

## **The value of biodiversity for the functioning of tropical forests: insurance effects during the first decade of the Sabah biodiversity experiment**

### **ABSTRACT**

One of the main environmental threats in the tropics is selective logging, which has degraded large areas of forest. In southeast Asia, enrichment planting with seedlings of the dominant group of dipterocarp tree species aims to accelerate restoration of forest structure and functioning. The role of tree diversity in forest restoration is still unclear, but the 'insurance hypothesis' predicts that in temporally and spatially varying environments planting mixtures may stabilize functioning owing to differences in species traits and ecologies. To test for potential insurance effects, we analyse the patterns of seedling mortality and growth in monoculture and mixture plots over the first decade of the Sabah biodiversity experiment. Our results reveal the species differences required for potential insurance effects including a trade-off in which species with denser wood have lower growth rates but higher survival. This trade-off was consistent over time during the first decade, but growth and mortality varied spatially across our 500 ha experiment with species responding to changing conditions in different ways. Overall, average survival rates were extreme in monocultures than mixtures consistent with a potential insurance effect in which monocultures of poorly surviving species risk recruitment failure, whereas monocultures of species with high survival have rates of selfthinning that are potentially wasteful when seedling stocks are limited. Longer-term monitoring as species interactions strengthen will be needed to more comprehensively test to what degree mixtures of species spread risk and use limited seedling stocks more efficiently to increase diversity and restore ecosystem structure and functioning.