

**Stand development and regeneration dynamics in the subtropical forests,  
Okinawa Island, southern Japan**

by

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**Abstract.** The present study investigated stand structure and growth dynamics based on comparing plots of different stand ages in a subtropical forest, Okinawa Island, southern Japan. The stand development showed that leaf mass reached its upper limit during 20 to >70 years from initiation, and above ground biomass continued to increase. Competitive effects and growth patterns were different among developmental phases or sites. In the early developmental stands, *Castanopsis sieboldii* showed asymptotic growth curves with upper limits of *DBH* growth, caused by inter- and intra-specific competition. In the early developmental stage, the cohort of *C. sieboldii*, which regenerated just after logging, is regulated by one-sided competition for light. Thus, asymptotic growth of *C. sieboldii* is caused by suppression from neighborhood competition. In the middle or late developmental stages, however, interspecific competition prevails, suggesting that regeneration of *C. sieboldii*, especially for the understory cohorts, is regulated by suppression from *other species*. The growth pattern of *C. sieboldii* in the oldest stand is quite different from the younger stands, showing a weak size-dependent growth with a peak at 10 cm *DBH* class in the subcanopy layer. This seems to follow a trend toward a steady state with gap dynamics. In the late developmental stage, the population dynamics of *C. sieboldii* may be driven by both suppression of subcanopy trees by canopy trees and regrowth of understory trees due to disturbance and gap formation.

In conclusion, the dominant species, *Castanopsis sieboldii* showed different growth patterns with stand development. Competitive effects between secondary and mature stands fluctuated, depending on the degree of heterogeneity of stand structure. The depression of species diversity in the middle developmental stage seems to be related to the dominance or thinning mechanisms of *C. sieboldii* throughout stand development, which is likely to interact with structural diversity of the subtropical forest in Yanbaru. However, the mode of competition between *C. sieboldii* and *other species* may not be determined monotonically by stand development. These results suggest that structural attributes of the subtropical forest vary with site condition. Variation in the mode and intensity of competition may reflect a heterogeneity of nutrient/water availability due to topography or land-use history. Thus it is difficult to detect successional convergence across sites. In order to understand the dynamics of the subtropical forest more completely, we need to investigate the functional relationship between site condition and competitive effects among trees, which brings about various patterns and processes at the stand level.

**Keywords:** *Castanopsis sieboldii*; Species diversity; Tree population dynamics; Competition; Growth dynamics; Mortality.