

Building sustainable botanic gardens: A simple silvicultural method adopted to turn wood trees into a productive arboretum in the dry zone of Sri Lanka

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Abstract

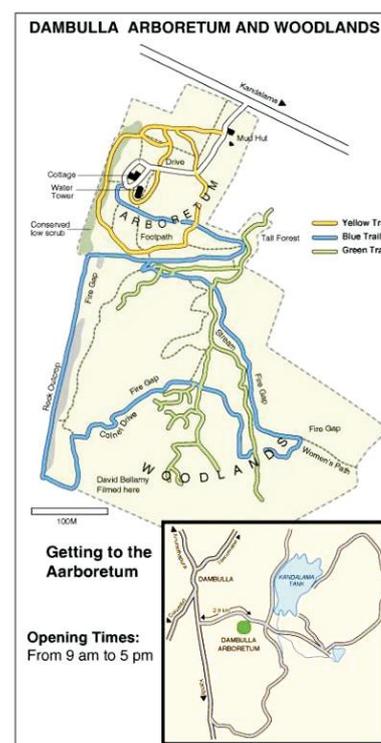
Over exploitation is the obvious phenomenon that degrades natural forest, by altering the structure and composition of the landscape. Therefore, rehabilitation and restoration of degraded forests is a most challenging task for forest managers. Under the direction of Mr. Sam Popham, an abandoned area of thorns is being turned into a field of trees such as Satinwood at the barren land in Dambulla, in the dry heartland of Sri Lanka. Efficient management of undergrowth and controlling the growth of creepers are the main silvicultural practices adopted at Popham. The policy is not to plant, but to release tree seedlings from competition and suppression by thorn scrub and creepers. This promotes re-colonization of indigenous and endemic species. Spontaneous seedlings will be released from the scrubland and encouraged to survive through childhood to adulthood. Therefore, the Popham method would be useful for accelerating natural plant regeneration towards secondary climax vegetation, while facilitating rich biodiversity compared to shifting cultivation land in Sri Lanka. This could also be adopted to degraded land in other parts of the world.

Key words : Popham arboretum, silvicultural management, Sri Lanka

Introduction

Dambulla Arboretum, which is commonly known as Sam Popham Arboretum, is unique because it harbors plenty of typical dry zone key plants. The Arboretum is situated in Dambulla ($7^{\circ} 51' 34''$ N and $80^{\circ} 40' 28''$ E), which is located in the dry heartland of Sri Lanka. This is the only dry zone arboretum in Sri Lanka and a living museum, a sanctuary for tropical trees that provides refuge for wildlife.

The arboretum was established in 1963 by Mr. Sam Popham, who is an Englishman. He bought a piece of land (3.6 ha), and it was silviculturally managed to form a natural forest. In 1989 the arboretum was extended up to 14.4 ha by acquiring adjoining land, which is now called as being woodland (Fig. 1). The vegetation types covered by the arboretum were scrubland, dry mixed evergreen forests, grasslands, rock outcrops, and woodlands. This variety of habitats contributes in increasing the biodiversity of the arboretum.



Methodology

Low cost Silvicultural method / Popham Principal

The policy is not to plant but to release tree seedlings from competition and suppression by thorn scrub and creepers (Popham, 1993). It promotes desired indigenous seedlings to re-colonize, through excluding creepers and thorny shrubs from the scrubland. Once in progress, spontaneous seedlings will be released from the scrubland and ultimately would have a better chance of surviving through childhood to adulthood. Removal of excessive tillering, dead branching and pruning growing tree seedlings are enhanced to accelerate regeneration. Then positions of saplings are marked with stakes, to avoid damage from subsequent ground cleaning. Their process is monitored. The new recruits in each season are marked by different identification pegs. They help seedlings to gain height through trunk-stemming and crown-thinning (Figure 1)

Strategy behind the Popham Principal

1. Silvicultural method manages small blocks

The scrubland is divided into 12 blocks and at least five grass cutting rounds were implemented for a block per year. The average cost for the Popham method is US\$ 143/ha/year (Dilhan *et al.*, 2009). The cost for this method is comparatively very low with compared to the rehabilitation project of Bintulu, Sarawak (Miyawaki, 1993), Malaysia (US\$ 15, 329 /ha/year).



Figure 1. Demonstration of Popham method: grass cutting enhances release of spontaneous seedlings from the soil seed bank

2. Thorn and climbers are banned

3. Growing up seedlings from the sweetest soil seed bank

Creepers and grasses in the ground may slow down the germination of seeds buried under the soil. Once these are managed, spontaneous seedlings are released.

4. Dead wood branches are chopped

Frequent slash and burn agriculture causes the formation of sick soil. Therefore, conversion of sour soil into fertile soil was vital. Mr. Popham overcame this problem by chopping down the dead wood into the soil and enhancing the accumulation of organic matter in the soil.

5. Watering the seedlings

At the initial stage watering was done.

6. Maintain fire breaks

Since local communities practice slash and burn agricultural farming, maintenance of fire breaks at the boundaries were done to prevent fire hazards.

Results and Discussion

Silvicultural management for restoration

Popham method promotes indigenous and endemic species to re-colonize the dry zone landscape and improve the biological diversity; it provides a habitat for native fauna, enhances the soil water retention properties and also decreases the fire hazards in the dry zone (Samarasinghe, 1995).

The aim of Popham method was to 'conserve', to clean but not to clear, to rid the grounds of the daunting rubbish created through the repeated slash and burn cultivation (Popham, 1985). Since grasses and competitive thorn, which occupied at the abandoned shifting cultivation land, suppress the development of tree seedlings and therefore ground sanitation through grass cuttings was adopted. Climbers were also banned because of the distortion they inflict on tree crowns (Popham, 1985). Furthermore, young trees were thinned out in overcrowded areas under the supervision on Mr. Popham. The above silvicultural practices at the arboretum boost the natural regeneration of tree seedlings *viz.*, satin wood and ebony.

Significant contribution to biodiversity

Popham method facilitates the increase in richness of plants, where we documented 225 plant species comprised of 58 families. Of them; 94 were trees, 42 were shrubs, 66 were herbs, 19 were climbers and 4 were parasitic plants. Eight species were endemic to Sri Lanka (Dilhan *et al.*, 2009 & Dilhan *et al.*, 2006).

Biodiversity of the arboretum includes, 85 bird species comprising of 69 residents, 9 migrants and 7 endemic species. Two endemics namely jungle fowl and grey hornbill are commonly seen at the arboretum. Of the migrants indian pitta is frequently abundant during the migratory season. Diverse habitats at the arboretum are home to increasing herpatafaunal diversity comprised of 6 amphibians and 36 reptiles (Vitarana & Weerarathna, 2008). Twenty species of mammals were reported at the arboretum including grey slender loris, toque monkey (Endemic), grey langur, Sri Lanka mouse-deer (Endemic), pangolin, and spotted deer (Vitarana & Weerarathna, 2008, Weerakoon and Goonatilake, 2006). General observations on invertebrate fauna depicted that the arboretum is home to a variety of

insects such as bees and butterflies. Of these, 40 butterflies including rare species viz., *Papilio* sp. were recorded at the arboretum (Dilhan *et al.*, 2009). The stratification and the diversity of indigenous flora helped to increase the faunal diversity of the arboretum.

Conclusions

Replanting is the most widely practiced method to rehabilitate the degraded forests in the world. However, Popham method ensures colonization of indigenous seedlings, when the degraded land is managed through simple silvicultural methods. Since the method is low cost and sustainable, it is ideal for implementation as a pilot project in forest rehabilitation. Taking the model of Popham arboretum in Sri Lanka is especially useful for third world countries. This will lead to biological wealth in rehabilitated forests within a few decades.

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