# Public Summary:

# High Carbon Stock Forest Assessment for PT Sumber Terang Agrolestari (STAL)

By TFT for Cargill Tropical Palm

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# Introduction

In December 2013 Cargill Tropical Palm contracted TFT to conduct a condensed High Carbon Stock (HCS) assessment of a 4,230 ha palm oil development area owned by PT Sumber Terang Agrolestari (PT STAL), in Banyuasin District, South Sumatra, Indonesia. The main objective of the assessment was to ensure that plantation development did not result in the conversion of HCS forest areas.

TFT conducted its analysis between December, 2013 and July, 2014 through a combination of desk analysis of satellite imagery as well as three field visits. This report summarizes the methodology used to undertake the HCS analysis and the main findings, as well as the further steps required to complete the analysis and create the final land use plan. The full report is available for download on Cargill's website.

# Methodology and Main Findings

The HCS process carried out by TFT in PT STAL was developed through a multi-stakeholder approach, and is being implemented with various plantation businesses in Indonesia, Papua New Guinea, and Liberia. The methodology uses satellite imagery to stratify land cover, followed by a simple forest inventory to generate above-ground biomass carbon values per land cover class and identify potential HCS areas. The results of this process are then run through a Decision Tree incorporating ecological and social values as well as operational factors to develop a definitive map of HCS areas.

### *Initial stratification of land cover using satellite images*

TFT used Geographical Information System software (ArcGis) to analyze high and moderate-resolution images captured in 2012 and 2013. Analysis of the data resulted in the identification of nine preliminary land cover classes, or strata. The table below shows the characteristics of each stratum and its area in hectares.

*Table 1: Visual stratification results*

| Stratum | Code | Description | Area (Ha) |
|---|---|---|---|
| Low Density Forest | HK1 | Appears to be remnant forest but highly disturbed and recovering (may contain plantation/mixed garden) | 36 |
| Young Regenerating Forest | BT | Mostly young re-growth forest, but with occasional patches of older forest within the stratum | 119 |
| Gelam High | GH | Areas dominated by one species (*Melaleuca* spp.) that either contain a high density of typically small diameter (<15cm Diameter at Breast Height) stems or low density of typically small diameter stems (<15cm Diameter at Breast Height) | 597 |
| Gelam Low | GL | | 434 |
| Scrub | BM | Recently cleared areas, some woody regrowth and grass-like gd. cover | 248 |
| Open Land | LT | Very recently cleared land with mostly grass or crops, few woody plants | 1,714 |
| Nipah | Nipah | Areas dominated by Nipah palm (*Nypa* spp.) typically located in areas of soft mud, where there is regular inflow of freshwater and nutritious silt | 992 |
| Oil Palm | OP | Planted areas of *Elaeis guineensis* (African oil palm) | 89 |
| **Total** | | | **4,229** |

*Field-testing of strata to assign average carbon values*

The next step in the HCS assessment is to undertake field samples in order to estimate the above-ground carbon content within the potential HCS strata identified through image analysis. Non-HCS strata including existing plantation areas (Oil Palm), cleared land, and enclave areas are therefore not assessed. Open Land and Nipah areas were also omitted as potential HCS forests after an initial field visit determined that Open Land was only covered with grasses and limited living woody material and that the vegetation in Nipah areas generally didn't meet the measurement requirement of diameter at breast height (DBH) greater than or equal to 5cm. Gelam High and Low strata an Scrub (BM) were included in sampling since the vegetation generally met the measurement requirement and samples would help to better understand the carbon content of these strata as well as to double-check the classification assigned on the bases of satellite imagery.

In all, 90 plots of 500 $m^2$ were included in the sampling, distributed according to the relative areas of the five strata of interest (HK1, BT, GH, GL, and BM). A plot design of two concentric circles was used, with all trees above 5 cm DBH measured in the inner circle, and only trees above 20 DBH measured in the outer circle. For each plot, above-ground biomass was estimated using the allometric equation developed by S. Brown (1997).[1] The estimated biomass was then converted to carbon using the IPCC conversion factor of biomass to carbon of 0.47.[2]

After analysing the Gelam High and Low plots there was no significant difference between the two strata and these were combined. The table below shows the estimated carbon values for the above-ground biomass in each stratum.

*Table 2: Final carbon estimates (tC/Ha) for PT STAL*

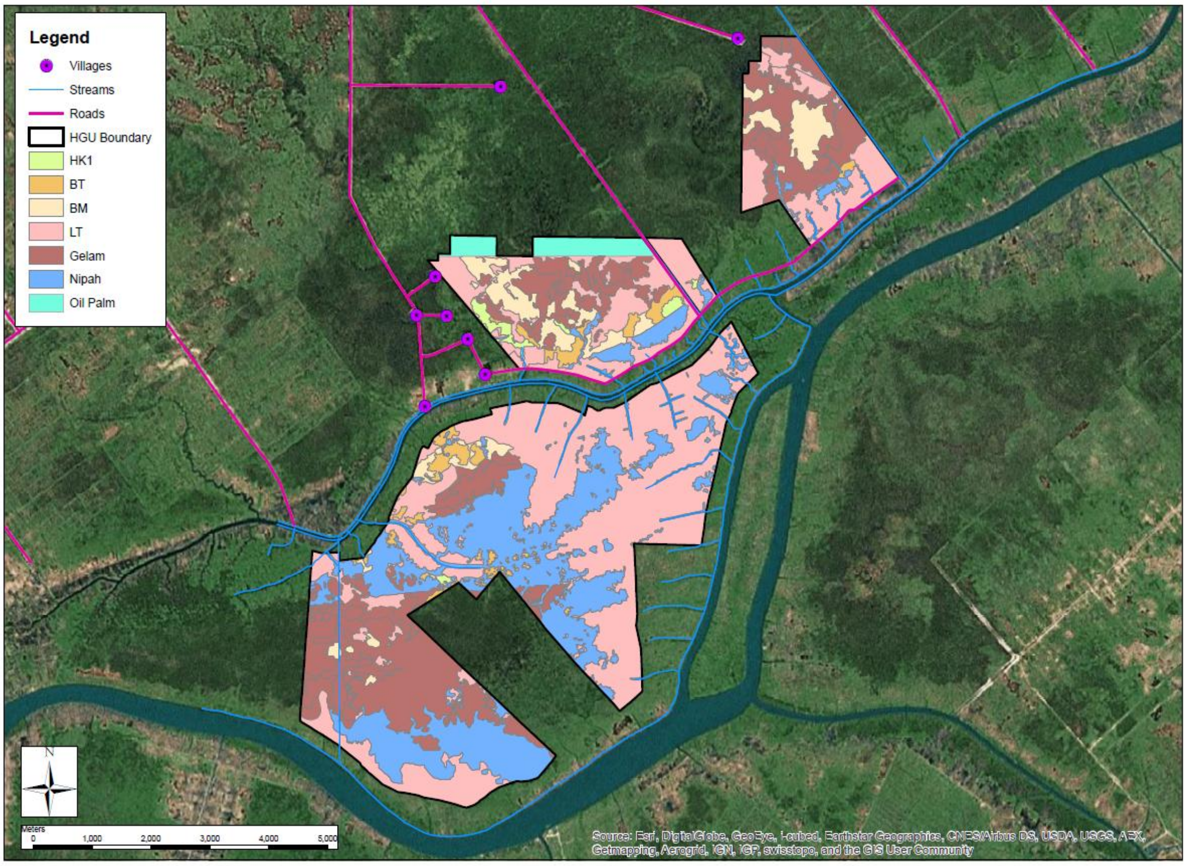
| Strata Revised | Number of Samples | Mean Carbon Stock (tC/Ha) | Standard Deviation | Standard Error | Lower Range | Upper Range | 90% Confidence Interval |
|---|---|---|---|---|---|---|---|
| HK | 15 | 77.0 | 54.8 | 14.1 | 52.1 | 102.0 | 24.9 |
| BT | 17 | 27.9 | 23.4 | 5.7 | 18.0 | 37.8 | 9.9 |
| BM | 14 | 13.3 | 8.8 | 2.3 | 9.2 | 17.5 | 4.2 |
| Gelam | 43 | 15.8 | 11.8 | 1.8 | 12.7 | 18.8 | 3.0 |

Based on the field sampling result and field observations, the Gelam strata was treated as non HCS. The average carbon value for the stratum was lower than that for Young Regenerating Forest (BT), which is regarded as the boundary between HCS and non HCS. The average carbon value estimated for the Gelam was closer to that achieved for Scrub (BM), which is not considered HCS.

The diagram below shows the distribution of land cover in PT STAL based on the stratification and field testing exercises.

[1] S. Brown (1997). "Estimating biomass and biomass change of tropical forests." FAO Forestry Paper No. 134.
[2] IPCC Guidelines for National Greenhouse Gas Inventories (2006). Available at: http://www.ipcc-nggip.iges.or.jp/public/2006gl/

### *Figure 1: Visual stratification results*

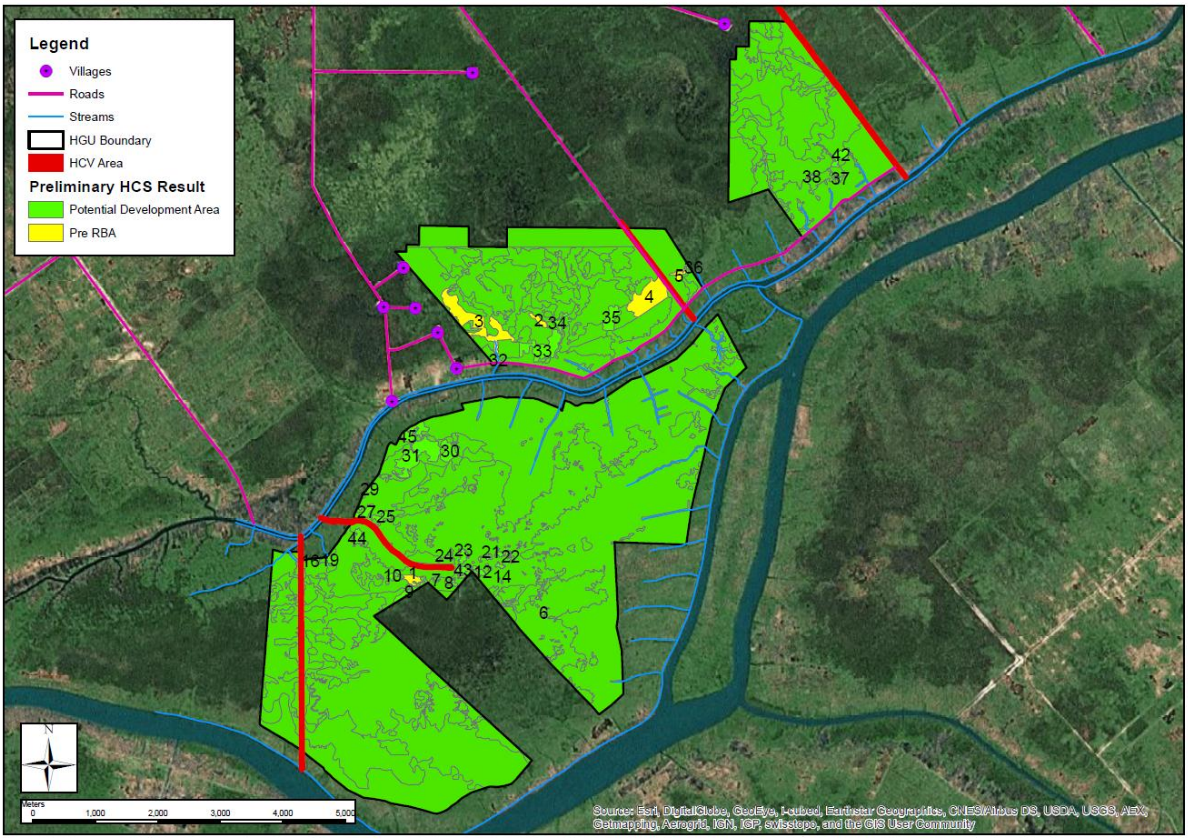



### *Decision-tree process to analyze HCS patches*

Merging connected potential HCS forest areas resulted in 45 distinct patches. The next phase of the HCS process requires analysing each patch to determine the most viable ways to maximize HCS forest protection and restore ecologically viable areas of forest. This involves assessing the shape, size, connectivity, habitat quality and threats to ensure that it is possible for the conserved HCS areas to continue or revert to their natural ecological function as a forest. Each patch is run through a 'Decision Tree' which takes these factors into account.

The patches are shown in the indicative HCS map below.

## Figure 2: Potential HCS patches in PT STAL




Of the 45 patches, 39 were too small, lacked a core area and were not connected to High Priority patches or High Conservation Value areas to warrant their conservation. The six remaining patches require further field visits to determine their biodiversity value or importance to communities in order to assess if they need protection.

# Recommendations and next steps

Overall, the assessment determined that little HCS exists within the proposed development area of PT STAL, as the area is dominated by Open Land and Nipah. Only small patches of Young Regenerating Forest (BT) and Low Density Forest (HK1) were identified as High Carbon Stock. Of those patches, six require further field visits in order to assess if they need to be conserved. Once a final determination has been made, the HCS areas need to be integrated with peatlands, High Conservation Value areas, and areas used by or important to local communities into a final conservation and land use plan for PT STAL.

Our main recommendation concerns community mapping and social impact assessment at PT STAL. The scope of TFT's work included only assessments of carbon stock and land use cover; however, during field visits TFT found that communities were actively cultivating food in areas of PT STAL, and if these areas are developed by PT STAL it remains unclear where these communities will continue to produce food for their livelihood. It is important that PT STAL work with communities to document these areas to reduce the likelihood of conflict in the future. To complete the current HCS assessment process for PT STAL, communities must be engaged and their inputs and feedback into the development/conservation proposal be included. This may increase the area needed for conservation and/or eliminate the need to conserve the patches identified for potential conservation.

TFT's other main recommendations to Cargill Tropical Palm include:

1. Sourcing high resolution satellite data, such as the World View image used for the PT STAL assessment. Such high resolution image data greatly helps to identify the land cover strata and aids the HCS assessment process.

2. Continue to complete HCS assessments using the methodology deployed in PT STAL for other areas targeted for expansion.

3. Engaging local communities early in future HCS assessment processes and appropriately capture information on landuse needs.