

Soil seed bank dynamics of selected wet and dry forests in Southern Sri Lanka

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Abstract

*Studies on natural regeneration dynamics of soil seed banks are important in determining the regeneration potential of natural forests. This study was carried out to study the regeneration potential and floristic composition of two natural forests in wet and dry zones of Sri Lanka. Two natural forests in Wilpita (low country wet zone) and Hambantota (low country dry zone) were selected for the study. Sampling was carried out in the top 10cm of the soil using a quadrant (30cm×30cm×10cm) along the transects and the number of seedlings emerged enumerated. The seedlings were transferred into poly bags once a week and allowed to grow for a few months to determine the floristic composition. The means of viable seeds in the Wilpita and Hambantota forests were 162 m² and 146 m², respectively. The number seedlings per square meter among the samples collected along the transect was not significantly different ($P>0.05$). The floristic composition and biological diversity of soil seed banks varied among the forest types. The population density was higher in the wet zone forest compared to the dry zone forest. *Alstonia macrophylla* (hawari nuga), *Macaranga peltata* (kenda), *Trema orientalis* (gedumba) and *Melastoma malabathricum* (bovitiya) were prominent tree species in the Wilpita forest. Moreover, affinity analysis showed that *A. macrophylla* was the most prominent tree species in this forest type.*

This study showed that the regeneration potential of the wet zone forest is much higher than that of the dry zone forest. The study also identified the major early successful species occurring in the soil seed banks and this information will be useful in developing an effective strategic management regime to restore degraded forest lands in these areas.

Key words: soil seed bank, natural regeneration, floristic composition, early successional species.

Introduction

Seed bank studies provide fundamental information on seed densities and floristic composition as well as regeneration potential of stored seeds. Seeds often show dormancy mechanisms, which prevent germination under conditions unsuitable for establishment. These dormant seeds are a reserve of viable seeds present in the soil. An important factor in the initiation of secondary succession is the amount of seeds stored in the soil, which can be termed as “seed crop” or floristic potential. The “floristic potential” of the regenerating community is dependent on the viable seed stored in the soil and seeds which are dispersed to the area after perturbation. This potential is realized when the requirement for germination are met and the dormancy of stored seed is broken by exposure to suitable growth conditions.

The existence of a substantial store of dormant seeds in tropical soils has been demonstrated by earlier studies (Putz and Papanah, 1987). The density of soil seed bank is highly variable depending on the frequency of occurrence of gaps, altitude and type of forests in temperate and tropical soils. Besides, a considerable site-to-site variation in the size of seed bank as well as in the floristic composition can exist. Studies of tropical forest soil seed banks have demonstrated the seeds of pioneers to be abundant (Garwood, 1989) and burial experiments have shown that the seeds of many pioneer species have the potential for long term viability in the soil (Hopkins et al., 1990; Graham, 1987) and observations of seed germination from soil samples have shown that the soil seed bank is

often dominated by species not fruiting locally at the time. Though Sri Lanka is enriched with different types of highly variable forest ecosystems, little information is available on the seed content and floristic composition of different forest types in Sri Lanka. Therefore, studies were undertaken to determine the size of soil seed banks in two forest types (wet and dry forests) in southern Sri Lanka and to identify the floristic composition of seed banks.

Materials and methods

The study was carried out in two natural forests in Wilpita (low country wet zone) and Hambantota (low country dry zone). Sampling was carried out using a quadrat (30cm×30cm×10cm) along the transect. Quadrat was placed 50cm apart the transect. Two soil samples were taken from each quadrat using a co-sampler (r=3cm) down to a depth of 10cm and placed in a polythene bag. In taken samples three transects 100m apart were used for each location. Live vegetation and decayed litter were carefully removed. Each soil co-sampler was crumbled and carefully placed in separate germination trays. The trays were laid in the laboratory with full sunlight and were kept moist by watering when necessary and stirred periodically to encourage further germination. No special techniques were employed to induce the germination of seeds. Date recording was carried out every other day for a period of 14 weeks from the time of placing the soil in the trays. All seedlings that appeared were recorded and identified. For each type a few seedlings were potted and allowed to grow further in order to make a positive identification of species while remaining seedlings were discarded.

Results and discussion

Significant variation in the size of seed bank was evident among the selected sites (Fig. 1). The mean numbers of viable seeds per square meter in Wilpita rain forest and Hambantota dry forest were 162 (±21) and 146 (±65), respectively. A large number of seeds (3925 ± 2533 seed/m²) was recorded in soil seed bank of Dipterocarp rain forest in South West China which is comparable with our study (Tang et al., 2006). Baider et al. (2001) also showed a high number of viable seeds in Brazilian forests.

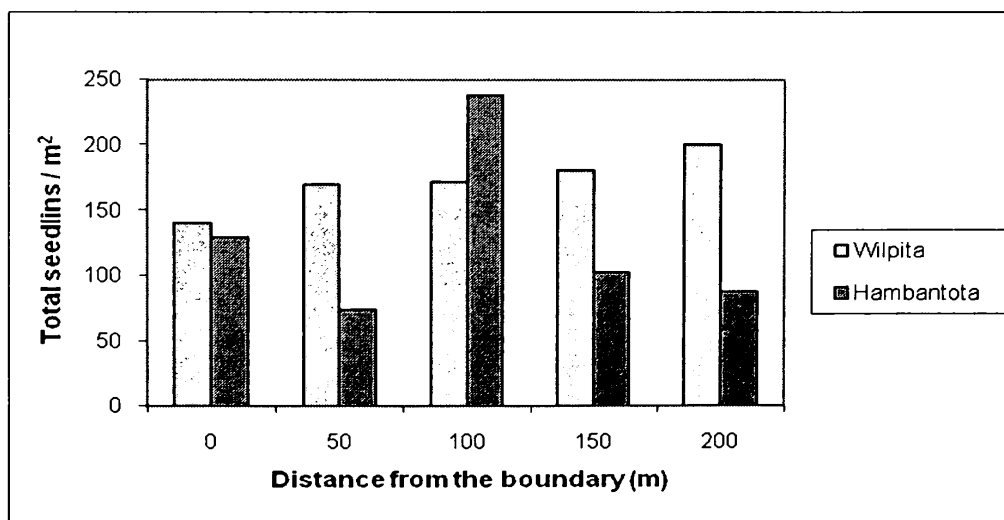


Figure 1. Seedling density of different forest types

Figs. 2 and 3 show the number of seedlings/m² along the transect in Hambantota and Wilpita, respectively. There were no significant differences ($P>0.05$) observed in the number of seedlings per square meter among the samples collected along the transect. Landenberger and Mc Graw (2004) pointed out that seed bank density declined significantly with distance from clean-cut, which is comparable with our study.

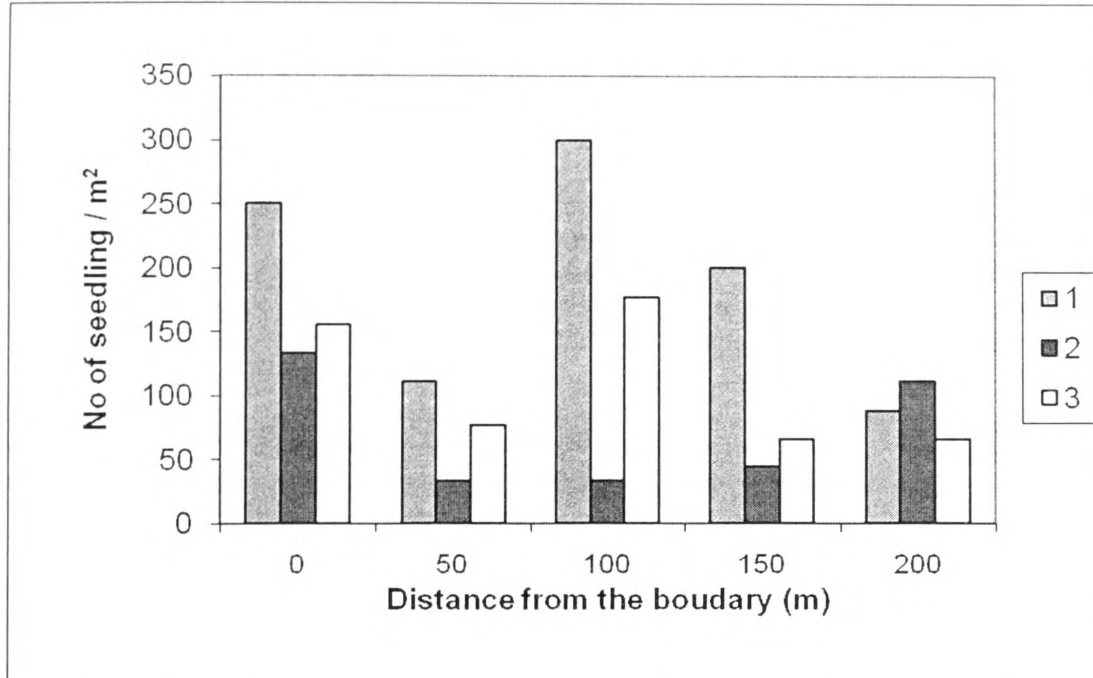


Figure 2. Seedling density of different transects in the dry forest at Hambantota

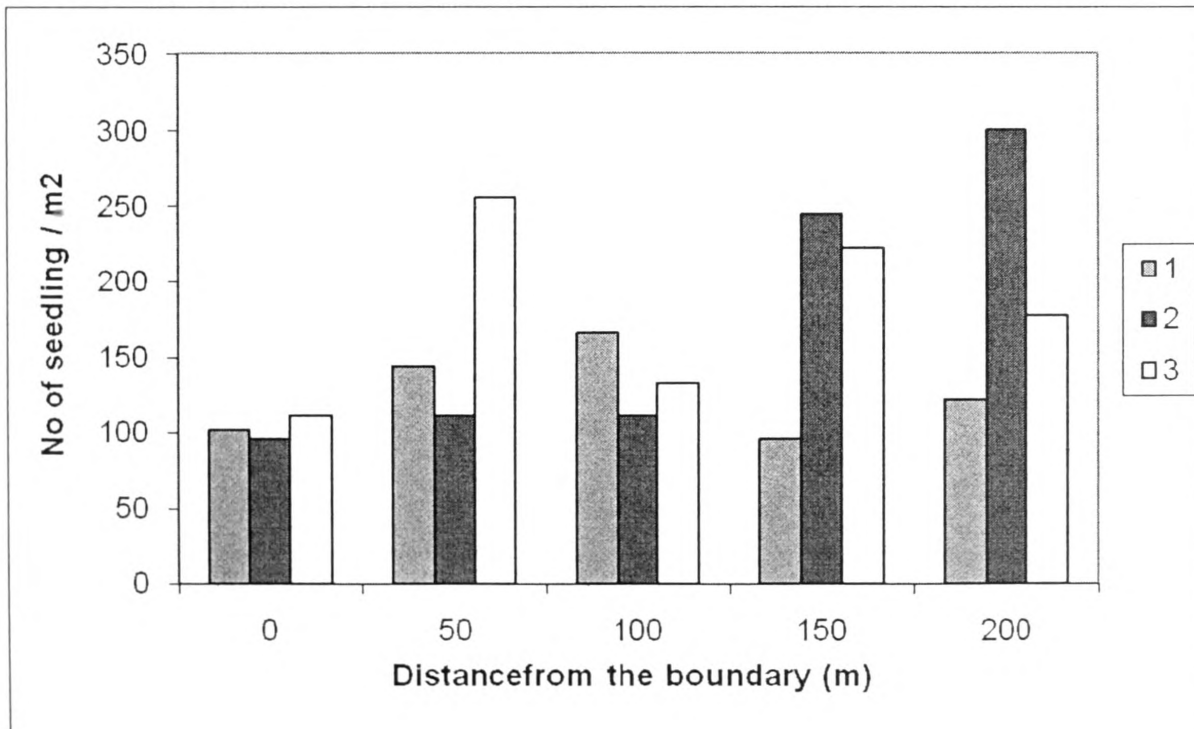


Figure 3. Seedling density of different transects in wet forest at Wilpita

The population density was higher in the wet zone forest compared to the dry zone forest. *Alstonia macrophylla* (hawari nuga), *Macaranga peltata* (kenda), *Trema orientalis* (gedumba) and *Melastoma malabathricum* (bovitiya) which are early successional species, were the prominent tree species in the Wilpita forest. Other studies (Tang et al., 2006; Baiider, 2001; Dalling et al., 1998) also showed that forest soil seed banks were dominated by pioneer species, which is in agreement with our observations. Affinity analysis showed that *A. macrophylla*, which is abundant in this area, was the most prominent tree species in this forest type.

Conclusions

Information on the soil seed bank will be useful in understanding the regeneration potential of forests because plant establishment in the early regeneration of tropical forests after disturbances are related to viable seeds in the soil bank. This study showed that the regeneration potential of wet zone forest is much higher than that of the dry zone. Further, this study identified the major early successful species occurring in the soil seed banks and determined their abundance. This information will be useful in developing an effective strategic management regime to restore degraded forest lands in these areas.

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