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**Monitoring forest changes 2014–2017 in Trusan Sugut Sustainable Forest Management Project Area**

by

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Monitoring of forest changes in Trusan Sugut Sustainable Forest Management Area was initiated on the 22<sup>th</sup> September 2014 with the establishment of 10 (0.13 ha) permanent sample plots. A first re-census activities were conducted from 14<sup>th</sup> till 16<sup>th</sup> November 2017, to evaluate forest change after 3 years of monitoring period. All labelled-trees  $\geq 10$  cm diameter at breast height (dbh) recorded previously were re-measured and their species identity were re-confirmed. Newly recruit of trees  $\geq 10$  cm dbh were labelled, re-measured tree dbh and identify to species level.

Plot similarities in relation to species composition were investigated and found that all 10 permanent sample plots (PSPs) are clustered according to the soil association and forest ecosystems. Both PSP 8 and PSP 9 represent disturbed lowland seasonal freshwater swamp forest (LSFWSF) that occur on Kinabatangan soil association. PSP 3, PSP 4 and PSP 5 were established in disturbed lowland mixed dipterocarp forest (LMDF) on Tanjung Aru soil association. The remaining PSPs were set up on Maliau soil association to represent the lowland mixed dipterocarp kerangas forest (LMDKF).

Overall tree recruitment is estimated to be 3 times more than mortality. All sample plots had significantly greater numbers of recruits than deaths over the interval 2014–2017, except for one plot. The LSFWSF ecosystem, poor drainage site, demonstrated the highest turnover rate in comparison with the other well drained ecosystems. Both LMDF and LMDKF ecosystems have similar turnover rates. Throughout the ecosystems observed, about 70 % of all tree death were represented by the lowest diameter size class (10.0 to 19.9 cm). In species compositional changes, the number of species recruited in LMDF and LMDKF were twice more, and three times more in LSFWSF in comparison with number of species recorded as dead in 2017. This demonstrated that diverse tree species that varies between successional group of trees from mixed climax and pioneer species, and also mixed structural canopy, such as main canopy, middle storey and understorey species were recruited in all forest ecosystem throughout the three-year period.

On average, all trees  $\geq 10$  cm dbh for all plots have demonstrated positive growth over the interval 2014–2017. The LSFWSF ecosystem demonstrated the highest tree growth rates and followed by LMDF and LMDKF in decreasing trend.

An overall average of 15 % increase of above ground biomass (AGB) was estimated over the interval 2014 and 2017. Overall average of AGB recorded were estimated about 288 Mg/ha and 332 Mg/ha in 2014 and 2017, respectively. As of 2017 census, the trees in LMDF recorded the highest AGB with an estimation of 587 Mg/ha. LMDKF and LSFWSF are estimated to be 30 % and 40 % lower than those recorded in LMDF, respectively.

The findings of high recruitment over mortality rate, positive tree growth and incremental trend of above ground biomass may indicate that the advance growth forests in the project area are on recuperating stages, hence demonstrating that the forests are on successional trajectory towards diverse composition and structural forests. However, data on above ground biomass, tree growth, mortality and recruitment rates have been obtained from two censuses at 3 years' interval only. Therefore, interpretation of the results should be approached with caution, and further assessments are needed to validate this monitoring observation. Furthermore, the present PSPs were established on advance growth forest condition and none on secondary forest. Therefore, additional PSPs are required to be established on secondary forest as reference to successional recovery of the forests. Periodically, all plots should be monitored for maintenance activities, and ideally for protection of the forest, a stand-based mapping of vegetation types using remote sensing and GIS should be made available to examine spatio-temporal changes in forest quality and conditions of this conservation area.