further detailed analysis with RapidEye imagery. Unfortunately due to atmospheric and cloud conditions, RapidEye 5 m pixel resolution imagery of this area for the relevant period in May 2015 was not available to support the further detailed baseline analysis.

Following consultation with APRIL Group and its stakeholders on 14 July 2015, it was agreed to use an alternative methodology utilizing the best available alternative data to RapidEye, which are Landsat 7 and Sentinel-1 Radar imagery from 16 May 2015, as the main data sources to conduct further detailed baseline analysis. This methodology was supported by further ground truthing as well as the computerized image classification. Due to the limitation of the Landsat image resolution, Hatfield was only able to delineate four of the six target land cover classes: "Standing", "Scrub", "Felled" and "Ready for Planting" areas.

Following completion of the baseline analysis for 16 May, 2015, Hatfield was tasked to conduct land cover change analysis. The best available imagery acquired was Landsat 8 on 9 June, 2015, although the quality of Landsat image was poor due to haze. This meant Hatfield could not conduct land cover change analysis using the same methodology as the baseline analysis, and simple visual interpretation analysis (without quantitative accuracy assessment) was applied. Following this change analysis, we identified approximately 39 hectares with visible land cover change from areas classified as standing on May 16th and classified as ready for planting on June 6th. An area of 128 ha classified as standing in May 16th remained standing on June 6th.

In reporting this finding we note the uncertainty involved in using the best available Landsat and Sentinel-1 imagery to establish a Baseline, indicated by low class seperability indices between certain land cover classes. Specifically, mixed patches of "Standing", "Felled" and "Scrub" areas in one compartment rendered analysis difficult and affected the overall accuracy of the baseline classification.

1.0   INTRODUCTION

PT Hatfield Indonesia (Hatfield) was contracted by APRIL Group to monitor and evaluate compliance in relation to its Sustainable Forest Management (SFMP) 2.0 commitments and its 15 May 2015 mixed hardwood (MWH) moratorium.

Hatfield developed a baseline MWH) moratorium land cover classification report in July 2015, which included PT Adindo Hutani Lestari (AHL), APRIL supplier in North Kalimantan[1].

This report is a follow up to the baseline report, and focuses on land monitoring of the AHL concession Block A - Sesayap River, Tana Tidung District, North Kalimantan province (Figure 1). This report follows a key stakeholders meeting held to review the RapidEye analysis for AHL baseline mapping on July 14th, 2015 (see Appendix A1).

The objective of this report was to update the baseline land cover and to conduct further monitoring of Block A, which was identified in the previous report as an area of potential risk with regard to compliance with the MHW moratorium. The scope of work was to use additional image sources, acquired subsequent to the moratorium, field work, and to conduct change detection with the baseline land cover.

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[1] Hatfield. 2015. *Independent Report on Mixed Hardwood (MHW) Moratorium Monitoring for April Group Concession in Pulau Padang – Riau and April Supplier (AHL) Concession in North Kalimantan* (Baseline Report)". Published on July 6th 2015.

Figure 1   Block A Study Area
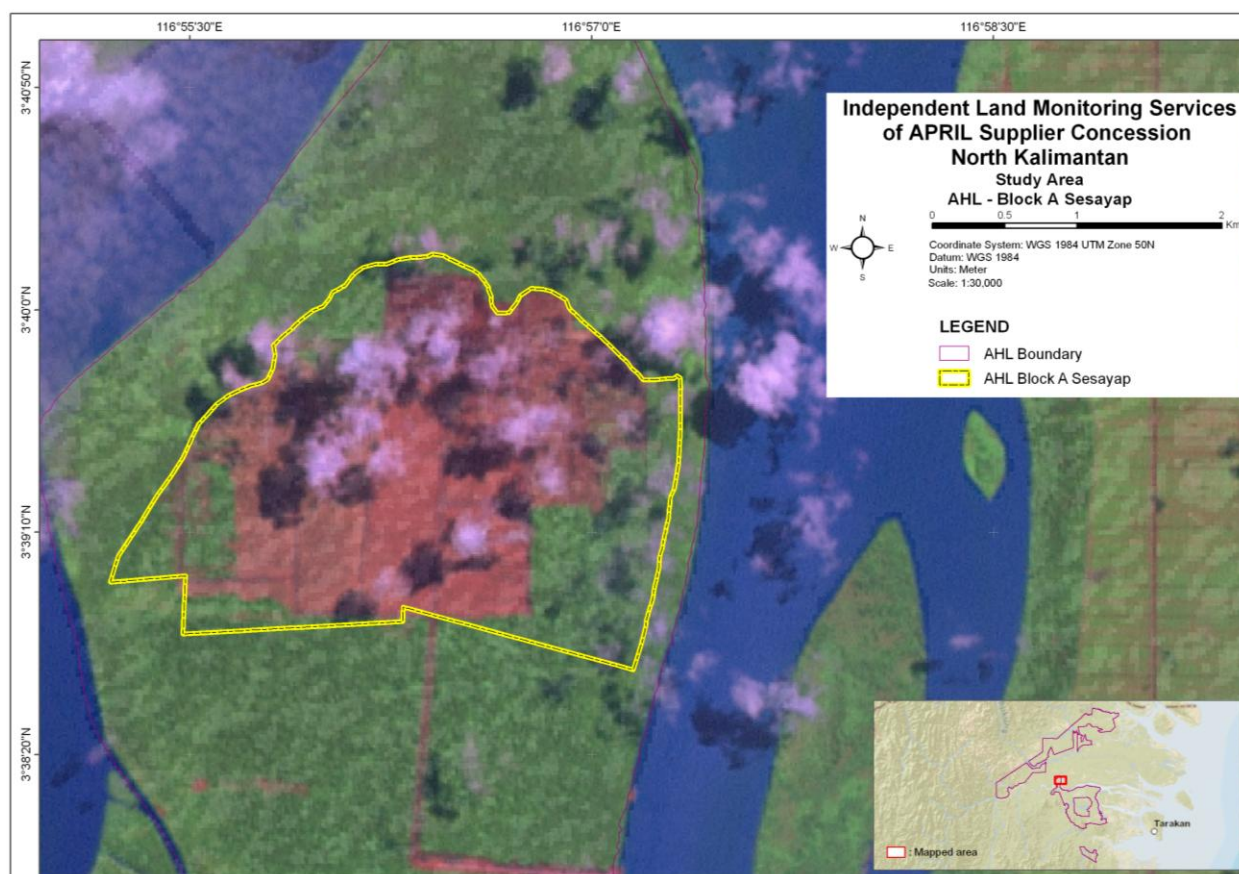
2.0   DATA SOURCE

For the baseline analysis, Hatfield used Landsat ETM 7 Path 117 Row 58 with an acquisition date of May 16th, 2015 (Figure 2) as the main data source for optical imagery, and Sentinel-1 Interferometric Wide Swath (IW) imagery acquired on May 16th, 2015 (Figure 3) as a supplementary radar image data source to extract ground information that are cloud-covered on the Landsat optical image. These data sources were pre-processed as described in the Baseline Report document (July 6th, 2015).

The area within the black circle in Figure 3 have a high probability of bare ground or cleared area compared to the surrounding, based on qualitative expert assessment of the radar image. In Figure 2, The 5,4,3 band combination is good at discriminating vegetation status and shows good colour contrast between the vegetated areas (green) and cleared areas (red/brown).

Hatfield conducted an aerial survey on June 26th 2015 and AHL also acquired aerial footage on May 15th 2015. This video footage was displayed during the key stakeholder meeting on July 7th, 2015. From that meeting, all stakeholders agreed that additional analysis will be performed for the specific locations indicated in Figure 4.

Figure 2   AHL Block A covered by Landsat ETM 7, May 16 2015.
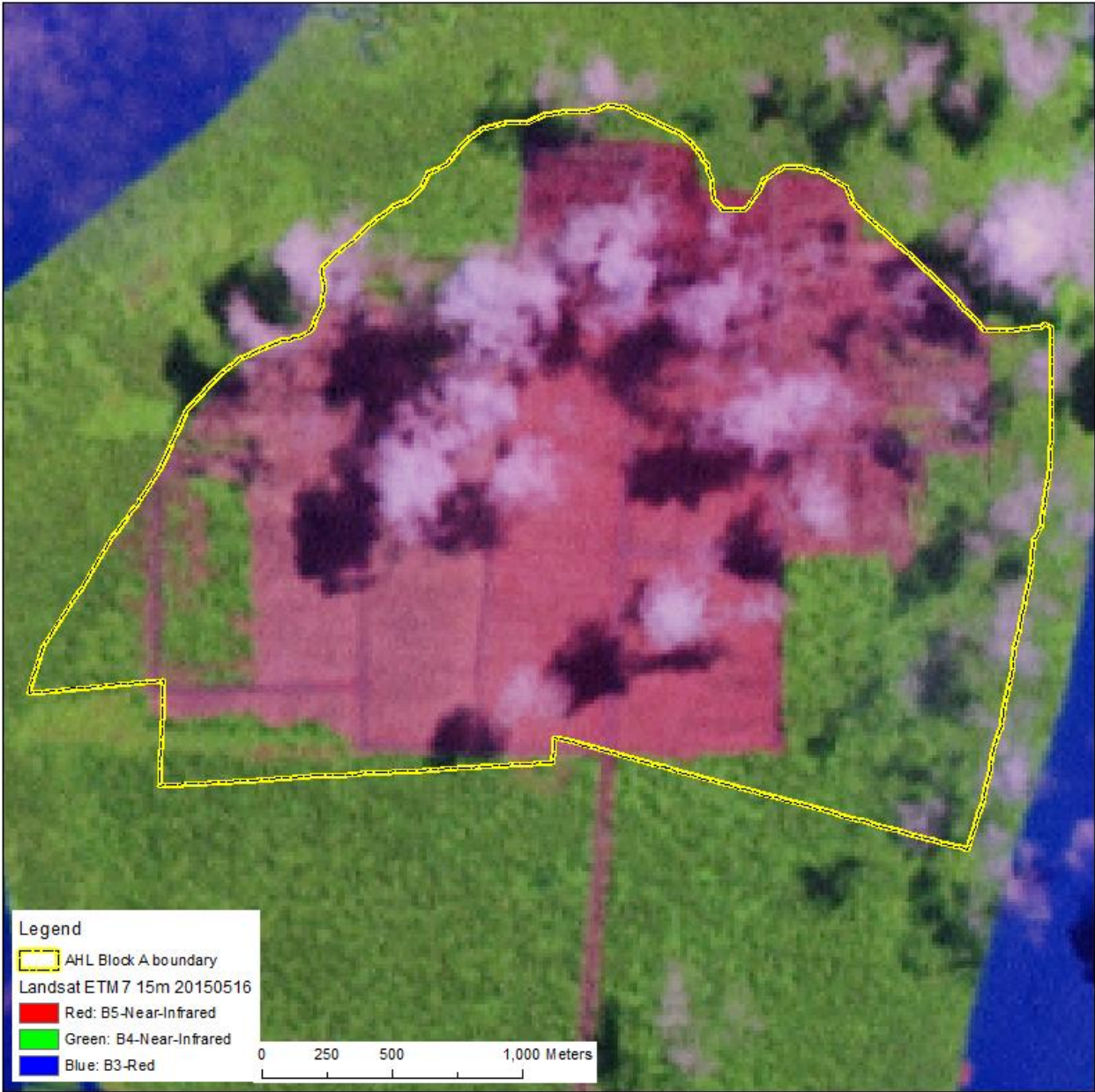

Legend

AHL Block A boundary
Landsat ETM 7 15m 20150516
Red: B5-Near-Infrared
Green: B4-Near-Infrared
Blue: B3-Red

0   250   500   1,000 Meters

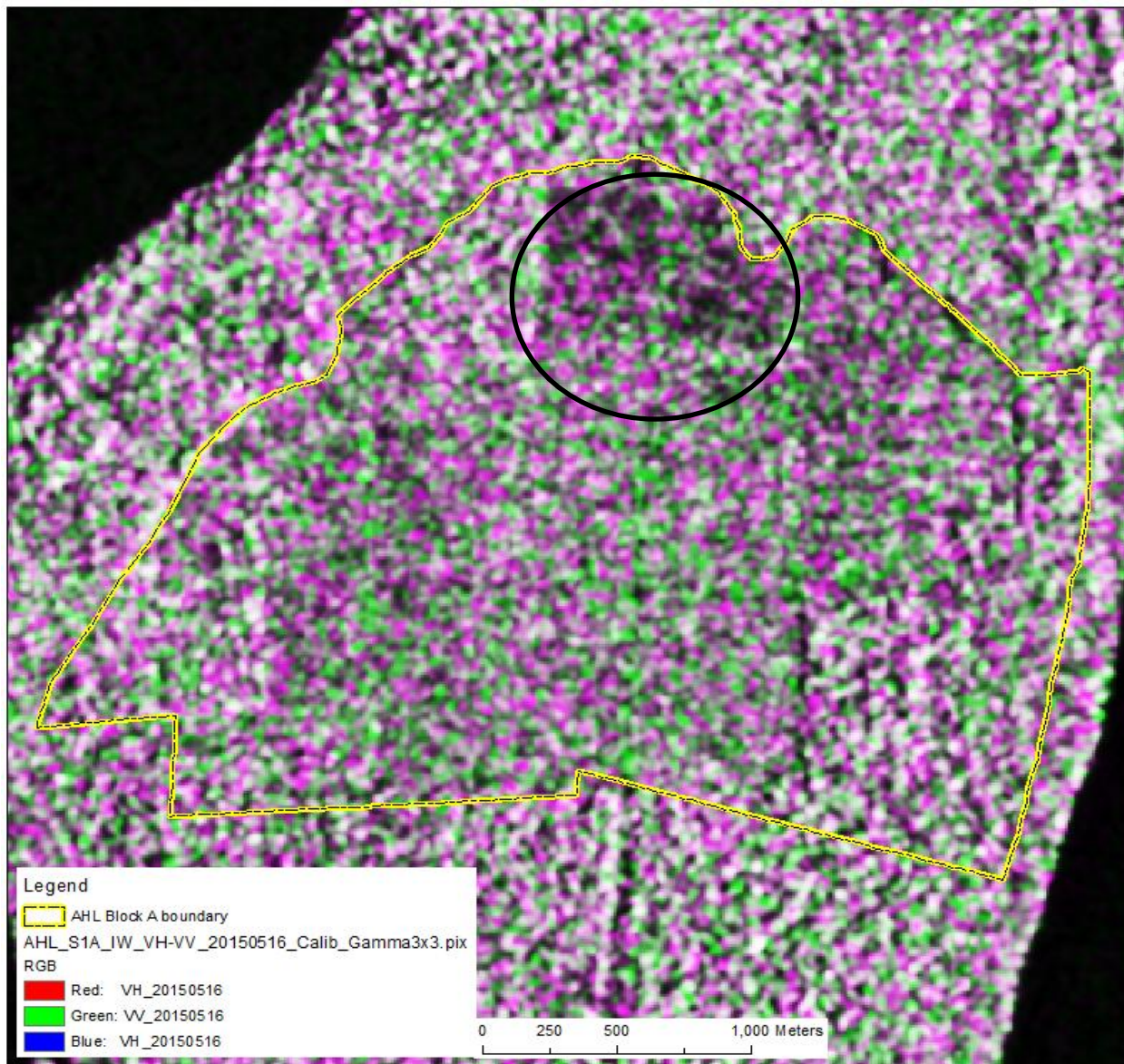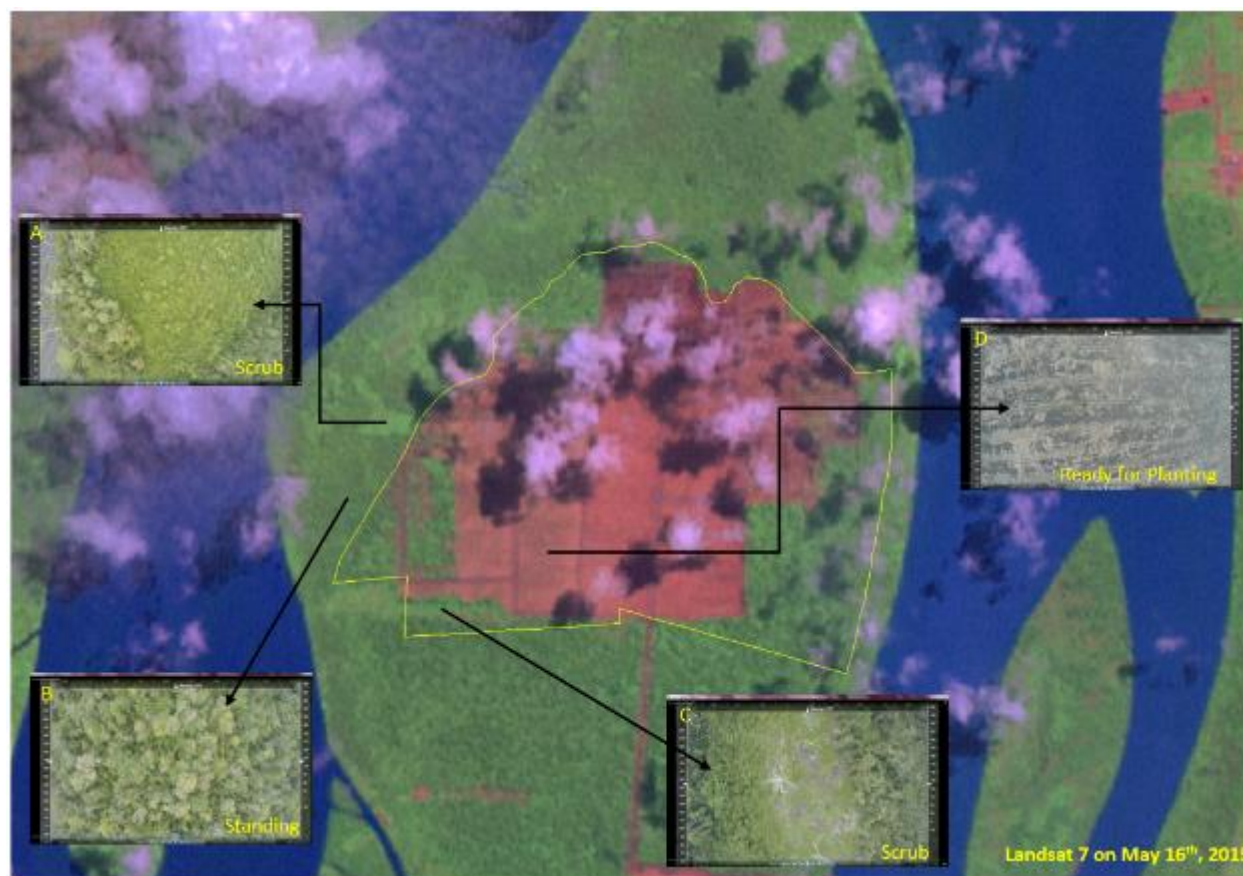**Figure 3**   AHL Block A covered by Sentinel-1 May 16, 2015.

Figure 4   AHL Block A Aerial Survey photos taken on June 26th 2015.

3.0   DATA PROCESSING

For the AHL Block A study area, image analysis is described in the following sections:

3.1   OBJECT SEGMENTATION & CLASSIFICATION

For the baseline May 16th Landsat image, Hatfield developed a ruleset in eCognition software to evaluate the areas indicated in Figure 4. The first process is object segmentation of the main data source (the Landsat image) using multiresolution segmentation algorithm (scale parameter of 25, shape of 0.1 and compactness of 0.5). Following the segmentation the classification process was completed based on the Landsat image spectral signature of each polygon compared to rules/thresholds developed by an image analyst. The target land cover classes were: standing trees, scrub, felled trees, ready for planting, extraction, and pre-bunching.

Due to the quality of June 9th 2015 Landsat image due to haze, Hatfield used simple visual interpretation analysis to classify the June 9th image. This involved an experienced image analyst reviewing the image and digitizing polygons and allocating each polygon to a land cover class based on the visual signature.

3.2　VISUAL ADJUSTMENT

A visual adjustment process was implemented as a final step to classify land cover affected by cloud and shadow in the May 16th Landsat image. This visual adjustment process employed RapidEye images taken on April 6th 2015 and July 7th 2015, and the previously described aerial survey footage as a reference to enable the image analysis to allocate a land cover class to areas below the cloud.

3.3　ACCURACY ASSESSMENT

An accuracy assessment for the May 16th Landsat image was performed by creating random points for each class and comparing the classification results at each point with the reference images (RapidEye images taken on April 6th 2015 and July 7th 2015) . The match and non-match results were summarized with a confusion matrix to the measure producer's accuracy, user's accuracy and overall accuracy.

An accuracy assessment for the June 9th 2015 image could not be conducted due to a lack of independent evaluation data.

3.4　LAND COVER CHANGE DETECTION

Change detection analysis was performed between the land cover classification maps on May 16th and June 9th 2015 using geographic information system (GIS) analysis tools.

4.0　RESULTS

4.1　BASELINE MAP

The final baseline May 16th 2015 map for AHL Block A – Sesayap is shown in Figure 5 (left). Due to the resolution of the source images (30 m pixels, 15 m when pan-sharpened), Hatfield was only able to delineate four land cover classes: "Standing", "Scrub", "Felled" and "Ready for Planting" areas, while "Extraction" and "Pre-bunching" classes could not be identified. The area of each identified land cover is shown in Table 1.

The "Felled" and "Scrub" classes are not well separated and this value is reflected in the producer's accuracy (Table 2) where Felled and Scrub classes do not exceed 80% accuracy.

4.2　LAND COVER CHANGE

The difference between the land cover on May 16th and June 6th identified approximately 39 hectares with visible land cover change where areas classified as standing in May 16th and classified as ready for planting in June 6th. An area of 128 ha classified as standing in May 16th remained standing on June 6th.

Hatfield notes uncertainty involved in using Landsat and Sentinel-1 imagery to establish a Baseline, as the class separation distance or coefficient index between each land cover class indicates poor separation was achieved for certain land cover classes. This has resulted in mixed patches of "Standing", "Felled", and "Scrub" areas in one compartment rendering analysis difficult and affecting the overall accuracy of the assessment.

Figure 5   Land Cover Change Analysis from May 16ᵗʰ to June 09ᵗʰ 2015 of AHL Block A Sesayap.
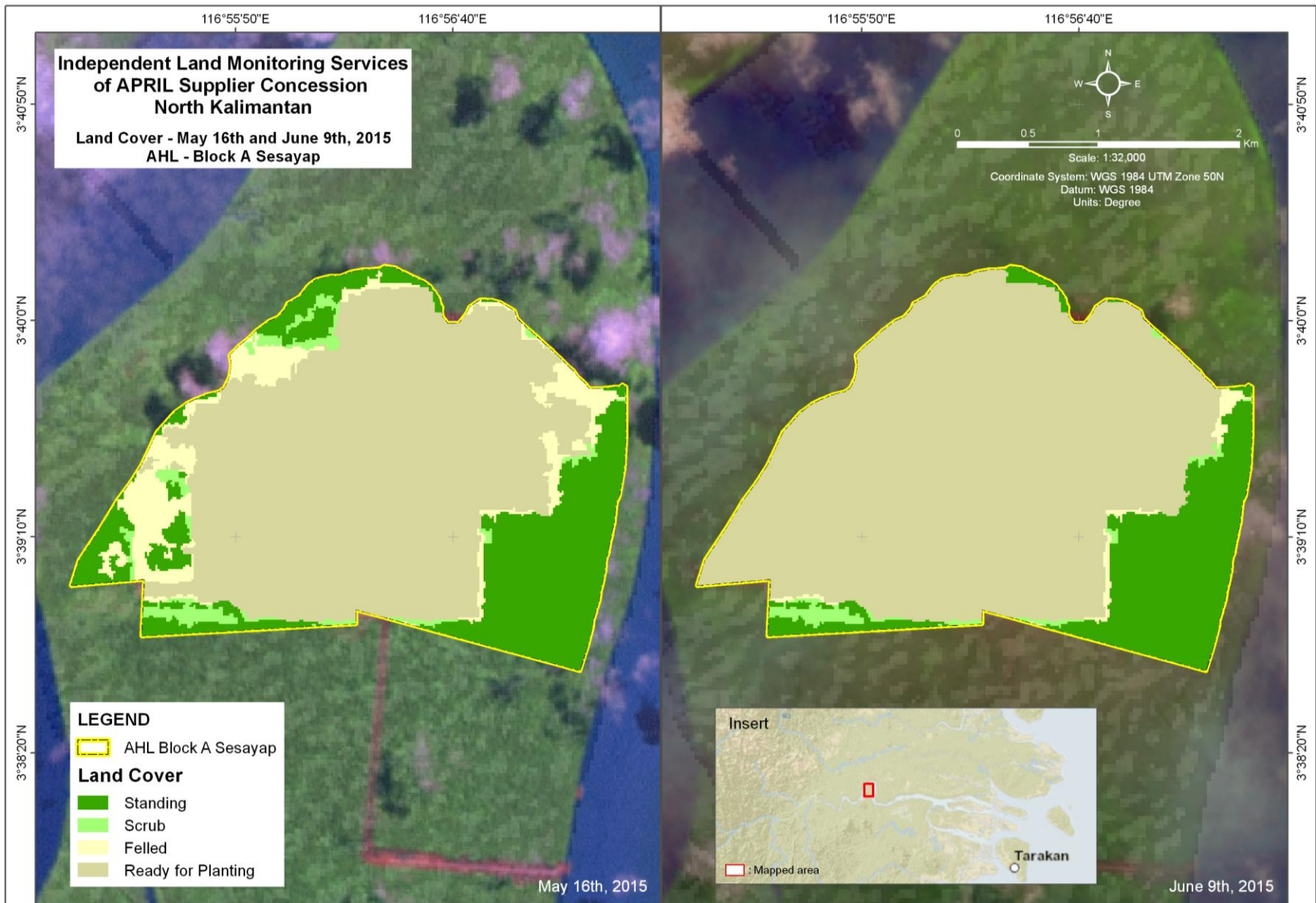
Table 1   Land Cover Change Analysis of AHL Block A.

Land cover class	Baseline in May (ha)	Status in June (ha)	Area change from May to June (ha)
Standing	167.34	128.32	-39.02
Scrub	22.49	11.55	-10.94
Felled	71.13	8.58	-62.55
Ready for Planting	484.29	596.80	112.51
Grand Total	745.24	745.24	

Table 2   Accuracy Assessment for Block A land cover classification on May 16th, 2015.

		Classification Results					
		Standing	Scrub	Felled	Ready for Planting	Grand Total	Commission Error (User accuracy)
Reference (Ground truth, Aerial)	Standing	10	2	2	-	14	71%
	Scrub	-	7	-	-	7	100%
	Felled	-	-	8	-	8	100%
	Ready for Planting	-	1	-	10	11	91%
	Grand Total	10	10	10	10	40	
	Omission Error (Producer's accuracy)	100%	70%	80%	100%		
	Overall Accuracy (Kappa coefficient)	88%					

APPENDICES

Appendix A1

Key Stakeholder Meeting Minutes

Hatfield

– *Meeting Minutes* –

Project No.:	APR7395
Topic/Subject:	Key Stakeholders meeting on RapidEye Analysis for AHL Baseline Map
Date:	July 14, 2015
Time:	09:00 – 11:30
Location:	Hatfield Bogor Office, LIPI Building 3rd Floor, Jl. Juanda 18, Bogor
Attendees:	Jemmy Chayadi (APRIL), Budi Wardhana (WWF), Nur Maliki Arifandi (WWF), Rika Sri Wahyuni (WWF), Agus Salim (Hatfield), Yunus Helmi (Hatfield)
Minutes by:	Jemmy Chayadi & Agus Salim

The meeting began (09:00 WIB) with a brief introduction by Agus Salim and introductions of all participants. Agus Salim provided update on data availability, key interpretation, showing aerial survey video date taken on 26 Jun 2015. And then it follows by showing Adindo's Arial footage (Block A – Sesayap) that taken from 15 May 2015. This was followed by round of questions from WWF, APRIL and Hatfield regarding the baseline mapping.

Key discussion points from meeting:

- Hatfield received the RapidEye imagery (the "Block A" area for Adindo – Sesayap) on Friday night of Jun 10, 2015. Unfortunately, the ones catalogued on 15 May 2015 and 31 May 2015 cannot be used for baseline analysis, as 98% of the imagery was blocked. (See figure 1)

- Although the other RapidEye imagery of 6 April 2015 (Figure 2) and 7 July 2015 (Figure 3) were usable, Hatfield cannot use them as our reference to define benchmark (threshold) for level-2 classification (ie. standing, felled, pre-bunching, extraction, scrub etc).

- Per discussion, the meeting participants have reached the agreement that the "key interpretation" for mapping and analysis should be based on the best available "usable" data (Landsat, Sentinel-1, RapidEye), which are complemented by ground truthing photo and aerial survey video (from 15 May 2015 and 25 June 2015).

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PT Hatfield Indonesia

- Therefore, the meeting participants have decided that:
  - For "Block A", Hatfield will conduct further analysis using landsat (Figure 4) and radar in May 2015 to best determine the baseline and level-2 classification; and
  - For other area, Hatfield has agreed to evaluate each block case-by-case using the best available "usable" data.

- Hatfield plans to submit its report on "Block A" this week.

Figure 1 RapidEye's catalog (http://eyefind.rapideye.com)
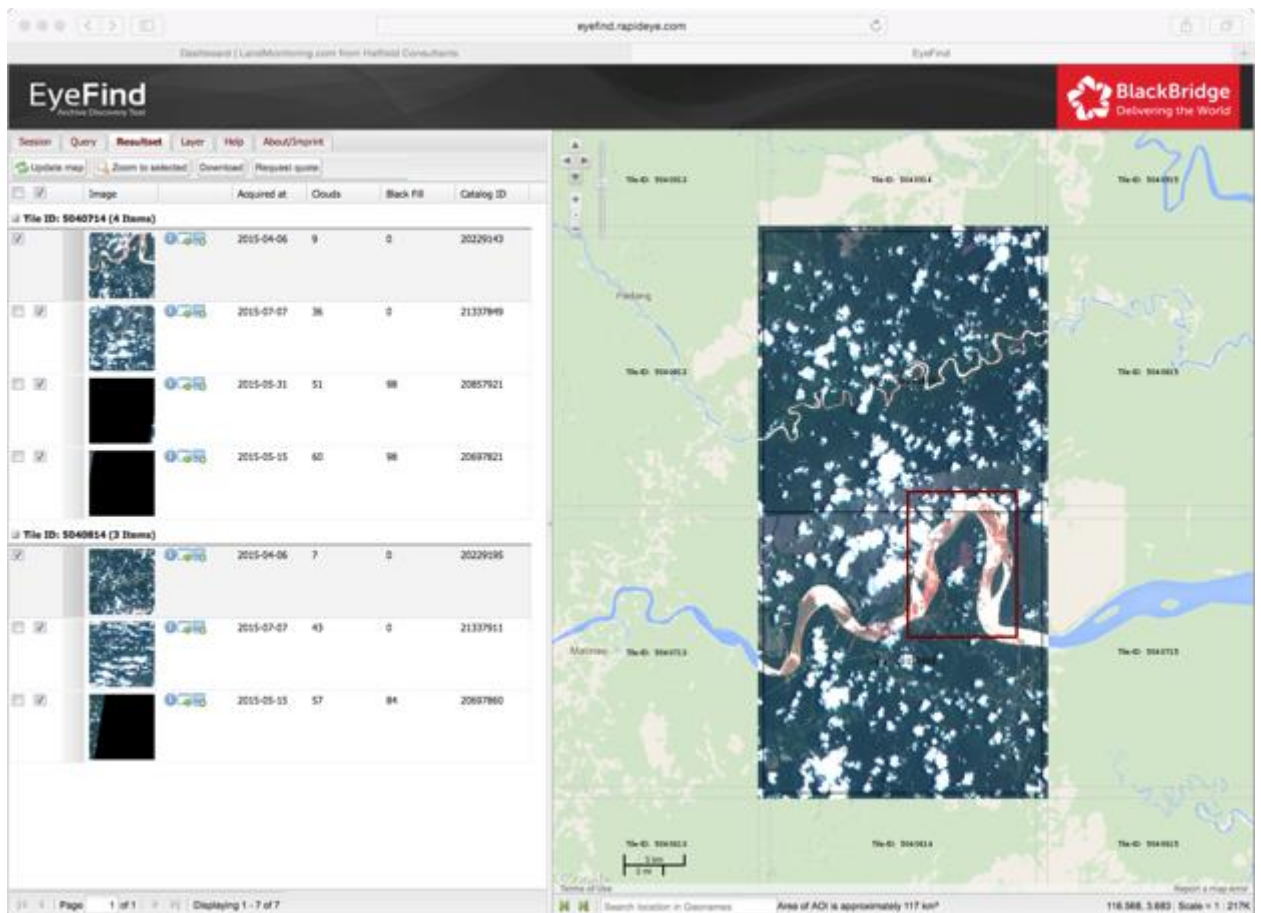
Figure 2   RapidEye Band 543 – Date acq. 06 April 2015
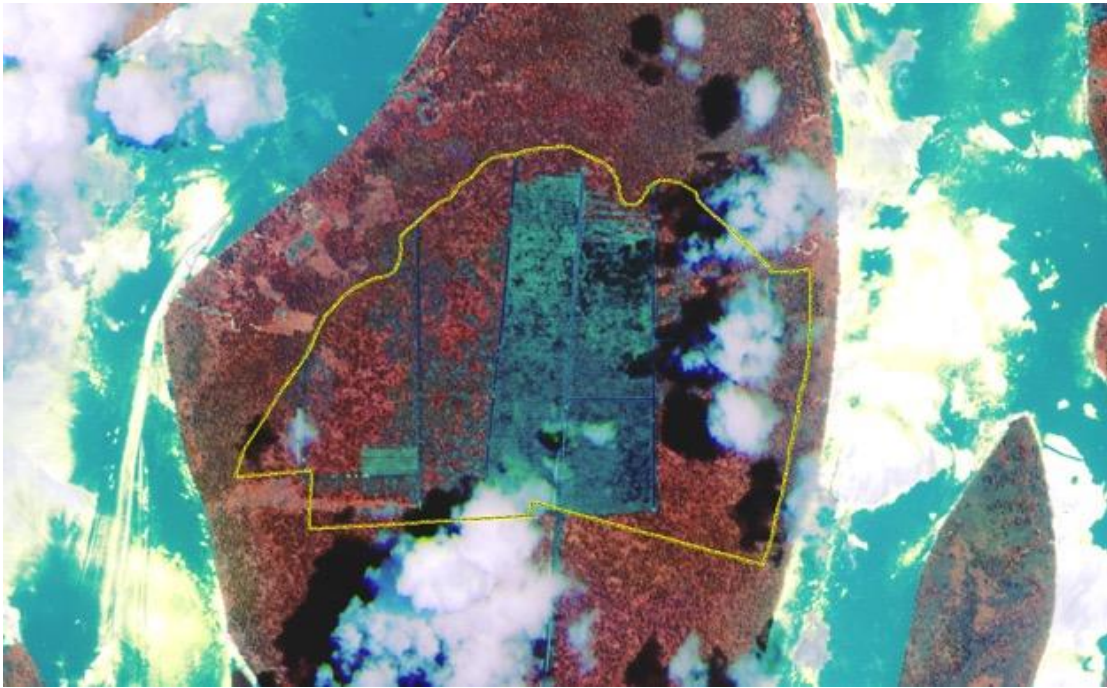

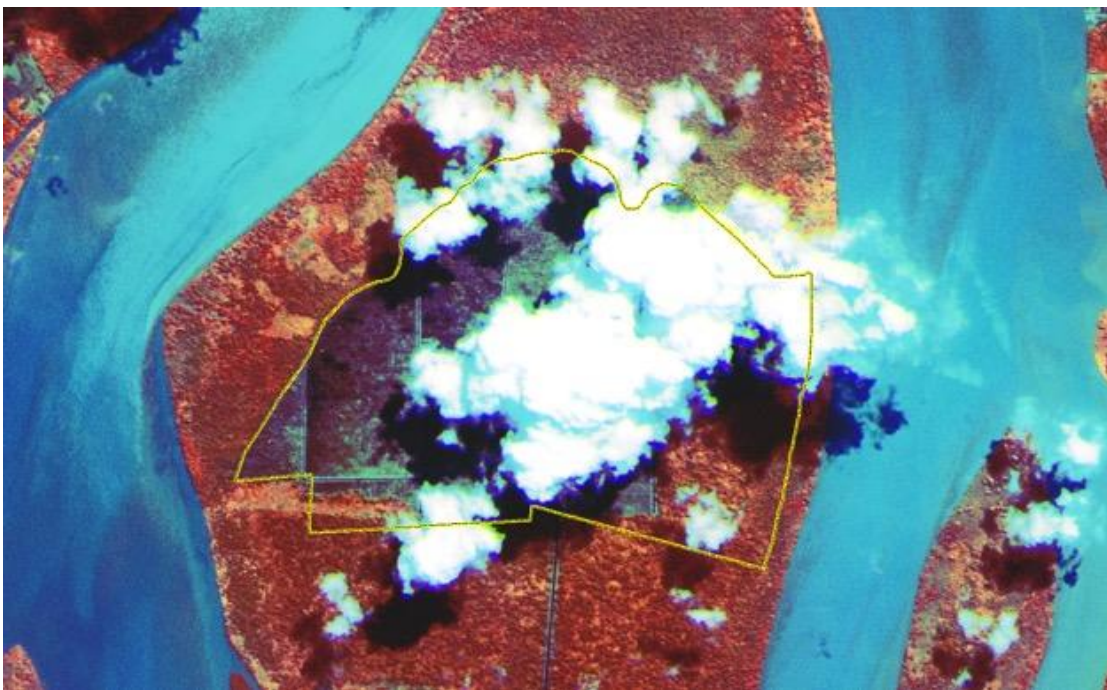Figure 3   RapidEye Band 543 – Date acq. 07 July 2015

Figure 4   Landsat ETM7 band 542 – Date acq. 16 May 2015