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**RESTORATION OF PLANT DIVERSITY
IN A MONOCULTURE *PINUS* PLANTATION
IN LOWER HANTANA, SRI LANKA**

A THESIS PRESENTED

BY

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RESTORATION OF PLANT DIVERSITY IN A MONOCULTURE *PINUS* PLANTATION IN LOWER HANTANA, SRI LANKA

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Abstract

Over 18,000 ha of *Pinus caribaea* plantations established in degraded wet lowland and lower montane areas in close proximity to traditional villages in Sri Lanka are poorly managed and subjected to frequent fires, set by local people who do not see much value in them for their subsistence. These plantations thus remain under-productive and under-utilized, particularly due to the paucity of plant and economic diversity for rural development. Therefore, more imaginative, community-friendly and low-cost management interventions are required to restore plant and economic diversity in these biodiversity-poor monoculture plantations.

This investigation mainly evaluates the growth performance of four broad leaved species introduced to a *Pinus* enrichment trial. Conducted in the *Pinus* stand in Hantana, in the University of Peradeniya the existing overstorey and understorey vegetation in the site was documented before initiation of the trial. In addition, the above ground biomass of *Pinus caribaea* trees felled for creating light gaps was determined to evaluate the total biomass and productivity of these pines.

The enrichment trial in the *Pinus* plantation in Hantana was initiated in 2002. There are two treatments (partial shade: three pine rows removed; full shade: *Pinus* understorey) and a control (full sun: open grassland area). The growth performances of the study species *Artocarpus nobilis* Thw. (Bedi del), *Madhuca longifolia* (L.) Macbride (Mee), *Michelia champaca* L. (Gini sapu) and *Terminalia bellirica* (Geartn.) Roxb. (Bulu) introduced to the enrichment trial were evaluated; the soil physico-chemical properties and light variations of treatments and control were also examined. At the study site, over 90% of the existing overstorey vegetation was *P. caribaea* trees, while 50-85% of the understorey cover was

Panicum maximum Jacq., both fire tolerant species. The above ground biomass of the 25-yr-old *P. caribaea* was 194 t/ha.

The total Daily Photosynthetic Photon Flux (DPPF) differed significantly among the treatments and control. The highest was in the full light control ($27 \text{ mol m}^{-2} \text{ day}^{-1}$). In the canopy removal treatment it was $13 \text{ mol m}^{-2} \text{ day}^{-1}$ while that in the *Pinus* understorey was $5 \text{ mol m}^{-2} \text{ day}^{-1}$. The soil physico-chemical properties were richer under the grassland (full light), and the values in the canopy removal treatment were better than those under the *Pinus* understorey.

The root collar diameter and plant height performances of the four broad-leaved species, 28 months after initial planting, varied significantly among the two treatments and control. The root collar diameter and plant height after 28 months were significantly higher in the full light compared to that in the full shade for *Terminalia bellirica* and *Madhuca longifolia*. In *Michelia champaca*, the root collar diameter and height were greatest in partial shade and least in full shade and in between in full light. This study demonstrates the better performance of broad-leaved species in the canopy removal treatment than in the *Pinus* understorey treatment in *P. caribaea* stands in lower Hantana. More specifically, *Michelia champaca* is well adapted to grow under the three pine row removed treatment. *Madhuca longifolia* and *Terminalia bellirica* showed better performance in full light. *Artocarpus nobilis* showed better performance similarly in partial shade and also in full light.

The results of this study could be applied to the cultivation of these study species in Sri Lanka's Central Province. As the four study species provide food to different herbivores, the biodiversity in enriched pine plantations would be much higher than in the non-enriched monoculture stands. Further, as the planted species are of utility value to local communities, anthropogenic fires leading to environmental degradation would also be considerably reduced.