Comparing Floristic Diversity between a Silviculturally Managed Arboretum and a Forest Reserve in Dambulla, Sri Lanka

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Abstract

Repeated slash and burn cultivation creates wasteland with thorny shrubs, which then takes a long time to become secondary forests through serial stages of succession. Assisted natural regeneration through silvicultural management is a useful restoration method to accelerate succession. This survey evaluates the effectiveness of a simple silvicultural method for the rehabilitation of degraded lands to productive forest, thereby increasing floristic wealth. Field-based comparative analyses of floristic composition were carried out at a silviculturally managed forest (Popham Arboretum) and a primary forest (Kaludiyapokuna Forest Reserve) which is located in Dambulla in Sri Lanka. Floristic analysis was used to examine the effectiveness of silvicultural techniques for successful restoration of degraded forest in the dry zone. Nine 20 m × 20 m plots in each forest were enumerated and the vegetation ≥ 10 cm girth at breast height was quantitatively analyzed. Cluster analysis resulted in five distinguishable clusters (two from Popham Arboretum and three from Kaludiyapokuna Forest Reserve). Similarity indices were generated to compare the plots within and between sites. Floristic similarity was higher in forest reserve plots compared to arboretum plots. A total of 72 plant species belonging to 60 genera and 26 families were recorded from the study sites. Of the recorded species, *Grewia damine* and *Syzygium cumini* (Importance Value Index, IVI = 24 and 23 respectively) were the ecologically co-dominant taxa at the Popham Arboretum. In contrast, *Mischodon zeylanicus* (IVI = 31), *Schleichera oleosa* (IVI = 25) and *Diospyros ebenum* (IVI = 21) were the abundant taxa in the forest reserve.

Keywords: *dry zone forest, floristics, silviculture, TWINSPAN classification*

1. Introduction

The dry zone of Sri Lanka covers about four million hectares (60 % of the total island area) and extends over the north, north-central and eastern parts of the island (Perera et al., 1977). Of the total forest cover in Sri Lanka (25%), dry zone forest comprises approximately 22% (Gunatilleke and Gunatilleke, 1983). The dry zone forests of Sri Lanka have experienced a large-scale depletion of forestland from (a) slash-and-burn (swidden) cultivation (Sandika and Withana, 2010) and (b) illegal felling or selective logging of valuable timber trees (Perera, 2001). Natural regeneration of degraded lands is usually poor in

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these dry zone forests (Weerawardana, 1999) because of the infertile soil and impenetrable barriers of scrub to tree seedlings. Repeated slash-and-burn agriculture directly impacts soil fertility that is needed in enhancing re-colonization of indigenous seedlings from a soil seed bank. Therefore, restoration of degraded forests using established common methods, including reforestation, is very challenging (Weerawardana, 1999). To answer this challenge, artificial regeneration can be initiated. Artificial regeneration is a technique of enrichment planting or replanting and is widely practiced in Sri Lanka albeit with a limited number of available species to convert degraded lands to woodlands. For example, the Forest Department of Sri Lanka regularly carries out tree planting campaigns using fast growing exotic trees as gap fillers in forested areas. One of the adverse effects of this kind of strategy is the deliberate introduction of plants that can become invasive species. For instance, *Leucaena leucocephala* was introduced in Sri Lanka as a multipurpose tree species in the early 1980s to be used as wind buffers for farmsteads, but seedlings have emerged in forests of the southern province and have been prolific (Marambe *et al*., 2001).

A simple but effective method to accelerate natural regeneration as an alternative to artificial means was introduced by Popham in 1963 (Popham, 1993). Essentially, this method can be described as a simple low-cost silvicultural method that boosts Assisted Natural Regeneration (ANR) in converting deforested lands to more productive forests (Dilhan *et al*., 2010; Shono *et al*., 2007). The guiding principle behind the low-cost silvicultural method was not to plant seedlings of native trees, but to allow seeds of native trees present in the soil seed bank to germinate (Popham, 1993). This low-cost silvicultural method is ideal because it is cost effective and easy to implement for private forest landowners to convert their land into a mini-arboretum through forest stewardship programs. This is akin to *in-situ* conservation of indigenous trees, which ensures the wealth of biological diversity.

Silvicultural management can be viewed as a disturbance in the ecological sense, except that it is a directed influence with predictable consequences (Van Miegroet, 1986). For instance, uneven-aged management through mixed-species stands enhances not only structural diversity but also biological diversity (Lentz *et al*., 1989; Phillips and Abercrombie Jr, 1987). Changes in structure and function of the forest depend upon the type of silvicultural system employed (Boncina, 2000). Therefore, the following factors should be addressed before implementing a silvicultural practice: tree composition, patch pattern, growing stock, vertical structure of the vegetation, availability of resources, and species diversity.

In this paper, the floristic richness of a managed forest, which depends on endogenous and exogenous influences, including human intervention, was compared to the floristic richness of a forest reserve to evaluate the effectiveness of silvicultural treatments to accelerate serial follow-up stages to bring back the forest. The specific aim of this study was to compare the structure and composition of the vegetation in the two forests using plot sampling.

2. Methodology

2.1 Study area

The main study site for this preliminary survey was the Popham Arboretum, which has been silviculturally managed for over four decades. The Popham Arboretum is located in the central province of Sri Lanka in the Matale district. It is about 2.9 km from the Kandalama-Dambulla Road. The total extent of the Popham Arboretum is 14.4 ha comprising 10.8 ha of woodland and 3.6 ha known as arboretum forest (Figure 1). The Kaludiyapokuna Forest Reserve (KFR) was selected for comparison. The reserve is located approximately 6 km from the arboretum and due east of Polonnaruwa Road and north of Kandalama Reservoir (Figure 1). KFR houses an 8^{th} – 9^{th} century monastery complex and caves with pre-Christian period paintings and inscriptions, and several ponds, and it is protected as a historical site as well as government reserve since 1990 (IUCN, 1997). The vegetation at the forest reserve site can be described as a dry mixed evergreen forest characterized by both deciduous and evergreen dry zone plants.

The annual rainfall is 1,520 mm and the average temperature is 29.5°C (Cramer, 1993). The major land use types in Dambulla study area are scrubland, homestead, forest, and paddy (Visvanathan, 2009). The population in Dambulla city is 72,082 in 2012 and the population density is 162 persons/km^2.

2.2 Vegetation sampling

Eighteen random 20 m × 20 m plots were sampled for flora with nine plots in the arboretum and nine plots in the forest reserve. Four of the arboretum plots were in an area designated as dry-mixed/evergreen forest, while the rest (5 plots) were selected from the woodland area (Figure 1). The dry mixed evergreen forest is dominated by *Manilkara*-*Chloroxylon* series and *Chloroxylon*-*Vitex*-*Berrya*-*Schleichera* series (Gaussen *et al*., 1964). In contrast, plots from the KFR (see also Figure 1) were selected by using an altitudinal gradient criterion ranging from a lower valley area to a gentle sloping area. Individuals ≥ 10 cm girth at breast height (gbh) (1.3 m above the ground) were enumerated within the plots and were labelled with numbered aluminium tags. Vegetation characteristics, which included density and gbh of all woody species, were recorded. The density and basal area of plant species were used to interpret the horizontal distribution of the vegetation. The Importance Value Indices (IVI) of all the species were calculated using relative basal area (RBA) and relative density (RD) for individuals (Dilhan *et al*., 2006). IVI is related to RBA and RD by the following equation:

$$\%IVI = \%RBA + \%RD$$

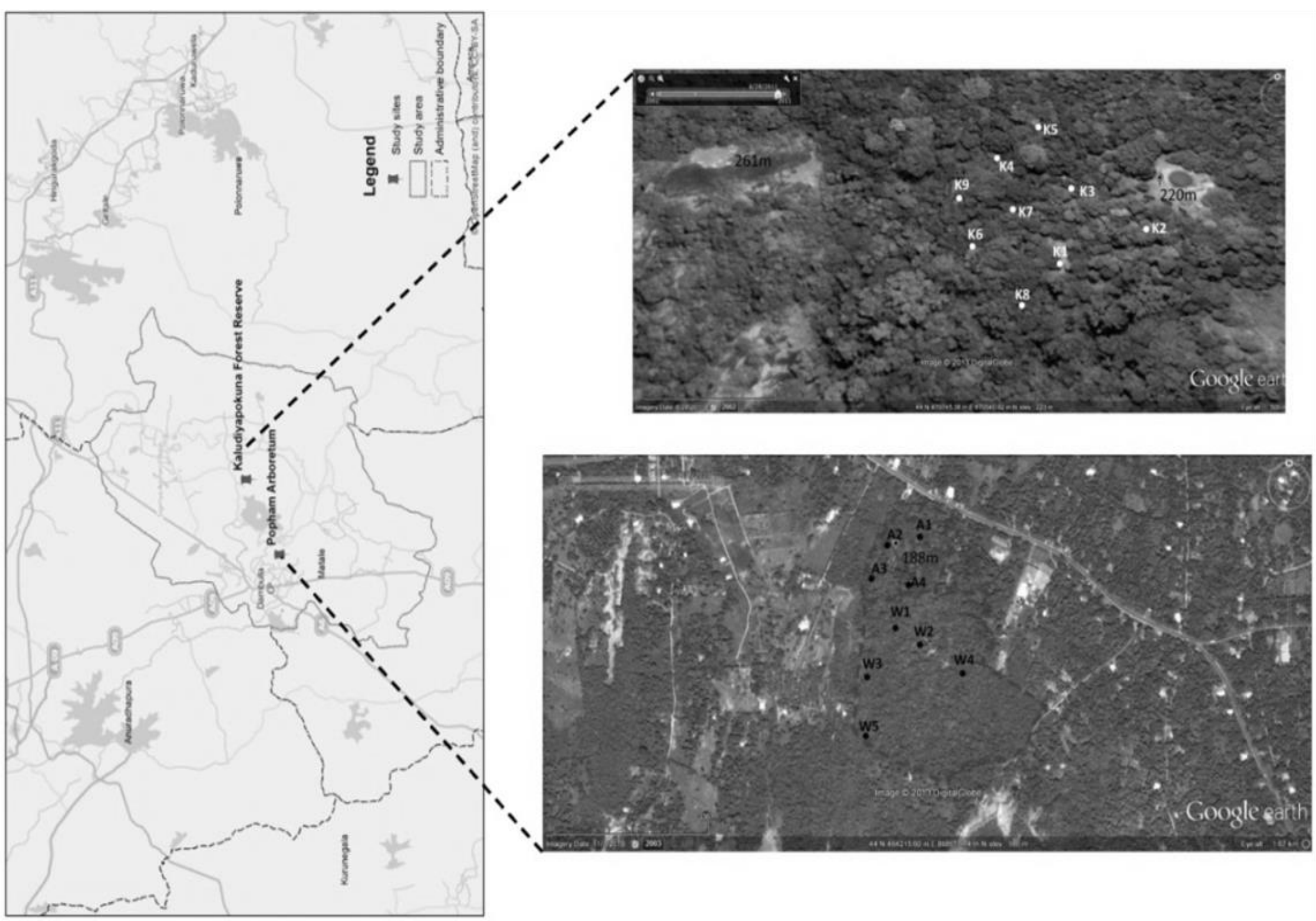

Figure 1: Map showing the sampling plots in the Popham Arboretum and KFR located in Dambulla in Central province of Sri Lanka.

A vegetation classification based on Two Way Indicator Species Analysis (TWINSPAN) was performed with species abundance data from two sites using $PCORD_4$ software (MJM software, Gleneden Beach, Oregon, USA). Species composition and community structure between the restored site and the natural forest was compared by computing mean similarity indices using the Bray-Curtis similarity index (Sorensen's index) with Primer© 5 software (Magurran, 2004).

3. Results and Discussion

Sri Lanka ranks second among tropical Asian countries in forest degradation, with 40% of forests subjected to degradation (Chokkalingam, 2001). Most of the dry zone forests in Sri Lanka are of secondary origin and severely degraded due to shifting cultivation resulting in thorny scrubland (Dilhan *et al*., 2002; Perera, 2001; Samarasinghe, 1995). However, despite Sri Lanka's high ranking and its severe forest degradation, there is very little literature addressing the different types of secondary forests and the characteristics that distinguish a secondary forest from a primary forest (De Jong *et al*., 2001). Generally, human induced forest fragments are expected to result in low species richness (McLennan and Plumptre, 2012), but it was hypothesized that a silviculturally managed secondary forest harbors more species than forest fragments. Therefore, a three-way comparison was constructed; it compared the floristic richness of rehabilitated secondary forest, namely the Popham Arboretum, to nearby natural forest and with previous floristic studies.

3.1 Species richness

A total of 72 plant species belonging to 60 genera and 26 families were enumerated for the Popham Arboretum and KFR (Appendix 1). Species richness in the arboretum was comprised of 48 plant species, 42 genera, and 21 families, whereas KFR was comprised of 33 plant species, 23 genera, and 16 families. Of the recorded species in the arboretum, 35 were trees and 13 were shrubs, whereas at KFR 23 were tree species and 8 were shrub species. Two endemic species, *Diplodiscus verrucosus* and *Xylopia nigricans*, were encountered at the arboretum and forest reserve respectively.

Species richness of the Popham Arboretum was considerably high; this indicated that the silvicultural management enhanced not only plant diversity but also rehabilitated ambient soils to recolonize juveniles (Popham, 1993). When the economic significance of flora was considered, it was found that plants at the arboretum harboured the highest economic value (see appendix 1); 27 had medicinal value, 15 had timber value, and 7 had both timber and medicinal value (Cramer, 1993; Dilhan *et al*., 2006). This supported the Dilhan *et al*. (2006) study, which reported 45 plants with medicinal value, 14 with timber value, and 7 with both timber and medicinal value out of 101 species belonging to 91 genera and 42 families at the Popham Arboretum. These results are also comparable with the floristic study on understory vegetation at the Hurulu Forest Reserve, which documented 49 medicinal plants out of 81 species belonging to 73 genera and 37 families (Solangaarachchi and Perera, 1993). Furthermore, Vandercone *et al*. (2011; 2012) recorded 73 species belonging to 58 genera and 30 families for 59 sampling plots at the KFR. In contrast to the arboretum findings, only 5 medicinal and 3 timber plants were recorded at KFR. This obvious difference between the recorded numbers of arboretum and KFR species may be a sampling issue, because the sample size may not have been sufficient to record all species.

3.2 Species and family importance values

In the Popham Arboretum, *Grewia damine* (IVI = 24 / 200) and *Syzygium cumini* (IVI = 23 / 200) were the ecologically co-dominant species. In contrast, the most dominant species in the KFR was *Mischodon zeylanicus* (IVI = 31) followed by *Schleichera oleosa* (IVI = 25) and *Diospyros ebenum* (IVI = 21). The leading family in the arboretum was Tiliaceae (IVI = 39 and 2 spp.), whereas Euphorbiaceae (IVI = 58, 4 spp.) and Sapindaceae (IVI = 45, 4 spp.) were the co-dominant families in the forest reserve.

Species richness in the arboretum ranged from 4 - 6 for Fabaceae, Rutaceae and Rubiaceae with IVI values ranging from 16 - 18. However, species richness with four species in the KFR was recorded only in Sapindaceae and Euphorbiaceae with IVI values ranging from 45 to 58.

3.3 Density, basal area, and population size

The number of individuals per plot ranged from 36 – 115 at the Popham Arboretum and from 31 – 108 at the KFR (Figure 2). The number of species recorded ranged from 16 – 23 in the arboretum and 9 – 17 in the forest reserve. The arboretum plot A3 had the highest number of individuals (115) with 23 species recorded. In contrast, the arboretum plot A1 had the lowest number of individuals (36) recorded with a comparatively high species richness (Figure 2). The average number of individuals in the woodland plots (W1 – W5) was higher (69±11) compared to the arboretum plots A1 – A4 (62±36). At the forest reserve, the average number of individuals was 58±27.

The stem density for all woody taxa measured at ≥ 10 cm gbh was 2,433±71 stems per hectare in the arboretum and only 1,442±70 stems per hectare at the forest reserve. The density of individuals was the highest at 0-10 cm dbh size class at both sites (arboretum = 1978±18; KFR = 858±11). The total basal area for the plots sampled at the arboretum was 118±1 m^2/ha, while it was 505±11 m^2/ha at the forest reserve. The forest reserve recorded the highest basal area (335±25 m^2/ha) in the dbh size class greater than 40 cm, whereas the arboretum recorded the highest basal area (44±0.4 m^2/ha) for 10-20 cm dbh size class. The highest species richness was recorded for the 2-10 population size class for both Popham Arboretum (18 spp.) and KFR (16 spp.).

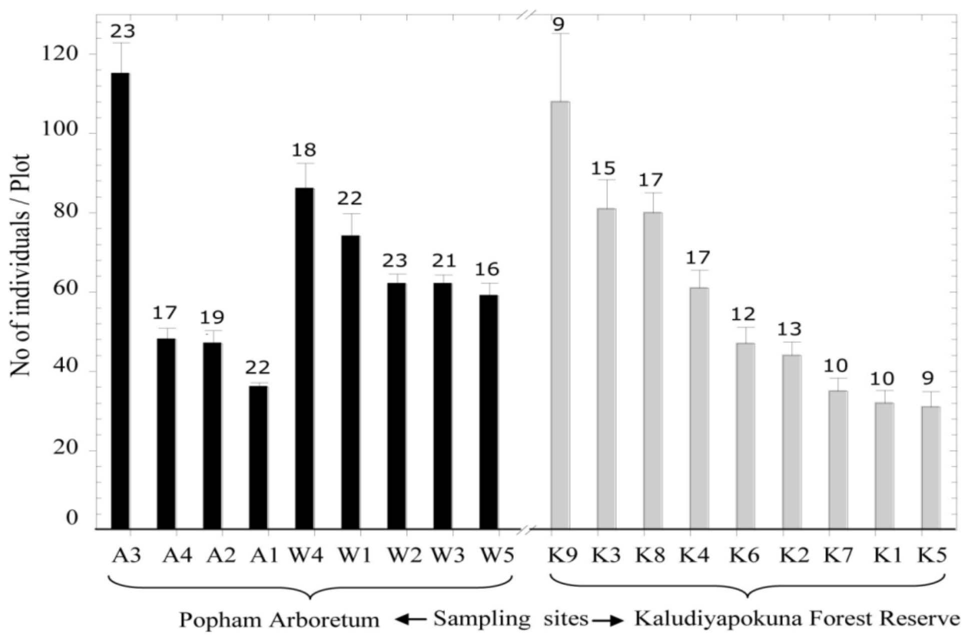

Figure 2. Number of individuals per plot sampled at Popham Arboretum and KFR. The figure represents plots A1 - A4 and W1 - W5 from the Popham Arboretum and plots K1 - K9 from the KFR. Number of species recorded for each plot is displayed above the error bars.

The average stem density of plants per plot was high in the silviculturally managed forest compared to the natural forest. The densities of individuals, especially in the lower dbh size classes in the arboretum, were higher compared to the forest reserve since the arboretum was prone to serial slash-and-burn cultivation. In contrast, the basal area of plants at KFR was four times larger than at the arboretum due to the increased presence of more mature plants. These results indicated that the arboretum is still in the young climax stage with heterogeneous vegetation, which necessitates conservation management and the planning of similar forests.

3.4 Trends and relationships

The Two Way Indicator Species Analysis (TWINSPAN) is summarized in Figure 3. Based on floristic composition, the 18 plots were classified into five clusters. The first division of the classification tree divided into two groups of nine plots with an eigen-value of E = 0.762. The first group comprised of woodland and arboretum plots, showed indicator species of *Chloroxylon swietenia* (Buruta) and *Diospyros habarala* (Kaluhabarala). The subgroup A2 plot's indicator species (E = 0.293) was *Acronychia pedunculata* (Ankenda). The subgroup A1 (E = 0.274) was characterized by the indicator species, *Diospyros malabarica* (Timbiri). Four woodland plots (W2 - W5) formed the third subgroup. The fourth subgroup consisted of two arboretum plots (A3 and A4) and a single woodland (W1) plot.

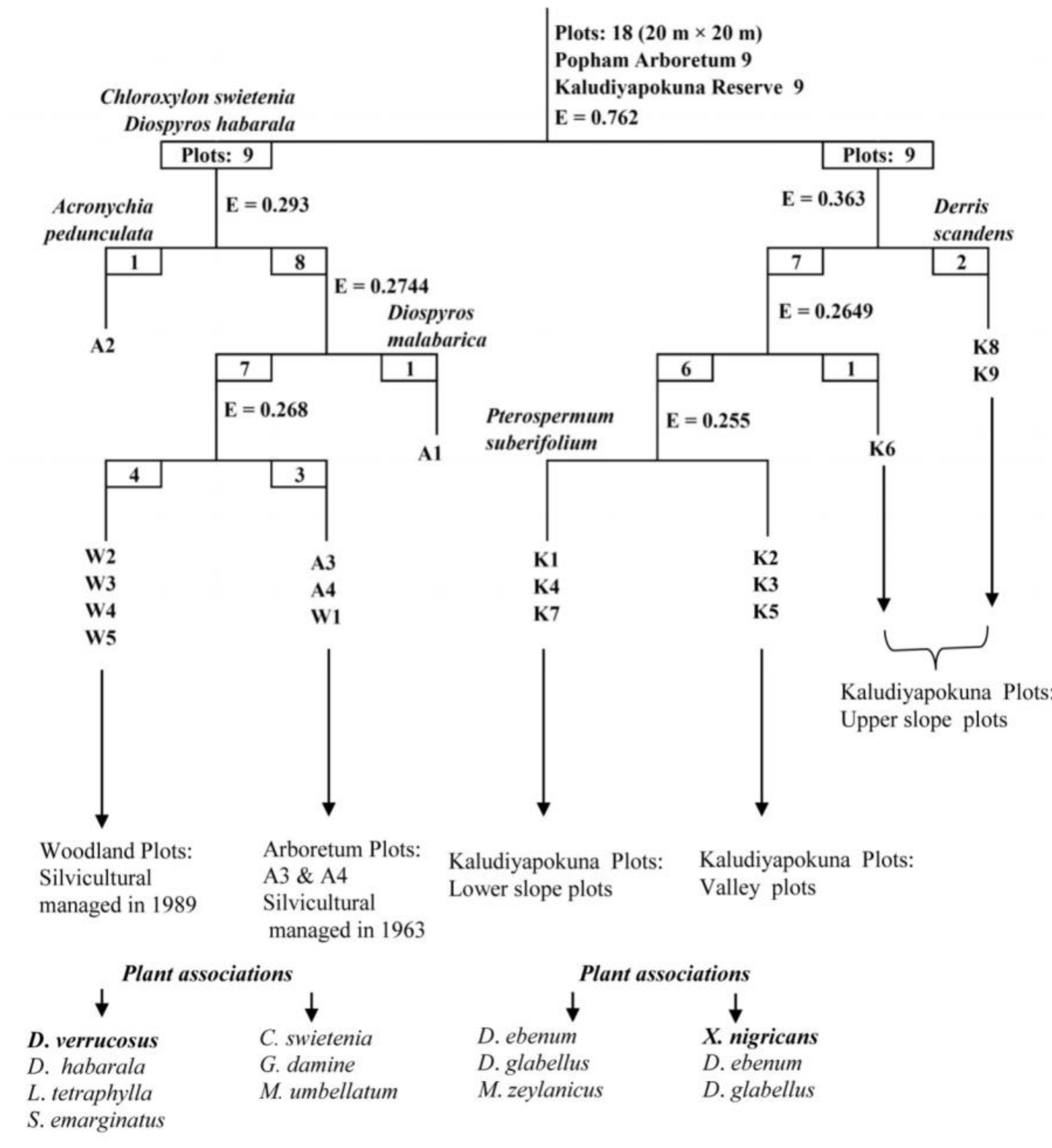

Figure 3: Classification (Two-Way Indicator Species Analysis) of 18 plots sampled in the Popham Arboretum (Arboretum - 4 plots labelled A1- A4, woodland - 5 plots labelled W1 - W5) and KFR (plots labelled K1 - K9) using species abundance data. The indicator species and the eigen values at each division are also annotated. Bold text indicates endemic species.

The second main group (*E* = 0.762) also separated into four distinguishable subgroups comprising nine plots located in the KFR. The indicator species, *Derris scandens* (Kala-wel), formed the first subgroup (*E* = 0.363): K8 and K9. For the second subgroup (*E* = 0.265) only a single plot, K6, could be assigned. The first and second subgroups were classified as upper slope plots. The third subgroup consisted of K2, K3, and K5, which were identified as valley plots. The fourth subgroup was represented by plots K1, K4, K7, and the indicator species, *Pterospermum suberifolium* (Welang). These plots were classified as lower slope plots.

In the TWINSPAN diagram, the arboretum and the woodland plots were separated as distinct plant communities (Figure 3). For example, *Chloroxylon*-*Grewia*-*Memecylon* and *Diplodiscus*-*Diospyros*-*Lepisanthes*-*Sapindus* were distinguished as plant communities in the arboretum and woodland, respectively. KFR was associated with the *Diospyros*-*Xylopia*- *Dimorphocalyx*-*Mischodon* plant community. Species composition of the two sites was not comparable due to the elevation gradient. For example, *Xylopia nigricans*, which was dominant at 225 m elevation in the valley plots of KFR (Figure 2), was not recorded in the arboretum. However, *Mischodon zeylanicus*, the dominant species at the lower slope plots of KFR, was found at the rock outcrop of the Popham Arboretum (Cramer, 1993; Dilhan *et al*., 2006; Popham, 1993).

As shown in the TWINSPAN diagram, the lower slope plots and the valley plots of KFR were closely lumped together at the base of the cluster and shared two dominant species, namely *D. ebenum* and *D. glabellus*. In contrast, upper slope plots (K8 and K9) were typically characterized by a liana, *Derris scandens*. As a silvicultural treatment, climbers like these were banned from Popham Arboretum to assist natural regeneration of native trees (Dilhan *et al*., 2010; Popham, 1993).

The derived Bray-Curtis similarity index yielded very high plant abundance similarity estimates for the natural forest (Table 1). Woodland plots (W1 to W5) also showed relatively high similarity among the plots (with values ranging from 0.33 to 0.70). The arboretum plots had lower similarity indices compared to woodland and natural forest. In addition, the similarity index for arboretum plot A3 was low compared to plots A1, A2, and A4.

Table 1: Comparison of plots within and between sites using the Bray-Curtis similarity index (Sorensen's index). The Bray-Curtis similarity index used mean abundance data of species of 18 plots sampled in the Popham Arboretum (Arboretum - 4 plots labelled A1- A4, woodland - 5 plots labelled W1 - W5) and KFR (plots labelled K1 - K9).

Plot	A1	A2	A3	A4	W1	W2	W3	W4	W5	K1	K2	K3	K4	K5	K6	K7	K8	K9
A1	1																	
A2	0.30	1																
A3	0.24	0.13	1															
A4	0.34	0.33	0.34	1														
W1	0.31	0.16	0.39	0.52	1													
W2	0.47	0.36	0.31	0.38	0.42	1												
W3	0.30	0.29	0.21	0.23	0.33	0.59	1											
W4	0.20	0.24	0.29	0.33	0.34	0.41	0.70	1										
W5	0.30	0.09	0.19	0.32	0.42	0.39	0.42	0.45	1									
K1	0.14	0.04	0.09	0.03	0.07	0.09	0.06	0.07	0.02	1								
K2	0.13	0.06	0.05	0.02	0.06	0.11	0.12	0.09	0.04	0.63	1							
K3	0.11	0.03	0.04	0.00	0.04	0.10	0.11	0.08	0.02	0.35	0.53	1						
K4	0.13	0.05	0.14	0.05	0.12	0.14	0.15	0.14	0.05	0.52	0.45	0.44	1					
K5	0.11	0.02	0.05	0.00	0.04	0.06	0.06	0.06	0.02	0.41	0.38	0.31	0.69	1				
K6	0.13	0.06	0.06	0.02	0.06	0.12	0.11	0.09	0.02	0.59	0.52	0.48	0.38	0.25	1			
K7	0.14	0.04	0.08	0.03	0.07	0.12	0.10	0.09	0.02	0.42	0.50	0.40	0.65	0.59	0.41	1		
K8	0.11	0.03	0.12	0.03	0.10	0.12	0.15	0.13	0.05	0.41	0.39	0.41	0.57	0.41	0.30	0.32	1	
K9	0.06	0.02	0.04	0.00	0.02	0.10	0.10	0.08	0.02	0.27	0.24	0.43	0.30	0.16	0.30	0.14	0.58	1

4. Conclusions

Over-exploitation of dry zone forest through shifting cultivation affects loss of biodiversity in Sri Lanka. Understanding biogeography and floristic wealth of degraded forests is important prior to the introduction of any rehabilitation or restoration program. This survey assesses the implementation of long-term silvicultural management practices and their contribution to floristic wealth. This floristic survey showed that the silviculturally managed forest was equally important to natural forest promising rich biota. Therefore, the Forest Department should apply this silvicultural method to the restoration of degraded shifting cultivation lands in Sri Lanka to conserve native plants. In addition, the biological wealth of the arboretum makes it advantageous to link it with neighbouring forests like KFR and Araula Hill through restoration corridors.

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Appendix 1: Exhaustive species list of identified vegetation

Species/Family	Species Code	Local Name	Economic Value	Life Form	Site
Annonaceae					
Polyalthia coffeoides	Poco	Omara		T	K
Polyalthia korinti	Poko	Ul-kenda	M	T	K *
Xylopia nigricans	Xyni	Heen-kenda		T	K
Apocynaceae					
Alstonia scholaris	Alsc	Ruk-attana		T	K *
Boraginaceae					
Cordia dichotoma	Codi	Lolu		T	A
Ehretia laevis	Ehla	Walangasal	M	T	A
Capparaceae					
Capparis zeylanica	Caze	Sudu-welangiriya	M	C	A/K
Celastraceae					
Pleurostylia opposita	Plop	Panakka	T	T	A
Clusiaceae					
Mesua ferrea	Mefe	Na		T	K *
Ebenaceae					
Diospyros ebenum	Dieb	Kaluwara	T	T	A/K
Diospyros habarala	Diha	Kaluhabarala		T	A
Diospyros malabarica	Dima	Timbiri	M	T	A
Diospyros oppositifolia	Diop	Kalu-mediriya	T	T	A
Diospyros ovalifolia	Diov	Kunumella		T	K *
Euphorbiaceae					
Bridelia retusa	Brre	Kaetakela	M/T	T	A
Dimorphocalyx glabellus	Digl	Welikaha		S	A/K
Drypetes sepiaria	Drse	Wira		T	K *
Flueggea leucopyrus	Flle	Heen-katu-pila	M	S	A
Mischodon zeylanicus	Mize	Tammanna		T	K *
Phyllanthus indicus	Phin	Karaw		T	A
Phyllanthus polyphyllus	Phpo	Kuratiya		S	A/K
Fabaceae					
Bahunia tomentosa	Bato	Petan		S	K *
Bauhinia racemosa	Bara	Maila	M	T	A
Cassia fistula	Cafi	Ehela	M/T	T	A
Cassia roxburghii	Caro	Ratu-wa	M	T	A
Derris scandens	Desc	Kala-wel		C	K *
Dichrostachys cinerea	Dici	Andara	M	S	A
Entada pusaetha	Enpu	Pus-wael	M	C	K
Tamarindus indica	Tain	Siyambala	M/T	T	A
Flacourtiaceae					
Flacourtia indica	Flin	Katukutundu		S	A
Hernandiaceae					
Gyrocarpus americanus	Gyam	Diya-labu		T	K *
Lauraceae					
Alseodaphne semecarpifolia	Alse	Wewarani	T	T	A
Cryptocarya sp.	Cryp	Gal-mora		T	K

Species/Family	Species Code	Local Name	Economic Value	Life Form	Site
Loganiaceae					
Abelmoschus angulosus	Aban	Kapu-kinissa		S	K
Melastomataceae					
Memecylon umbellatum	Meum	Kora-kaha	M	T	A
Meliaceae					
Azadiracta indica	Azin	Kohomba	M/T	T	A
Chukrasia tabularis	Chta	Hulunhik	M/T	T	A
Moraceae					
Ficus amplissima	Fiam	Ela-nuga		T	K *
Ficus heterophylla	Fihe	Wal-ehetu		T	K
Streblus asper	Stas	Nitul	M	T	A
Myrtaceae					
Eugenia bracteata	Eubr	Daeduwa		T	A
Syzygium cumini	Sycu	Ma-dan	M/T	T	A
Ochnaceae					
Ochna obtusata	Ocob	Galkera		S	A
Rubiaceae					
Benkara malabarica	Bema	Getakula		S	A
Canthium coromandelicum	Caco	Kara	M	S	A
Canthium dicoccum	Cadi	Bokutu	M	T	A
Catunaregam spinosa	Casp	Kukurman	M	S	A
Ixora pavetta	Ixpa	Godaratmal	M	T	A
Mitragyne parvifolia	Mipa	Helamba	M/T	T	A
Rutaceae					
Acronychia pedunculata	Acpe	Ankenda	M	T	A
Chloroxylon swietenia	Chsw	Buruta	T	T	A
Glycosmis mauritiana	Glma	Bol-pana		S	K *
Glycosmis pentaphylla	Glpe	Dodan-pana	M	T	K
Limonia acidissima	Liac	Divul	M	T	A
Murraya exotica	Muex	Etteriya		S	K
Pleiospermium alatum	Plal	Tunpat-kurudu	M	S	A
Sapindaceae					
Allophylus serratus	Alse	Kobbe	M	S	A/K
Dimocarpus longan	Dilo	Mora		T	K *
Lepisanthes tetraphylla	Lete	Dambu		T	A/K
Sapindus emarginatus	Saem	Penela		T	A
Schleichera oleosa	Scol	Kon		T	A/K
Sapotaceae					
Manilkara hexandra	Mahe	Palu	T	T	A
Sterculiaceae					
Pterospermum suberifolium	Ptsu	Welang		T	A/K
Sterculia balanghas	Stba	Nawa		T	K
Tiliaceae					
Berrya cordifolia	Beco	Halmilla	T	T	K *
Diplodiscus verrucosus	Dive	Dik-wenna		T	A
Grewia damine	Grda	Damunu		T	A/K
Grewia rothii	Grro	Bora-damunu		T	K *

Species/Family	Species Code	Local Name	Economic Value	Life Form	Site
Verbenaceae					
Premna tomentosa	Prto	Seru		T	A
Vitex altissima	Vial	Milla	T	T	A/K

(Economic value: M= Medicine, T = Timber; Life Forms: T = Tree, S = Shrub, C= Climber;

Site: A = Arboretum, K= KFR)
* Species recorded for the arboretum (Cramer,1993; Dilhan et al., 2006).
Bold text indicates endemic plants.