学 位 論 文 審 査 の 要 旨

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学 位 論 文 題 名

Differentiation in architecture and demographic properties across forest types and species in tropical lowland Kalimantan.
（熱帯低地カリマンタンにおける森林型間および樹種間の
樹冠構造と個体群動態特性の分化）

Lowland forests in Kalimantan are the most extreme on earth in terms of huge biomass and tree species diversity, and where three forest types are recognized in relation to soil conditions: i.e., heath forest, peat swamp forest, and mixed dipterocarp forests. These forests are unique in terms of physiognomy, canopy architecture, and the composition of tree species. Heath and peat swamp forests occurring on flat topography are on nutrient-poor, acidic soils, whereas, mixed dipterocarap forest on hilly topography occurs on relatively nutrient-rich alluvial loam soil. These forests are experiencing progressive conversion to palm oil and rubber plantations, and it is essential to evaluate these endangered ecosystems for management planning. This thesis examined architectural, and functional traits of tree saplings that contribute to regeneration, and demographic properties of tree populations and their consequences in tree size structure across three forest types in lowland Kalimantan.

Saplings (150-310 cm tall) of species that represent each forest type were selected under the canopy of developed forest stands. Among these, there was one species found in all forest types and two species in heath and peat swamp forests.

Significant differences in crown allometries were found among forest types and species. Saplings in mixed dipterocarp forest had thicker stem and wider crown at the same sapling height compared to other forests. They had higher specific leaf area, higher mass-based leaf nitrogen content and lower wood density. Heath forest saplings showed the lowest leaf nitrogen content and the highest wood density. Species with cross-forest-type distribution showed plastic change in sapling traits, which was similar to inter-specific difference among forest types. Results suggested that saplings show morphological responses to nutritional and water conditions of forest types.

To characterize the dynamics of peat swamp forest, five forest plots of 50 m x 50 m of selective-logged peat swamp forest in Sebangau basin in Central Kalimantan were monitored over 12 years. Based on the estimated growth, mortality, and recruitment rates, observed tree size distribution was compared with demographically projected stable size distributions at the levels of plots and species. The deviation between observed and projected size distribution suggested that the forest is still on recovery process. Large-statured species tended to have low size growth rate, low mortality and recruitment rate, whereas short species showed the opposite demographic properties.

Demographic projection of stable tree size distribution was carried out for three forest types, based on the censuses of five 1-ha plots in West and Central Kalimantan. Tree-size dependent growth rate and mortality varied across forest types. Heath forest with dense understory of small trees showed high growth rate and low mortality for small sized trees, and also high recruitment rate. By contrast, high growth rate and low mortality for large sized trees, and low recruitment rate characterized mixed dipterocarp forest with tall and dense canopy layer. The peat swamp forest showed intermediate demographic properties that fell between the other two. High vigor and productivity of understory trees in heath forest on poor soil were likely due to high light availability underneath relatively thin canopy layer.

This thesis quantified the differentiation in architectural and demographic properties across forest types in lowland Kalimantan, and which helps prediction of forest dynamics for better conservation and management.

The examination committee recognized that the present thesis provides new ecological information for better management of lowland rain forests in Kalimamtam. The committee evaluated enthusiasm of the applicant in intensive field work, and for collaboration with many students and researchers during the course of graduate school, thereby concluded that the applicant is eligible for the degree of Doctor of Philosophy (Environmental Science).