Ecology of Kapur (*Dryobalanops*)

- A synthesis of findings from a 15-year population study at Lambir -

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Kapur or the genus *Dryobalanops* (Dipterocarpaceae) consists of seven species, which sometimes dominate the canopy of Bornean tropical rain forests. Kapur is also important for forest plantation in Malaysia. Knowledge of ecology of Kapur therefore provides useful information not only for purely ecological questions but also for plantation and restoration of tropical rain forests. In this presentation, we will summarize the results of a series of studies on population dynamics of two Kapur species, *D. aromatica* and *D. lanceolata*, at Lambir Hills National Park in Sarawak. The following are our major findings over the last 15 years.

Seed production: Both species produced seeds relatively often in Dipterocarpacea, which show general flowering phenomena in reproduction. For *D. aromatica*, individual variation in fruiting was related to topography within a population in a mast year. Individuals on sandy ridges were more likely to produce fruits than those on clay rich valleys if their sizes are similar.

Seed dispersal: Their fruit are dispersed by wind, but the dispersal distance was limited (mostly < 30 m). The dispersal of fruits was fitted well to a Weibul distribution model, by which we could estimate density of dispersed seeds at any sites within a 52-ha study plot.

Seedling establishment: Establishment of seedlings from dispersed seeds was affected by topography and canopy gaps. A field experiment showed that establishment rate was lower in valleys than on ridges, and lower under closed canopy than in canopy gaps for both species. Under closed canopy of sandy ridges, only 1.7% of seeds could establish to seedlings in *D. lanceolata,* while quite a few seeds established in *D. aromatica*. No density and distance effects were found in seed mortality for both species.

Seedling survival and growth: Established seedlings of both species were shade tolerant; 10%-20% of seedlings survived > 10 years under closed canopy. Seedlings survived slightly better in gaps; 10-year survival rates were 20%-30%. However, seedlings under closed canopy grew little: mean height growth during 10 years was 20-40 cm under closed canopy. In contrast, seedlings grew well in canopy gaps; mean height growth was 100-150 cm in 10 years. Seedling survival was suggested to be affected by topography, distance to mother tree and seedling density as well as canopy gaps.

Dynamics of larger trees (dbh > 1 cm): Population dynamics and growth for trees > 1 cm dbh has been monitored in a 52-ha plot from 1992. Mortality was significantly affected by tree size (dbh) for both species and by topography for *D. aromatica*, which had higher mortality on valleys. El Nino drought in 1998 elevated mortality of both species. El Nino effect was especially large in trees of *D. aromatica* standing on sandy ridges. Diameter growth was also affected by topography; trees in valleys grew better for both species. During the last 10 years, the population of *D. aromatica* and *D. lanceolata* increased 43.7% and 12.3%, respectively, in the 52-ha plot, while trees of all species increased only 7.3%.

In our presentation, we will make a model for population dynamics of Kapur based on these results. We will simulate their population dynamics and discuss their characteristics.