# Biodiversity Observation and Carbon Sequestration Monitoring

## in the Logged Over Area of PT. Ratah Timber Co, Kutai Barat, East kalimantan Province

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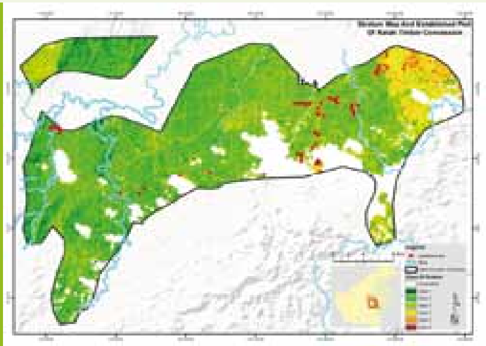
## A. Background

Biodiversity safeguarding is increasingly required in any land management projects. It is not an exception for timber production in natural forests. In order to comply with the current international requirement, forest managers need to safeguard biodiversity at their concession; safeguard measures need to be incorporated into their longterm management plan.

Map of Kutai Barat overlaid with concession map



Biodiversity safeguarding is also needed in REDD+ (Reducing Emissions from Deforestation and Forest Degradation+). REDD+ is an effort to reduce emissions from deforestation and forest degradation, conservation of forest carbon stocks, sustainable management of forests, and enhancement of forest carbon stocks (UNFCCC 2010). Each REDD+ operating nation or state will have to safeguard biological diversity. Perverse effects of global warming is one of the major concerns because carbon stock can be enhanced in exchange with biodiversity. For instance, enhancement of carbon through plantation is allowed in REDD+. Plantation of exotic fast growing species can be more cost-effective in sequestering carbon than allowing the re-growth of degraded native forests. However, if such plantations were replaced degraded native forests, biodiversity may be lost in exchange with carbon.

As the negotiating text of REDD+ stipulates, REDD+ must be consistent with the conservation of natural forests and thus policies/systems to safeguard natural forests must be developed and implemented. There are the reasons why WWF Indonesia encourage timber industrial concession to consider biodiversity in their forest management. In this case, Ratah Timber is our pilot project to assess biodiversity safeguard implementation in the logging concession.

## B. Objective

This pilot project is aimed to characterize and monitor the biodiversity of tropical rain forests within the timber concession in Kutai Barat, East Kalimantan, Indonesia. The ultimate purpose of the biodiversity characterization and monitoring is to provide the management entity with ways and means to achieve the synergy of timber production, biodiversity conservation and carbon sequestration in its timber concession.

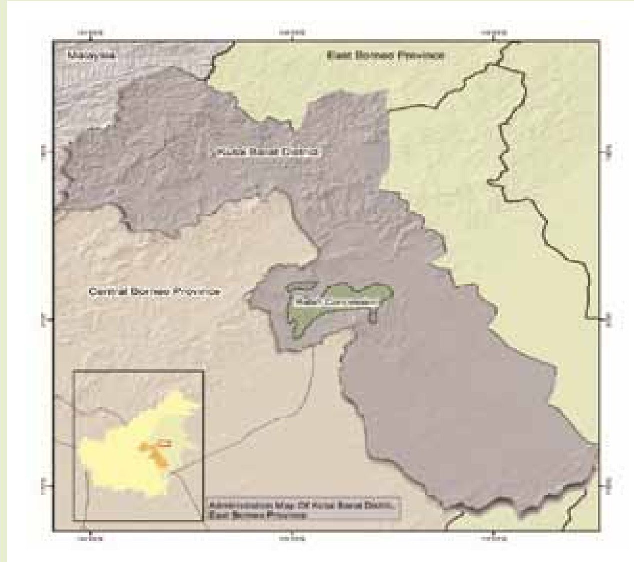
Moreover, preparatory activities for REDD+ are being conducted in the Kutai Barat area. Thus this project will help timber industrial concession to achieve the sustainable forestry complying with the global certification principles and also the contribution to the REDD+ activities by conducting biodiversity observation.

## C. Methods

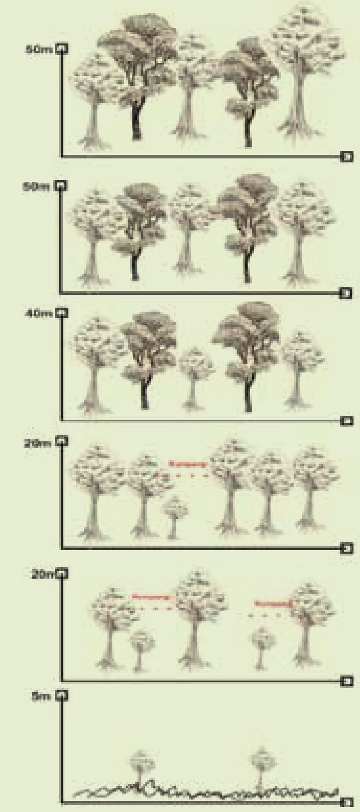
Community composition of canopy trees is a surrogate of "ecosystem integrity" or "ecosystem health" and indirectly indicates the overall ecosystem intactness, regeneration, resilience, the quality of ecosystem services, and etc. It can be also a surrogate of the biodiversity of insects, mammals, fungi and other biological groups. Community composition of canopy trees is enumerated by inventorying large trees in a plot laid out on the ground. Abundance of a species can be determined based on the density of stems, basal area, stem volume or other quantitative metrics. Community composition of canopy trees is a surrogate of "ecosystem integrity" or "ecosystem health" and indirectly indicates the overall ecosystem intactness, regeneration, resilience, the quality of ecosystem services, and etc. It can be also a surrogate of the biodiversity of insects, mammals, fungi and other biological groups. Community composition of canopy trees is enumerated by inventorying large trees in a plot laid out on the ground.

Placing a large number of count-plots is costly. Therefore this research Incorporates a stratification process in the inventory to reduce the number of count-plots and the overall cost.

Stratification is a process to classify the vegetation of the concession into several classes based on the condition of the vegetation (see Figure 1-stratum criterion). Researchers classify the concession into 6 stratum classes and prepare a stratification map based on the vegetation categorization by using satellite data. An appropriate number of count-plots need to be laid out in each stratum class. Based on our past experiences, ten plots per stratum will be adequate. Total number of count-plots will be 60 (10 count-plots in each stratum class * 6 stratum classes). Conservation area of highest intactness in the concession must be included in the inventory. Before these count plots determined, researchers generate many random points in each stratum class as potential localities of count-plots. Each random point is indicated with its precise longitude and latitude. In each of the ten plots selected for each stratum, we measured diameter at breast height (dbh) of trees ≥10cm dbh and identified species. Chave's allometric equation was applied to dbh data and above-ground biomass was estimated for each plot.



Random points and forest Stratum



Stratum 1:
- 2-3 high rise trees >50 m
- 4-5 trees with more than 60 cm diameter
- Dipterocarp species dominant

Stratum 2:
- No high rise trees
- 4-5 trees with more than 60 cm diameter
- Dipterocarp species dominant

Stratum 3:
- No dipterocarp species found
- Less pioneer trees

Stratum 4:
- No dipterocarp species found
- Grown with a lot of pioneer trees
- A lot of small tree branches

Stratum 5:
- No pioneer trees found
- A lot of small tree branches

Stratum 6:
- No trees with more than 10 cm diameter

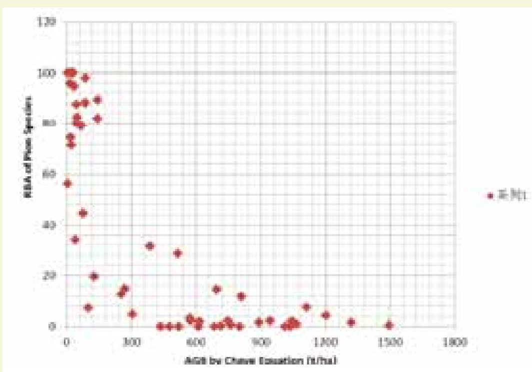
## D. Results

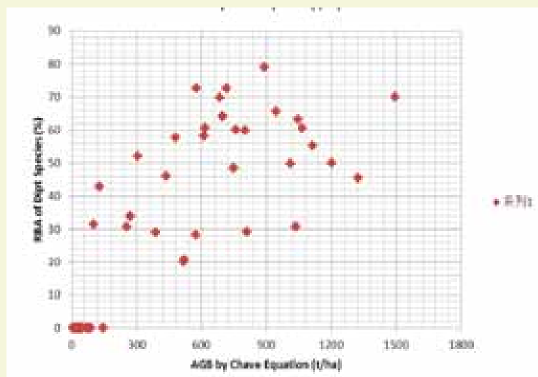
Pioneer species dominate highly-degraded stands in Ratah (such as Macaranga, Octomeles, Neolamarckia, Neuclea, Trema, and Duabanga). The relative abundance of such pioneer species increased with decreasing AGB (increasing logging intensity) (Fig. x; AGB and RBA of pioneer here).

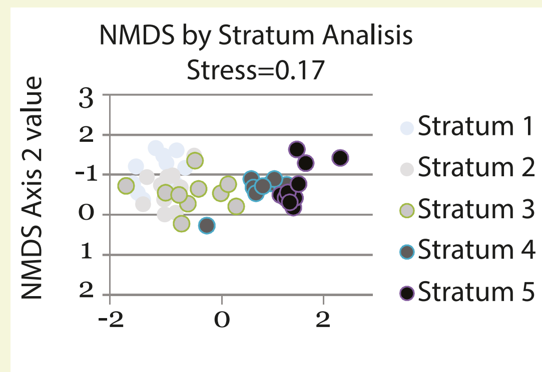
On the other hand, the relative abundance of Dipterocarpaceae , which includes late-successional species, decreased with decreasing AGB (increasing logging intensity) (Fig. x; AGB and RBA of dipterocarp here).

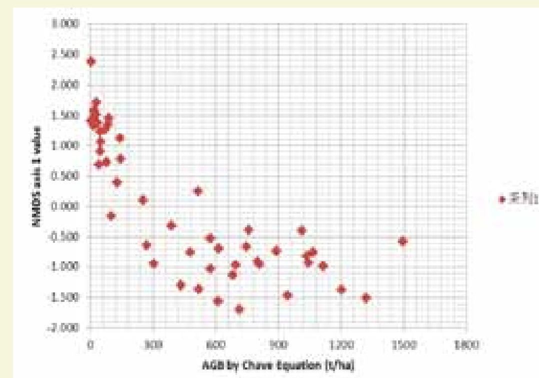
An NMDS multivariate analysis applied to our dataset demonstrated that ten plots within a given stratum formed a relatively cohesive cluster (Fig. x; NMDS here). This indicates that those plots included at the same stratum resemble with each other in species composition. This also indicates that our stratified random sampling is adequate to sample representative stands in each stratum.

When NMDS axis 1 values are plotted against AGB values, there is a linear relationship (Fig. x; AGB and NMDS axis 1). It is suggested that this linear relationship is a result of the interplays of the increasing pioneer species and the decreasing dipterocarp species with increasing logging intensity. NMDS axis 1 values can, thus, indicate species composition as a function of logging intensity.







The same results have been obtained in logging concessions of Sabah, the neighboring Malaysia state (Imai et al. unpublished). Therefore, this procedure can be applied to dipterocarp rain forests in East Kalimantan and probably elsewhere to evaluate the species composition in relation to logging intensity.

## E. Conclusion

The procedure described on this report can be repeated at the end of a land-use project (e.g. REDD+) in the same plots and elucidate any changes during the monitoring period. If species compositon is maintained over time, adequacy of management will be verified. This is a sensitive method to detect changes in biodiversity in relation to logging. This is also a cost effective-method to evaluate ecosystem health and management adequacy. We suggest that this method should be duplicated in other concessions as a standard method to safeguard biodiveristy in land management projects.

## F. Credit

1. WWF Indonesia
2. Kyoto University
3. Ratah Timber Company

WWF

PT.RATAH TIMBER