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SEEDLING RECRUITMENT AT A DRY ZONE FOREST ARBORETUM OF SRI LANKA

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INTRODUCTION

Regeneration of slash and burn agricultural lands into secondary forests is challenging due to the scarcity of seed bearing trees in such areas. Repeated slash and burn agriculture directly impacts on soil fertility, which is essential for re-colonization of indigenous seedlings from a soil seed bank. Therefore, restoration of degraded forests using silvicultural methods is promising (Weerawardane, 1999). A simple but effective silvicultural method was introduced by Popham (1993) to accelerate natural regeneration. This method can be described as a rudimentary low-cost silvicultural method that boosts Assisted Natural Regeneration (ANR) in converting deforested lands to more productive forests effectively (Dilhan et al., 2010; Shono, 2007). With the onset of the rainy season, tree seedlings are liberated and therefore initial treatment such as ground sanitation is essential to spur accelerated growth. This low cost silvicultural method involves marking those seedlings with stakes and ensuring seedlings survival throughout the vulnerability period by suppressing the growth of weeds. The present study aims to understand the management and environmental factors that influence seedling recruitment in the Popham Arboretum in Sri Lanka.

METHODOLOGY

The Popham Arboretum is located in the Dry Zone of Dambulla in Matale District (80° 40' 28" E and 7° 51' 34" N) of the north central province of Sri Lanka. The dry zone experiences a five-month dry spell from May to the end of September and then north-eastern monsoonal rainfall starts from October to December. The annual rainfall average is 1380 mm, and the average air temperature is 27.7 °C (Fig. 1). The prevailing soil type in the arboretum is reddish brown earth and humic gray soils.

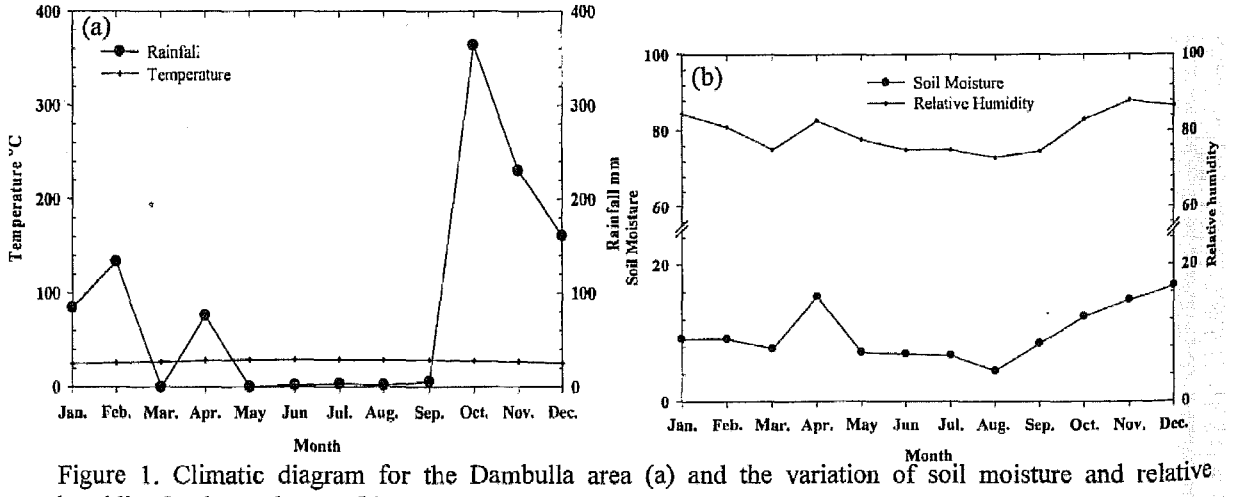

Figure 1. Climatic diagram for the Dambulla area (a) and the variation of soil moisture and relative humidity for the study area (b).

The total extent of the Popham Arboretum is 14.4 ha comprising 3.6 ha in the forestland and 10.8 ha of the woodland. In this study, seedling recruitment in the forestland was observed during the grass cutting season, from November 2005 to January 2006. The total number of

tree and shrub seedlings was counted within the study area (3.6 ha in forestland), and the unit area per hectare was calculated.

RESULTS AND DISCUSSION

A total of 637 seedlings comprising 35 species belonging to 16 families were encountered at the forestland of the arboretum during November 2005 to January 2006 (Table 1). Of the recorded seedlings, Fabaceae comprised five species, while Rutaceae and Sapindaceae comprised four species each.

Figure 2 shows the 11 species, which yielded 75% (475 individuals) of recruit seedlings for the wet season (November 2005 to January 2006). The 35 species recruited in the wet season contribute 177 seedlings/ha. A peak in seedlings liberation for leading species was observed in December 2005. Seedling recruitment during the monsoonal season (October to December) correlates with high moisture content in soil (15% ± 2) and high relative humidity (86% ± 3) (Fig. 1). The most dominant tree seedling recorded at the forest in the wet season was *Chloroxylon swietenia* (satin wood). According to a floristic survey by Dilhan et al. (2006), *C. swietenia* is the fourth dominant mature species in the arboretum.

Table 1. Regeneration dynamics of seedlings in the arboretum during November 2005 to January 2006. No. of seedlings encountered in each species is shown in parenthesis.

Family	Spp. Rich.	No. of Indi.	Plant Species	
Fabaceae	5	99	*Cassia fistula* (52)	*Cassia roxburghii* (36)
			Bauhinia racemosa (4)	*Bauhinia tomentosa* (3)
			Tamarindus indica (4)	
Rutaceae	4	151	*Chloroxylon swietenia* (120)	*Pamburus missionis* (18)
			Pleiospermium alatum (11)	*Acronychia pedunculata* (2)
Sapindaceae	4	12	*Schleichera oleosa* (6)	*Dimocarpus longan* (3)
			Lepisanthes tetraphylla (2)	*Sapindus emarginatus* (1)
Euphorbiaceae	3	56	*Drypetes sepiaria* (36)	*Phyllanthus indicus* (14)
			Bridelia retusa (6)	
Celastraceae	3	16	*Pleurostylia opposite* (10)	*Cassine balae* (4)
			Cassine glauca (2)	
Meliaceae	2	150	*Azadiracta indica* (41)	*Chukrasia tabularis* (109)
Tiliaceae	2	27	*Berrya cordifolia* (10)	*Grewia damine* (17)
Lauraceae	2	19	*Litsea glutinosa* (12)	*Terminalia cattappa* (7)
Myrtaceae	2	12	*Eugenia bracteata* (2)	*Syzygium cumini* (10)
Ebenaceae	2	10	*Diospyros ebenum* (6)	*Diospyros ferrea* (4)
Sapotaceae	1	32	*Manilkara hexandra* (32)	
Sterculiaceae	1	26	*Pterospermum suberifolium*(26)	
Verbenaceae	1	15	*Vitex altissima* (15)	
Moraceae	1	8	*Streblus asper*(8)	
Rubiaceae	1	3	*Canthium dicocum* (3)	
Gyrocarpaceae	1	1	*Gyrocarpus americanus*(1)	
Total	35	637		

high density of reproductive mother plants, production of a large number of seeds and wind dispersal patterns made *C. swietenia* the leading recruiting seedling.

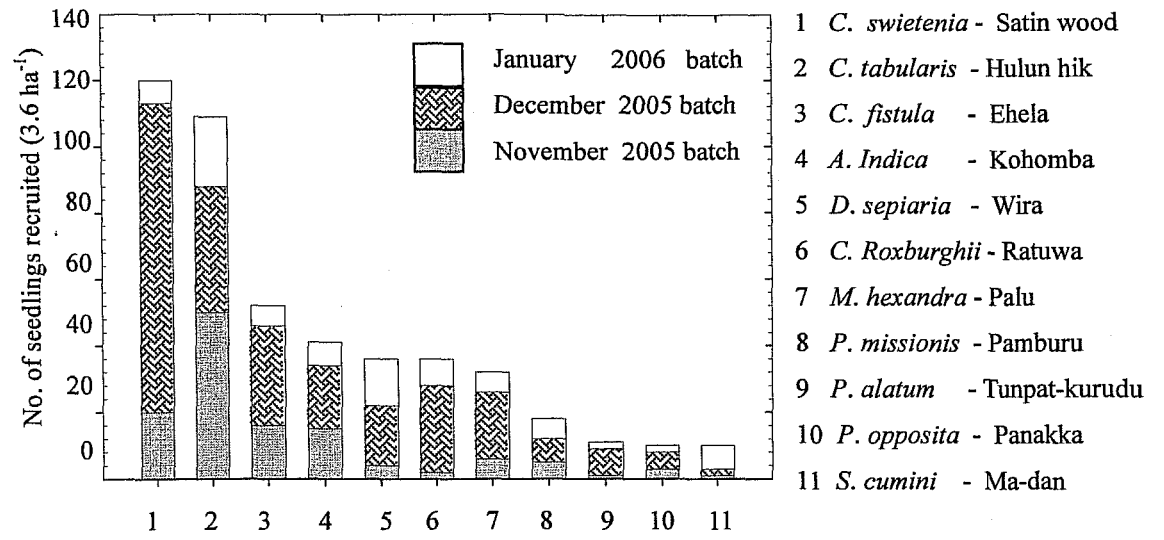

Figure 2. Number of seedling recruits encountered during the wet season in the arboretum.

Figure 3 shows a comparison of the top ten most dominant recruitment seedlings in 2006 from previously collected data in 1996 (Weerawardane, 1999). The number of seedling recruits in selected species in 1996 (6.3 ± 0.7) was comparatively lower than in 2006 (12.2 ± 3.8) but not significant (P=0.16). The reason for an increase in the number of seedlings in 2006 compared to 1996 may be attributed to transitioning of immature trees into reproductive active mature plants during a previous decade prior to sampling. Furthermore, continuous ground sanitation practices adopted by the arboretum management also enhanced seedling colonization. Similarly, Vieira and Scariot (2006) suggested that the clipping of plants around established seedlings can be a good management option to improving growth and survival. Such simple, effective, and low cost silvicultural management techniques may increase not only the resprouting ability of species but also improve the mechanism of regeneration in dry zone forests considered for restoration (Vieira & Scariot, 2006).

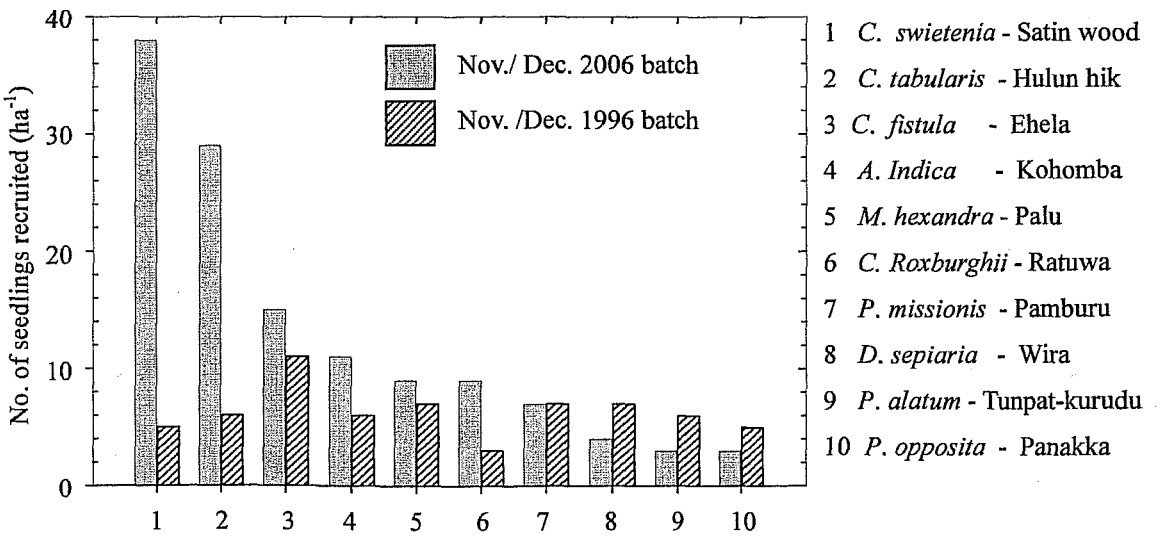

Figure 3. Comparison of recruiting seedlings for a decade (1996 - 2006).
Seedling recruiting data in 1996 was obtained from Weerawardane (1999).

CONCLUSIONS / RECOMMENDATIONS

Our findings suggest that silvicultural treatments are important to consider in recruiting seedlings from a soil seed bank at the onset of the rainy season. High soil moisture and high humidity seems to break the seed dormancy at the monsoonal period, and grass cutting seems

to encourage the seedlings to emerge from the competitive weeds. Although assisted natural regeneration is labour intensive, primarily, it facilitates tree seedlings diversity, which can be self-sustaining especially with respect to long-term ecological restoration. Therefore, we reiterate that this method may be ideal for restoration of degraded forests in Sri Lanka and may be a boon to diversity enrichment.

The biological wealth of the arboretum makes it feasible to link through restoration corridors to proximate neighbouring forests like Kaludiyapokuna forest reserve and Araula hill. The *in situ* conservation of dry zone plants is important to maintain a natural stock of seedlings, which can be used in reforestation programs in Sri Lanka. Furthermore, a government intervention through an ecosystem restoration program in Popham Arboretum may necessitate upgrading to a federally-funded forest reserve that can be utilized to enhance promulgation of native trees.

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