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RESEARCH ARTICLE

Environmental Science

Ecological characterization of the 40-year-old regenerated rainforest patch in Olaboduwa-Kodigahakanda adds value in promoting forest-based nature tourism

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Abstract: Ecosystem and floristic characteristics have been extensively studied to address environmental disturbances and mitigation measures. However, their importance as key landscape elements in evoking natural attractiveness is less explored. This paper focuses on the ecological evaluation of the scenic beauty, carbon storage and ecosystem health of a forest fragment, Olaboduwa-Kodigahakanda in the suburbs of Colombo, through a quantitative approach to demonstrate the non-consumptive social value marketed for forest-based nature tourism. The forest accommodated 171 species of plants, 202 fauna including 69 bird species and 15 fish species, and 40 macro fungal species. A total of 32 threatened species were reported. The diversity of vegetation varied across the canopy, understory and undergrowth, and exhibited three distinct communities denoted by *Dipterocarpus zeylanicus*, *Mimosops elengi* and a mix of species. Plant age structure analysis confirmed a mid-successional forest regeneration phase enriched with endemic species *Artocarpus nobilis*, and *D. zeylanicus* in the canopy and *Gaertnera vaginans* in the understory. The living trees stored 134.82 ± 50.51 Mg/ha carbon, and 494.8 tons of CO_2e/ha greenhouse gasses, and showed satisfactory health in terms of greenness. School children were the key visitors engaged in nature exploration and educational day walks while youth preferred rock climbing as an adventure sport. Removal of invasive plants, enrichment planting of native species with regular monitoring and related follow up actions are recommended for forest management to offset impacts of disturbances while stream restoration initiatives would stimulate aquatic life. Strengthening local community participation in surveillance, management and revenue generation is crucial for sustainable nature tourism. The forest stands as a model for promoting forest-based nature tourism of secondary forest fragments in wet lowlands.

Keywords: Sub-urban forests, secondary forests, nature, biodiversity, eco-tourism, ecological value

INTRODUCTION

In recent years, the importance of forests in regulating climate, maintaining soil health, supporting biodiversity, and enhancing human well-being has become increasingly prominent and mainstreamed into policy decisions (Mace, 2005; CBD 2022). This has led to a growing societal demand in recognizing the social values of forest activities such as for tourism, recreation, and environmental education. Although fewer visitors are attracted to forests outside protected areas, smaller lesser-known forests in peri or sub-urban settings have gained popularity as people seek out areas for therapeutic motives, nature exploration, and recreational activities such as photography, camping, walking, hiking, rock climbing, and bird or animal-watching (SLTDA, 2020; Grebner et al., 2022; Mann et al., 2024; Lehto et al., 2025; Lin et al., 2025). Thus, nature has now become a playground for adventure and recreational experiences for humans with social media playing a significant role in promoting these destinations to both local and foreign

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tourists, and thereby transforming lesser-known places into tourist attractions (Arts et al., 2021; Hung & Liou, 2023).

Ecosystem components and processes lay the foundation for the natural environment. Floristic features such as species composition and richness, density and distribution, and tree size and age create structural complexity for habitat niches of wildlife. Using ecological evidence, nature's social benefits, especially scenic and recreational offerings, greenhouse gas capturing potential etc. can be easily marketed to promote nature tourism and value addition to ecosystems dispelling the misconception of them being considered "useless". Such judgements are particularly important in safeguarding lesser-known small forest patches scattered in human dominated landscapes (Rolston & Coufal, 1991; Ng et.al., 2021; Lehto et al., 2025). Further, ecological characteristics reflect the detrimental impacts of human visitation and indicate the necessity of remedial measures (Cole, 2004; Marion et al., 2016) and provide insights into decisive aspects of ecosystem management. The adoption of a community-based approach in nature tourism creates environmental consciousness and motivation to develop positive socio-economic perspectives and actions in protecting the environment (Wickramasinghe, 2013).

The Southwestern lowlands of Sri Lanka contain a large number of undescribed small secondary forest patches with unique ecological characteristics, and their sustainability is confronted with increasing societal demands (MOFE, 1998; Fernando et al., 2015; Sumanapala & Wolf, 2020). This paper derives quantitative ecological evidence for non-consumptive social values marketable in forest-based nature tourism at Olaboduwa-Kodigahakanda, a patch of secondary rainforest, and propose management aspects to enhance its services. Inventories were prepared for flora, fauna, and, for the first time, for macro-fungi. Ecological and floristic features, diversity, age structure and regeneration capacity, living biomass and carbon stock, and forest health in terms of a greenness-index were quantified. Recreation offerings were consolidated, and recommendations for improvement of forest cover and hydrological aspects were proposed to sustain Olaboduwa-Kodigahakanda as a biologically rich and ecologically stable forest-based nature tourism destination.

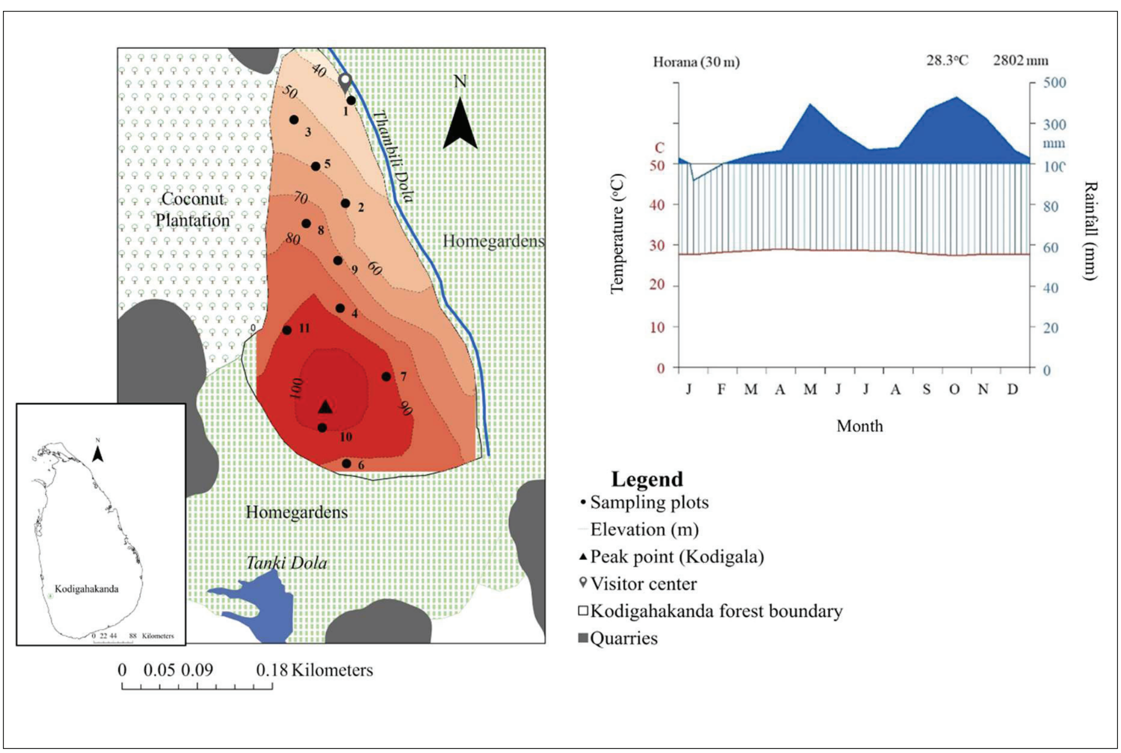

Figure 1: Location with sampling stands, and Climate map of Horana indicating the elevation, and the average annual temperature & rainfall

MATERIALS AND METHODS

Study site

The site Kodigahakanda (6°46'59"N-6°46'42"N, 80°0'50"E-80°0'56"E, 135-380msl,7.2ha) was named to locate Kodi-gala (115.2msl), the highest elevation in the suburbs of Colombo, which served as a trigonometrical station in the colonial period. In the 1860s the forest was cleared for planting coffee, and later for coconut. Since the early 1980s, after uprooting coconut trees, the ancestral owners of the land allowed it to regenerate naturally while safeguarding against destructive activities through community surveillance (Hettiarachchi, 2004). At present, the forest serves as the watershed for the stream Thembili dola. The forest lies on rocky terrain comprised of pre-Cambrian crystalline with red-yellow podzolic soil (Hettiarachchi, 2004), and experiences an average annual rainfall >2800 mm and a temperature of 28 ^{o}C (Figure 1).

Flora, macro-fungi, fauna and soil data collection

Vascular plants in accessible areas including eleven 10 m x10 m random sample stands were botanically identified using taxonomic literature and their conservation status was determined (MOE, 2020a). Fruiting bodies of macro fungi were collected monthly over a year with records of their habitat before they were photographed and identified (Kirk, 2024; GBIF, 2024). The canopy and understory of the stands were enumerated. Height, diameter at breast height (DBH) of canopy trees >5 m and ≥5 cm girth, and understory individuals 3-5 m tall and >1.3 cm girth were recorded. Four 2 m × 2 m sub-samples per stand were used for counting liana stems, undergrowth herbs, and seedlings <1 m in height. Forest canopy cover was estimated using hemispherical photography using a fish-eye lens 1.5 m above the ground. gap light analyzer (GLA) free software version 2.0 was used to analyze canopy images to calculate canopy openness (Frazer et al., 1999). Fauna was scientifically identified using taxonomic literature based on direct and indirect observations, acoustics, footprints, and faeces between 0600 h-1200 h, and 1500 h-1800 h for approximately 200 total hours. Their conservation status was determined (MOE, 2020b; 2021). Litter-less composite soil samples up to 15 cm in depth collected from stands were air dried, sieved and analyzed at 24 °C for pH (Thermo Scientific™) and electrical conductivity (Hanna™), moisture content followed by drying for 10-12 h at 105 °C (Sarkar & Haldar, 2010). The soil organic carbon was determined using the Walkley-Black colorimetric method, and total nitrogen (N), phosphorus (P), and potassium (K) of H_2SO_4 digested soil using Kjeldahl, Olsen and flame photometric methods, respectively (AOAC, 2005).

Analysis of floristic diversity, age structure, communities and heterogeneity

Canopy, understory, and undergrowth diversity of stands were quantified using Shannon Wiener (H′), Inverse Simpson's (1-D) and Margalef (D_{mg}) indices. The ecological dominance of species was determined by the important value index (IVI) (Crawley, 1989; Krebs, 2009) using PAST ecological software (version 4.03). The relevant formulae were $H' = \sum p_i . \ln (p_i)$; where p_i is the proportional abundance of species; $1\text{-}D = 1- \sum [n_i (n_i -1) / N (N-1)]$, where, n_i is the number of individuals of species 'i', and N is the total number of individuals; $D_{mg} = (S-1)/ \ln (N)$, where, S is the total number of species and N is the total number of individuals of all species; IVI = relative density (RD) + relative basal cover (RC) + relative frequency (RF). Age structure analysis of all canopy individuals and the three most ecologically dominant tree species were depicted, and the regeneration status was determined (Crawley, 1989). Floristic communities were identified by subjecting species occurrences in stands to the Bray-Curtis dissimilarity index (Hao et al., 2019) followed by hierarchical clustering and the Vegan software of RStudio (R Core team, 2012). Synoptic significance values (P<0.05) were determined through the "synoptic indicator value index" (IndVal) for identifying key floristic communities. Species that scored >1.0 were considered as indicator species that are firmly associated with one community type. The "Indicspecies" package (P<0.05) was used to identify character species whose mean cover is high within a particular community (Kefalew et al., 2022). To quantify how strongly a species is associated with a specific plant community, synoptic indicator values obtained for each species in each floristic community were statistically analyzed (P<0.05) to name the community. The heterogeneity of vegetation was determined by the association of soil and floristic characteristics of stands (species occurrences, individuals, liana stem counts) projected using canonical correspondence analysis (CCA) using PAST ecological software version 4.03.

Biomass and carbon stock of living trees and green-house gas capturing potential

Carbon stock was estimated using DBH, allometric equations and wood density values available for trees and lianas (FAO, 2024). The formulae used were: Above ground biomass of trees (AGB_{Tree}) in kg tree^{-1} = $0.0673\times(\rho D^2 H)^{0.976}$, where, ρ is wood density (gcm^{-3}), D is the DBH (cm), and H is the tree height in meters (m) (Chave et al., 2014); Belowground biomass of trees (BGB_{Tree}) = exp [-1.0587 + 0.8836 ln (AGB (Tree)] (Cairns et al., 1997); Above ground biomass of lianas (AGB_{Liana}) = exp [-1.484 + 2.657 ln (D)] where, D is the DBH of the liana stem; Below ground biomass of lianas (BGB_{Liana}) = AGB (Liana) x 0.26, and total carbon stock of trees (MgC ha^{-1}) = Above and below ground biomass (Mg ha^{-1}) x 0.47. The carbon stock of lianas was computed to be 50% of the above and below ground liana biomass. (Gerwing & Farias, 2000; IPCC, 2006; Babu & Parthasaran, 2019; Neth et al., 2022). A conversion factor of 0.50 was used to convert biomass (dry weight) to carbon equivalents (CO2e) to identify the green- house gas capturing potential (Petersson et al., 2012).

Forest health

The health of an ecosystem reflects productivity, ecological functioning and resilience, as well as the success of management practices. This is assessed by both, the normalized difference vegetation index (NDVI) and Greenness Index (GI) (Pandapotan et al. 2016; Ali et al., 2018; Rumat et al., 2018; Chandler et al., 2021). For image analysis, Sentinel-2 multispectral satellite imagery (2021) of the study area, and Sinharaja and Kanneliya forests as reference sites were obtained from the Copernicus program of the European Space Agency, cloud filtered and downloaded (https://browser.dataspace.copernicus.eu/, dated February 2024). Following pre-processing, and raster and band clipping, both GI and NDVI for the forests were calculated and mapped using the equations; GI = G / (R + G + B) and NDVI = (N - R) / (N + R); where, G = Band 3 (Green); R = Band 4 (Red); B = Band 2 (Blue) and N = Band 8 (Near-infrared). ArcGIS Pro software was used for NDVI and GI calculations and mapping (Weier & Herring, 2000; Meter group, 2024).

Visitation analysis

Information on visitors and recreation activities that took place at Olaboduwa-Kodigahakanda were extracted from visitor book records (2014-2023) and available entrance tickets issued for adventure sports (2020-2023).

RESULTS AND DISCUSSION

Flora, macro fungi and fauna

The forest accommodated a total of 171 plant species common to lowland rainforests. Among them 90% were native, 8.7% endemic, 9.9% exotic, and 6.4% were threatened. Among the 69 plant families, Fabaceae, Rubiaceae, Euphorbiaceae and Malvaceae were highly represented (SI Table1A). Some orchid species such as *Eulophia epidendraea* (J. Koenig ex Retz.) C.E.C. Fisch, *Sarcanthus peninsularis* Dalzell.,*Thrixspermum pulchellum* (Thw.) Schltr., and *Dendrobium aphyllum* (Roxb.) C.E.C. Fisch, recorded in previous inventories (Kotagama, 1986; Hettiarachchi, 2004; Palihawardana, 2015) were not found possibly due to changes in the microclimate over the years. The threat to flora was also evident by the presence of two endangered plant species (*Rungia latior* Nees, and *Areca concinna* Thwaites), and nine plant species in the vulnerable category (*Trichopus zeylanicus* (Gaertn.) R.Br., *Erythrina variegate* L., *Grona heterocarpa* (L.) Verdc., *Cinnamomum verum* J. Presl, *Tolypanthus gardneri* (Wight & Arn.) Benth., *Horsfieldia iryaghedhi* (Gaertn.) Warb**.,** *Nepenthes distillatoria* L., *Guettarda speciosa* L., *Saraca asoca* (Roxb.) W.J.de Wilde]. Charismatic plant species of the forest were identified as *Begonia malabarica* Lam. (for having the largest flower of the genus), and *Memecylon* spp. (for representing many species including the threatened *M. rivulare* Thw. and *M. grande* Retz.), which added vibrant colours to enhance landscape aesthetics. A notable feature of the forest was the richness (9%) of liana species. Lianas account for 10% to 45% of woody stems and 35% of the diversity of woody species in tropical forests and perform an integral role in forest regeneration, the maintenance of species diversity and ecosystem processes (Marshell et al., 2020). In forest canopies with low disturbances, lianas help to protect plants from strong winds, weed invasion (via competition), and herbivory. However, increased light levels in canopy gaps may stimulate prolific growth of lianas impeding tree growth and survival (Toledo-Aceves and Swaine, 2007; Ingwell et al., 2010; Schnitzer and Bongers, 2011; Visser et al., 2018; Meunier et al., 2021). Hence, managing the liana population assists in the regeneration of degraded forests towards uninterrupted succession.

The occurrence of 40 macro-fungi species belonging to 6 orders and 17 families was reported with wide representation in the Agaricales and Polyporales orders. Many (31 species) were saprophytes, while 10 were mutualistic (mostly mycorrhizal) and 9 were parasitic taxa (SI Table1-B). The soil inhabiting fungi (11 species) represented the families Lyophyllaceae, Fomitopsidaceae, Gomphaceae, Sclerodermataceae, Hygrophoraceae and Clavariaceae. Others occupied mostly dead wood, twigs and dried leaves with live wood serving as the substratum only for *Oudemansiella australis* G. Stev. & G.M. Taylor.

The forest accommodated a total of 202 species of fauna (23 mammal, 69 bird, 29 reptile, 8 amphibian, 57 butterfly and 15 fish species) which included 12.3 % endemic species, and 9.4% threatened species (SI Table 1-C). Observing fauna provided recreational pleasure to people while the presence of the Atlas moth (*Attacus atlas* Linnaeus, 1758) added special conservation value and attraction for educational tours.

Floristic details and forest management aspects

The forest canopy of Olaboduwa-Kodigahakanda reached a height of 10 to 15 m, roofing a dense understory and sparse undergrowth. The diversity of the canopy, understory and undergrowth varied broadly across the forest (SI-Table 2). The Shannon-Weiner Index (H') reflecting species diversity exhibited the widest range for the understory (0.556- 2.432) compared to the forest undergrowth (0-1.528) and canopy (0.888-2.032). The inverse Simpsons Index (1-D), which reflects both species diversity and evenness, showed a broad range for the undergrowth (0-0.760) than understory (0.290-0.895) and canopy (0.542-0.840). Plant species richness as reflected by the Margalef's index (D_{mg}) also exhibited a broad range for the understory (0.692-3.301) than the canopy (0.805-3.119) and undergrowth (0-2.118) reflecting the diverse nature of the strata. The eastern slope of the forest leading to Thambili dola reported the highest canopy diversity while the lowest was reported in stands with high abundance of *D. zeylanicus*. Rocky areas reflected the least values for diversity and richness in undergrowth. The aggressive invader *Oclandra stridula* (Thw.) C.E.C. Fisch. was reported from the understory of this area. Regular removal by digging out could control their spread and may suppress its dominance while facilitating the growth of other native species (Madawala and Wijewickrama, 2021). The introduction of threatened and common medicinal species of lowland rainforests e.g., *Costus speciosus* (Thebu), *Strobilanthes* sp., *Sonerila* sp., *Impatiens* sp., to the forest understory would improve the naturalistic beauty of the forest interior.

Based on IVI values, *Artocarpus nobilis* Thw., *D. zeylanicus, Melicopelunu-ankenda* (Gaertn.) T.G. Hartley, *Aporosa cardiosperma* (Gaertn.) T.G. Hartley, *Alstonia macrophylla* Wall. ex G. Don*, Tabernaemontana dichotoma* (L.) Poir.*, Mimusops elengi* L. were canopy dominant species (SI Table 3). Importantly, the endemic species *A. nobilis* and *D. zeylanicus* together accounted for 25% of canopy dominance, which is an uncommon feature of a regenerating forest. Hence, encouraging the diversification of canopy tree species may improve the resilience of the ecosystem. Nevertheless, *A. macrophylla* trees raised over the canopy indicated an ill-fated condition. Its prolific seed production, long-distance dispersal, and longer viability period in the soil bank undoubtedly promotes its establishment and aggressive spread all over the forest unless immediate control measures are taken. Being a timber species, its adverse effects on native vegetation are often overlooked. Hand pulling of seedlings and digging of saplings on a regular basis will reduce its population density while debarking and basal cutting are recommended for destroying large trees (Jayawardhane & Gunaratne, 2022). The dominance of endemic species in the understory, *Gaertnera vaginans* (DC.) Thwaites and *Phoenix pusilla* Gaertn. is another notable feature of this forest. However, the dominant species of the undergrowth *Nephrolepis biserrata*, and *Clidemia hirta* (L.) D. Don. are said to displace native vegetation at a rapid rate (Duenas- Lopez, 2022; Bhatta et al., 2023), hence requiring adoption of measures to control their populations followed by the re-establishment of undergrowth with native species.

The age structure of forest canopy tress was abundant in the 10 – 20 cm and 25 – 30 cm stem diameter classes (Figure 2) with an average DBH of 18.46 ± 10.04 cm. Canopy openness (24.13 ± 4.03%) and a forest stand structure deviating away from the typical reverse J shape (condition between positively skewed and normal) indicated a mid-succession stage of regeneration (Crawley, 1989). The age structure of dominant canopy species varied (Figure 3). Seedlings of *A. nobilis* and *A. cardiosperma* were scanty due to possible consumption of seeds by rodents, and this is a matter of concern for their future survival. In contrast, *D. zeylanicus* seedling population was exceptionally high in its dominant zone (Figure 3). Absence of *A. macrophylla* saplings suggest possible elimination because of competition with native species followed by stem exclusion during succession. However, monitoring growth of seedlings into saplings of both *D. zeylanicus* and *A. macrophylla* should not be overlooked in forest regeneration.

The forest vegetation was zoned into three major plant communities (*D. zeylanicus*, *M. elengi* community and mixed plant species) as indicated by the Bray and Curtis dissimilarity index at a dissimilarity range of 0.5 – 0.7 (Figure 4). This provided a solid scientific foundation to confirm the ambiguous zonation explained by tour guides during field visits. *D. zeylanicus* and *M. elengi* remained as indicator species in their respective communities (SI-Table 4). According to personal communication with owners, before clearing in the 1860s, Kodigahakanda was predominantly dominated by *D. zeylanicus* and the small patch which had been left since then is the area where it dominates at present. *A. nobilis* and *Goniothalamus* sp. were the characteristic species of the mixed plant community.

The CCA biplots indicated that soil moisture is relatively influential in species distribution. However, many species clustered around N, P, K, and C gradients indicated their preference for fertile soil, except for one stand which represented the rocky area (Figure 5).

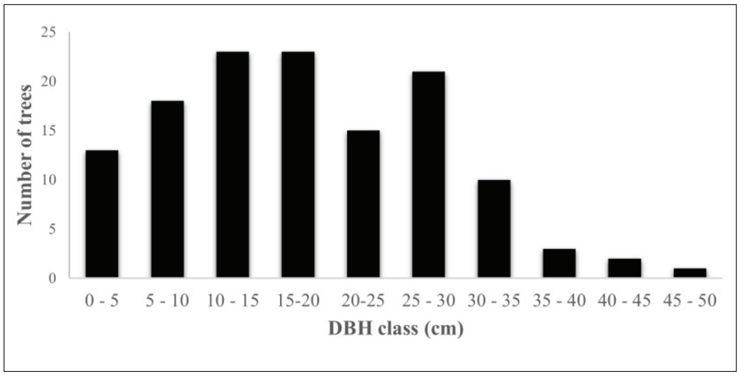

Figure 2: Diameter class categories of canopy trees

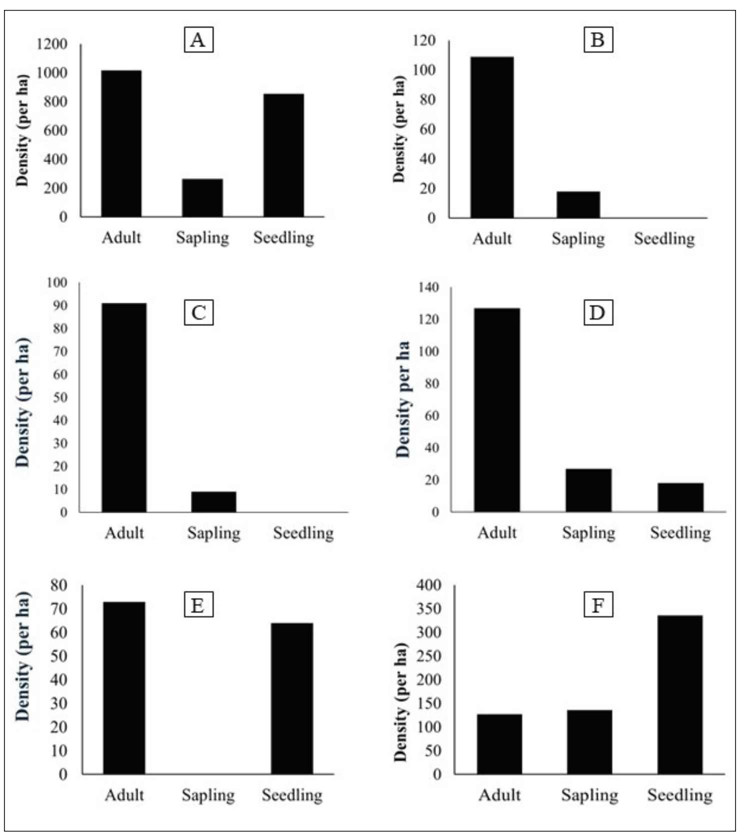

Figure 3: Age structure distribution of (A) all canopy trees, (B) *A. nobilis,* (C) *A. cardiosperma* (D) *M. lunu-ankenda*, , (E) *A. macrophylla,* (F) *D. zeylanicus*

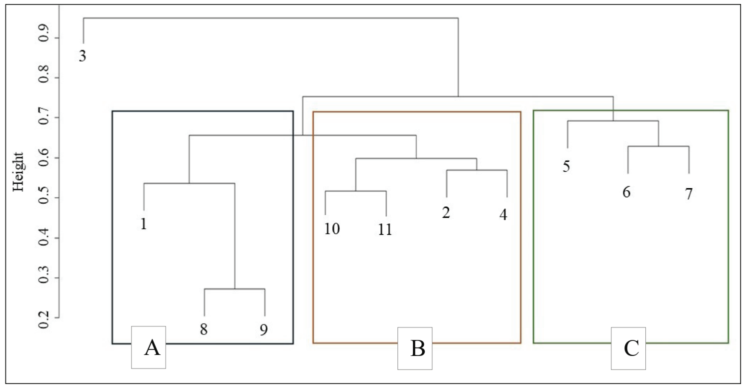

Figure 4: Bray-Curtis hierarchical clustering dendrogram of vegetation dissimilarity representing three communities; A): *D. zeylanicus* community, B): *M. elengi* community, and C): mixed plant community.

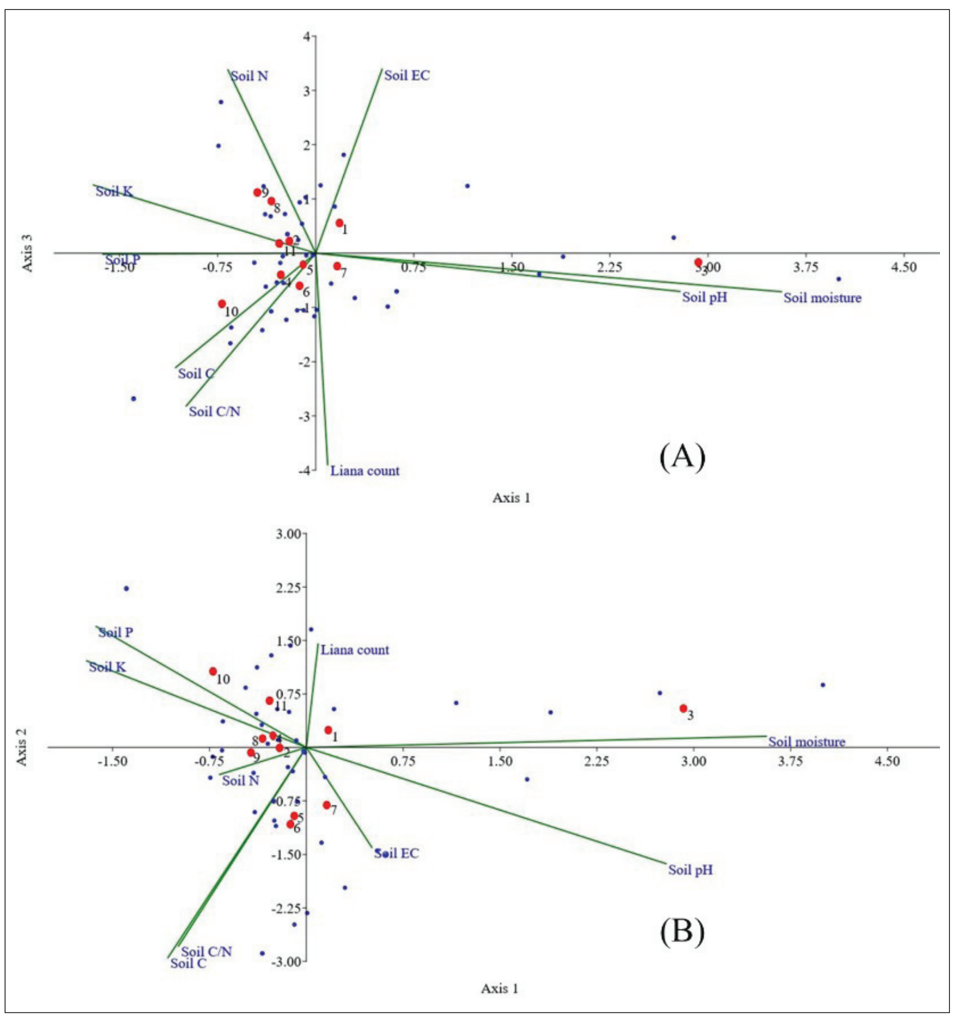

Figure 5: Canonical Correspondence Analysis (CCA) biplots of site heterogeneity analysis (A) between axis 1 & 3, (B) axis 1 & 2, for which high Eigen values were 0.669, 0.390, 0.351, respectively. Blue dots represent plant species, and red dots represent sampling plots.

Biomass and carbon stock of living trees

Trees and lianas contributed 80% and 20%, respectively, to the total woody biomass of the forest. In primary tropical lowland forests, liana biomass has been estimated to be 5 to 10% of the total woody biomass whereas in secondary forests it may approach 30% (Gerwing & Farias, 2000, Schnitzer & Bongers, 2011). The estimation of above and below ground carbon stock (CS) of Kodigahakanda forest was 134.82 ± 50.51 MgC ha^{-1} to which trees contributed 81.2% and lianas 18%. This low value is expected for a regenerating forest compared to optimum values estimated from closed forests such as Sinharaja, which accounted for 336.8 MgC ha^{-1} only for above ground carbon (Kumarathunge & Iqbal, 2009). The contribution of individual canopy tree species to the CS of the forest was driven by the relative stem cover of the three ecologically dominant tree species, particularly by large trees of *D. zeylanicus* (Figure 6A). The lowest CS was accounted for in sample stands with high liana stem count (Figure 6B) due to their thinner stems for sequestering CO_2 despite their efficient investment of energy compared to trees at the canopy level (Van der Heijden et al., 2013). Nevertheless, the forest exhibited a capacity to trap 494.8 tons of CO_2e/ha greenhouse gasses.

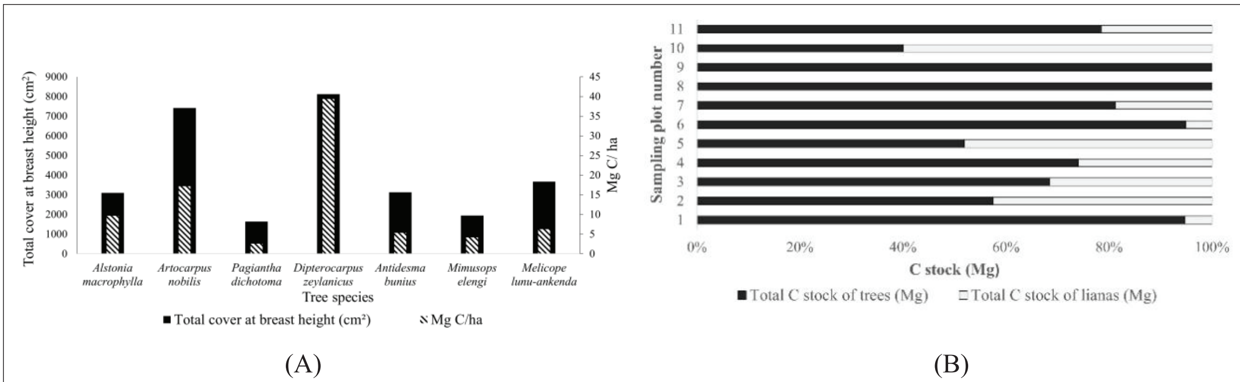

Figure 6: A) Carbon stock partitioning of canopy tree species, and B) trees and lianas in sample stands

Forest health, NDVI assessment, Index of greenness and suggestions for site improvements

An average NDVI value of 0.698 was obtained for Olaboduwa-Kodigahakanda indicating a dense green forest canopy despite its secondary origin. Generally, an NDVI value range of 0.6-0.8 indicates dense vegetation such as in tropical rainforests and a moderate range of 0.2-0.3 is typical for shrubs and grasslands (Weier & Herring, 2000; Meter group, 2024). A broad NDVI range of 0.44 – 0.77 across the forest indicates the heterogeneity of regenerating vegetation with lower values towards the eastern side and higher values in the core regions (Figure 7). The GI assessment ranged from 0.34-0.39 with an average of 0.36 and displayed similar ranges to Sinharaja (0.32-0.36 with an average of 0.34) and for Kanneliya (0.33-0.37 with an average of 0.35).

Being the watershed for the Thambili Dola stream, the Olaboduwa-Kodigahakanda forest requires to maintain a dense canopy; hence, enrichment planting of species that strengthen community structure, ecological succession and resilience is vital. Focusing on wild fruit trees would attract more birds and bats facilitating passive regeneration through ornithochory. Strengthening stream restoration would not only enhance aesthetics of the landscape but also to strengthen hydrological aspects and aquatic life functionally linking with the forest ecosystem. This is crucial since Tanki Dola remains a stagnant patch of water whereas in the past, four main streams ('Tanki Dola', 'Pili Dola', 'Nas Dola', and 'Dikgal Dola') descended from the forest (Hettiarachchi, 2004). Form-based restoration by physically altering components of a stream can restore its natural shape, enhance water flow and reduce erosion. Process-based restoration activities such as removing anthropogenic barriers to stream flow and pollution control are vital to maintain the health of the ecosystem (Wohl et al. 2015).

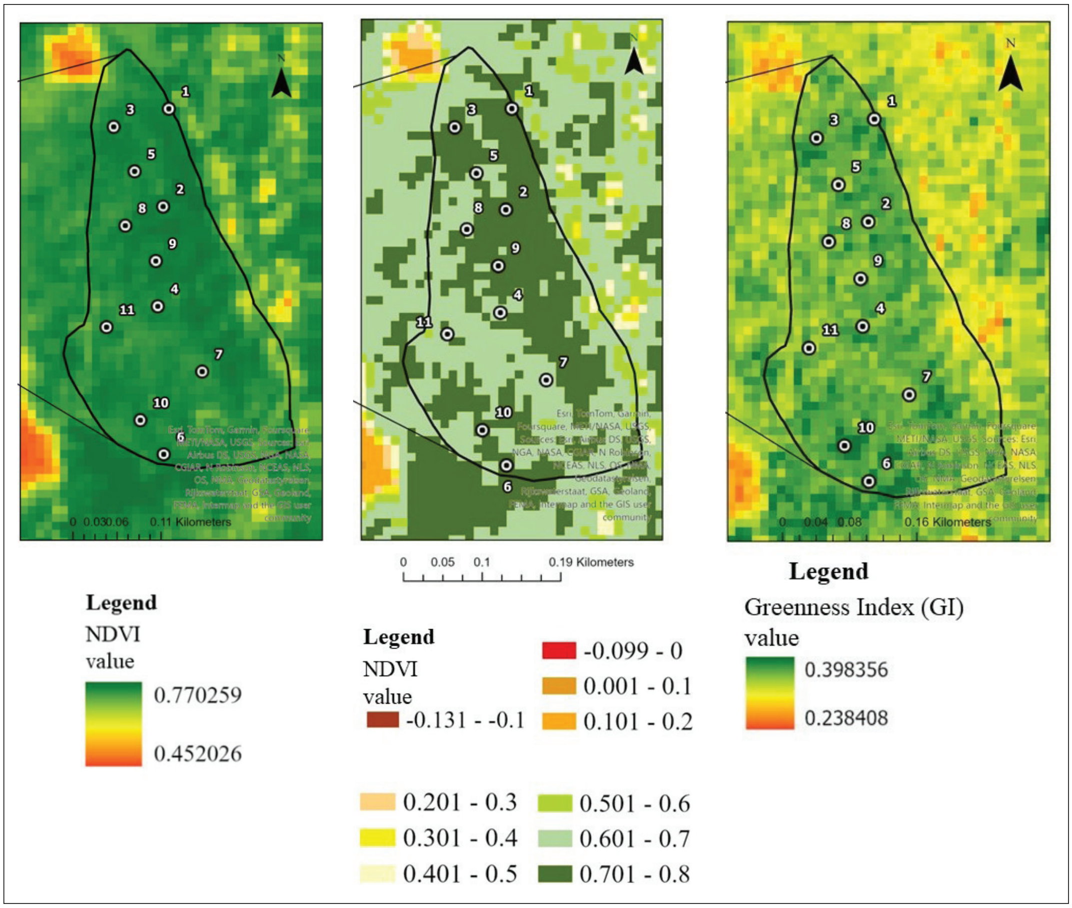

Figure 7: A) NDVI map (B) Classified NDVI ranks (C) Greenness Index (GI)

Recreation offerings and visitation

Olaboduwa-Kodigahakanda has been visited mainly by school children residing within a 10-25 km radius, mostly in groups of 20-50 individuals and occasionally 50-100. They are often involved in Scouting and Guiding activities (40%), environmental pioneer guides (28%), educational field visits (8%), and camping events (8%). Children from schools located beyond 25 km have visited only for day walks (16%). Educational visits often involve briefing students on identifying plants and animals, observing the heterogenous nature of vegetation, and learning the cultural importance of Kodigala. Adventure sports, notably rock climbing under guidance, are offered as outbound training offered for youth and adult groups.

It is apparent that marketing the aesthetics and other recreational offerings, carbon sequestration capacity and green status of the forest could widen opportunities for therapeutic relaxation, meditation, research, activity-based fun and learning-games that generate income while appreciating the natural environment. Especially at a time when economic needs drive people to take part in environmentally damaging practices, it is crucial to link local people with nature and improve attitudes and behaviors towards environmental consciousness and respect for the local natural wealth and culture. The civil organization associated with Olaboduwa-Kodigahakanda conducts tour guide training sessions for youth from the local community and connect them with visitor groups. However, only 12 school-aged individuals (including recent school leavers) work in this capacity on a paid basis. Besides this engagement, many opportunities exist for the local community, especially as food vendors and transportation providers.

Developing site-specific models of forest-based nature tourism with local community participation in a socio- environmentally responsible and economically viable manner is essential to ensure sustainability of nature-tourism. Such models have shown success in Sri Lanka despite limited efforts and commitments to uplift the industry (Wickramasinghe, 2013; Sumanapala and Wolf, 2020). Over the recent years, private forest owners have shown increased commitment to enhancing forest benefits and aspiring to conserving small forest patches (Fahrig, 2020, Mayer, 2019), which is considered vital by the UN Decade of Environment Restoration 2030 proclaimed by the United Nations General Assembly (UNGA resolution A/RES/73/284). Although public-private partnerships in forest management through nature tourism have been encouraged in Sri Lanka, private forest owners engaged in conservation, environmental education, nature tourism and community development have not received sufficient attention.

Introducing a policy-level strategy to link the forest ecology of small forest patches with sustainable nature tourism could be a practical approach to motivate private ownership and the neighborhood community to improve the production capacity and multiple benefits delivered by forests of small spatial scales supporting the conservation approach of a 'small habitat matrix' in mitigating climate change and forest degradation (Panagopoulos, 2009; Fahrig, 2020, Ng et al, 2020).

CONCLUSION

The structural and compositional characteristics that have developed over an in-destructible 40 years of forest succession at Olaboduwa-Kodigahakanda have provided insights into aspects of value addition to small forest patches. Together with its geo-morphological features, the areas floristic characteristics and wildlife have not only created a scenic landscape for recreational activities, but also an opportunity for revenue generation shared among the members of the local community engaged in tourism. To ensure long term sustainability of social values, ecosystem restoration and monitoring initiatives are recommended. A site specific forest-based tourism model with good governance and community participation will attract nature loving and conservation- oriented tourists, improving the image and prospects for Olaboduwa-Kodigahakanda while serving as a model destination for uplifting sustainable forest-based tourism.

Acknowledgement

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Supplementary information attached seperately.