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FLORISTIC RICHNESS AND RECREATION POTENTIAL OF POMPEKELLE FOREST RESERVE

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Abstract

Pompekelle Forest Reserve is a small urban forest in the heart of Ratnapura town in the lowlands of southwestern Sri Lanka. In a phytoecological survey, woody plants of more than 5 cm dbh were enumerated in samples of the hilltop, mid-slope and valley. Species richness, diversity, evenness, dominance and importance-value indices were calculated. A total of 116 species were found, belonging to 38 families. Species diversity and evenness were higher on the hilltop than in the valley. Species dominance was higher in the valley than on the hilltop and mid-slope. Trees of the Apocynaceae, Celastraceae, Dilleniaceae, Leguminosae, and Moraceae were prominent throughout. Separate communities were identified for the hilltop, mid-slope and valley. Endemicity was higher on the hilltop than on the mid-slope and in the valley. There was an abundance of regenerating canopy species, which indicates that the forest is fast recovering from past interference such as illicit felling. A long-term recreational development plan was prepared on the basis of the floristic data obtained in the present survey, a questionnaire survey with about 200 respondents, and a resource survey that used aerial photographs and "one-inch" maps. It was supplemented with a working plan that included detailed site drawings.

Introduction

Ecotourism has become a very attractive use option in developing countries that have tropical forests. The growing demand presents numerous opportunities for increasing sustainable local and national development, while at the same time protecting national parks and reserves so that the tropical forest and other cultural heritages remain intact. Promotion of tourism in these reserves may help to promote local pride and cultural awareness, while it also generates an income for the local population. However, this type of development requires cooperation by the public and private sectors of the economy (including the local people themselves) as well as adequate funding, planning, and innovative training, for the proper recognition of ecotourism.

Ecotourism may have undesirable economic, cultural and socio-economic effects if it is not practiced with great care. In a review of the economic analysis of ecotourism Steele (1995) expressed apprehension about how open access to renewable natural sites may lead to both economic and environmental inefficiency. He stressed the importance of strong ownership for the successful imple-mentation of ecotourism. In a study of protected areas and nature conservation on and near Iriomete Island, in Japan, Tisdell & Takashi (1992) claimed that the enforcement of conservation regulations appeared to be hampered, in both protected land and marine areas, by the lack of available government staff for surveillance; there had been continuing problems in reconciling increasing tourism with nature conservation. In an extensive study of the potentials and pitfalls of ecotourism in Belize, Costa Rica and Dominica, Boo (1990) reported that negative environmental impacts on the forest reserves had been minimal. However, as obstacles to the success of ecotourism, he picked out poor transport and accommodation infrastructure in the parks, inadequate promotion, lack of a park service, and lack of trained guides to give nature tours.

The main objective of the present study was to assist in the planning being done by the Ratnapura Municipal Council, by providing information on various ecological characteristics of the forest (floristic richness, diversity, endemism) and to prepare a plan for developing its recreational potential.

Study site

Pompekelle belongs to the category of forests collectively known as "Other State Forests", which individually are less than 200 ha in the dry zone or 20 ha in the wet zone, and are managed by the Local Administration. It is about 12 ha in extent, situated in the heart of Ratnapura town, and is administered by the Ratnapura Municipal Council. Prior to its being declared the Pompekelle Urban Forest Park, it had become a degraded patch of forest under the negative influence of human activities. It is now in the process of being developed for educational and recreational purposes by the Municipal Council, with the help and guidance of the Forest Department and other government agencies. There are about 86,000 people living in the area that comes under the Municipal Council. Some families live very close to, and even inside the forest. It used to be the catchment area for the reservoir located inside it, which supplied water to the town. However, the reservoir has now been abandoned because of siltation and pollution by human activity.

Because of its location in the wet lowlands of Sri Lanka, the vegetation is related to that of the other low-country wet evergreen forests. The mean annual rainfall is 3749 mm, with more than 206 rainy days per year, and the mean annual temperature is 27.5°.

Phytosociological survey

Size and shape of plots

Fixed-area plots were used, as this sampling method yields data such as a species list, and estimates of stem density, frequency, diameter-class distribution, basal area and

abundance. All woody plants with a dbh of more than 5 cm were enumerated in plots of 20 × 20 m. Within these large plots, smaller plots of 5 × 5 m were set out, in which saplings (< 5 cm dbh and > 1m in height) were enumerated. Within the 5 × 5 m plots, 1 × 1 m plots were laid out in which seedlings (woody plants < 1 m in height) were enumerated. For trees, a record was made of the number of species, number of individual trees, dbh, and height, For saplings and seedlings, only the numbers of species and of individuals were recorded. Herbarium specimens were prepared for plants unidentified in the field.

Number of plots sampled

In order to determine the number of plots to be sampled, the number of new species encountered in each new plot was plotted against the number of plots sampled. The point at which such a curve, projected, is going to intersect the horizontal axis gives an estimate of how many plots should be sampled.

Stand variables

The relative density of each species and the stem number density of each plot were calculated from the data collected. The basal area of each species for stems > 5 cm dbh were calculated within each plot.

Ecological indices

Shannon's ecological indices of diversity, evenness, and dominance were calculated for each plot by the following formulas:

Diversity: $H' = Pi \times \log (Pi)$

where Pi is proportional abundance

Evenness: $J' = H'/H'max$

where $H' max = \log S$, and S is the number of species

Dominance: $1 - J'$

Importance value index (IVI) = Relative density + Relative basal area + Relative frequency

Relative density = number of individuals of a species ÷ total number of all individuals

Relative basal area = total basal area of a species ÷ total basal area of all species

Relative frequency = frequency of one species ÷ total frequency of all species

Results

A total of 23 plots were sampled, each with an area of 400 m^2. Of these, 8 were on the hilltop, 8 on the mid-slope and 7 in the valley. Table 1 shows the numbers of new species found in these plots in each area.

Table 1: Distribution of sample plots by site type, and the number of new species found in each plot

Hilltop		Mid-slope		Valley	
Plot No.	No. of new species	Plot No.	No. of new species	Plot No.	No. of new species
1	11	2	16	5	14
4	9	3	11	6	16
7	12	8	6	11	5
9	8	10	5	14	0
12	0	13	4	19	4
16	5	15	2	20	5
22	3	17	4	21	2
23	2	18	0		

In all, 116 species were enumerated, belonging to 80 genera and 36 families; 36 were endemic species, belonging to 34 families. The hilltop showed the greatest floristic richness, diversity and evenness, followed by the mid-slope and the valley. The valley showed the greatest species dominance. The percentage endemicity was greatest on the hilltop, followed by the mid-slope and valley (Tables 2 and 3).

Table 2 : Floristic composition by site type

	Hilltop	Mid-slope	Valley
Number of plots	6	8	7
Total number of species	49	41	44
Total number of individual plants	134	198	144
Endemics as a percentage of the total number of individual plants	56	45	39

Table 3 : Average values of Shannon's indices of diversity, evenness and dominance by site types

Elevation	Diversity	Evenness	Dominance
Hilltop	0.175	0.168	0.832
Mid-slope	0.020	0.060	0.816
Valley	0.010	0.043	0.957

Trees belonging to the families Apocynaceae, Celastraceae, Dilleniaceae, Leguminosae, and Moraceae were prominent throughout the forest. There were 13 dominant tree species (based on IVI values): *Alstonia macrophylla, Anisophylla cinnamomoides,*

Alstonia scholaris, Artocarpus heterophyllus, Bhesa zeylanica, Dillenia suffruticosa, Garcinia quasita, Hedyotis fruticosa, Horsfieldia iriya, Humboldtia lourifolia, Kokoona zeylanica, Myristica dactyloides, and *Xanthophylum geminiflorum.* A complete list of the woody flora is given in an Appendix. The following tree communities were recognized on the hilltop and mid-slope:

Hilltop:

Canopy: *Vitex–Dillenia–Shorea–Mangifera*

Understorey: *Semecarpus mooni–Dillenia,* with saplings and seedlings of dominant and canopy trees

Mid-slope:

Canopy: *Dillenia–Chaetocarpus–Alstonia–Myristica*

Understorey: *Schumacheria–Hamboldtia–Garcinia–Dillenia–Syzygium,* with saplings and seedlings of canopy trees

The reduced floristic composition and diversity in the valley indicate that of the three areas it has been most subjected to human interference. The presence of a reservoir with public access could have made this worse. Although many references can be found in a series of papers by Gunatilleke & Gunatilleke (see for example Gunatilleke & Gunatilleke, 1985) to the presence of *Mesua, Doona, Dipterocarpus,* and *Shorea* species in the low-country wet-zone forests, they are almost non-existent in this forest; perhaps they have been selectively exploited in the past. Upon comparing the floristic richness of Pompekelle with six other lowland wet-zone forests, as reported by Gunatilleke & Gunatilleke (1985) it was apparent that although percentage endemicity was less, the numbers of species, genera and families in Pompekelle were comparable to those of the other lowland wet-zone forests.

The presence of pioneer genera, such as *Dillenia, Alstonia,* and *Schumacheria,* supplies further evidence that the forest had been extensively disturbed by human activities. The greatest number of stems sampled were in the 10-20 cm dbh class, and there were few trees of greater dbh. This finding also indicates that the forest is still regenerating, and fast recovering from human disturbance.

Survey of recreational potential

Data gathering

A questionnaire survey was conducted among about 200 people, including school children, teachers, businessmen, government workers, and others who live in and around Ratnapura. They were selected randomly, as individuals. Aerial photographs and ground survey maps were used to evaluate forest cover and to locate the boundary of the forest reserve. The existing resources were marked on the maps. This work was supplemented with field observations of the forest. The observations of the phytosociological survey were also utilized.

A working map was prepared from the existing maps and the data. It shows the the type of developmental activities proposed, the sites where they will be located, the time

needed for development, and any recognizable problems. Detailed drawings were prepared for each activity proposed.

Results and discussion

It was apparent that the reserve had already been used for activities such as hiking, picnicking, nature watching, swimming, etc., although at a low intensity. After it was made into an urban forest park its use by children from schools in and around Ratnapura greatly increased. Almost all the respondents to the questionnaire survey, selected randomly from a cross section of people with diverse backgrounds, agreed that more recreational facilities should be provided. This shows the enhanced awareness of the general public in the appreciation of nature.

It is proposed to include the following activities in the forest reserve in the future. Figure 1 shows their location in the reserve. Because of the limited funds available, it is proposed that development should be in three stages according to priority:

Initial stage. Construction of more nature trails, more picnic benches, summer huts, a research centre, toilets, a car park, camping facilities, a room for a permanent guard, rehabilitation of the reservoir, trails for bird and butterfly watching, labelling the trees along the trails with both botanical and local names, introducing a demonstration medicinal garden, planting the disturbed areas with native trees, planting bamboos and ornamental trees in the valley. It is proposed to introduce a guide service to assist visitors, as a lack of trained guides to give nature tours has been found elsewhere to be an obstacle to successful ecotourism (Boo, 1990).

Second stage. Building a lodging facility and a snack bar. The need for these depends on the attraction of visitors to the site which in turn depends greatly on the amount of publicity given to the forest park. Therefore, it was proposed to give increased publicity to the forest by way of electronic and print media, leaflets, signboards by the roadside, and other promotional activities. All the infrastructure building will be done in the disturbed area. The hilltop will be made the least accessible part as there is greater species richness and diversity compared with the other sites, and from the ecological point of view it is the most worth protecting.

In order to generate funds for the effective maintenance of the forest park it is proposed to introduce an appropriate entry fee. It has been observed by many researchers that an entry fee does not deter tourists from visiting, if they think the forest is worth a visit (Tobias et al., 1991; Maille et al., 1993).

However promising the introduction of recreation facilities may seem, negative environmental impacts could occur. They may include littering, cutting trees for camp fires, making huts, etc., and disturbance with damaging effects on the behaviour and ecology of resident wildlife. Observations on these effects have been reported by

Whelan, 1979; Griffiths et al., 1993, Lippold, 1990). Fines should be imposed to deter these malpractices. Assignment of a guard to overlook the entire forest and to make sure that all activities go according to plan is strongly recommended.

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Appendix – The floristic composition of Pompekelle (woody plants > 5 cm dbh)

Family	Scientific name	Local name
Anacardiaceae	*Semecarpus mooni*	badulla
	Mangifera zeylanica	etamba
	Campnosperma zeylanica	aridda
	Mangifera indica	amba
Annonaceae	*Artabotrys zeylanicum*	yakada wel
	Xylopia parvifolia	netaw
	Uvaria merum	bu pattika
	Uvaria zeylanicum	palukan
	Polyalthia saberosa	kalati
Apocynaceae	*Plumeria acuminata*	araliya
	Alstonia macrophylla	hawarinuga
	Alstonia scholaris	rukaththana
	Pagiantha zeylanica	divikaduru
Burseraceae	*Canarium zeylanicum*	kakuna
Celastraceae	*Bhesa zeylanica*	pelanga

	Kokoona zeylanica	kokoon
Clusiaceae	*Garcinia quasita*	rath goraka
	Garcinia echinocarpa	madol
	Callophyllum thwaitesii	keena
	Mesua nagasarium	na
Connaraceae	*Connarus championii*	radalia wel
Convolvulaceae	*Argyreia populifolia*	girithilla wel
Dilleniaceae	*Dillenia suffruticosa*	malpara
	Tetracera sarmentosa	corasa wel
	Wormia triquetra	diyapara
	Schumacheria castanaeifolia	kekiriwera
	Dillenia retusa	godapara
Dipterocarpaceae	*Shorea trapezifolia*	yakahalu dun
	Shorea congestiflora	tiniya dun
Ebenaceae	*Diospyros insignis*	
Elaeocarpaceae	*Elaeocarpus seratus*	weralu
Euphorbiaceae	*Chaetocarpus castanaeocarpus*	hadawaka
	Bridelia mooni	patkela
	Macaranga peltata	kanda
	Breynia rhamnoides	gas kela
	Aporosa lanceolata	heenkirilla
Lauraceae	*Neolitsea cassia*	davulkurundu
	Litsea longifolia	ratkeliya
	Cinnamomum multiflorum	walkurundu
	Cryptocarya wightiana	gulumora
Leguminosae	*Entada scandens*	puswel
	Humboldtia lourifolia	galkaranda
	Adenanthera aglaeosperma	masmoru
	Aberima bigemina	kalatiya
	Tamarindus indica	siyambala
	Crotalaria retusa	keppetiya
Liliaceae	*Dracaena thwaitesii*	dracaena
Melastomaceae	*Melastoma malabarica*	mabovitiya
	Axinandra zeylanica	polluna
	Memecylon gardneri	pinibaru
Meliaceae	*Melia dubia*	lunumidella
	Pseudocarpa championii	gonapana
Moraceae	*Artocarpus heterophyllus*	jak
	Artocarpus nobilis	bedidel
	Ficus nervosa	nuga
Myristicaceae	*Myristica dactyloides*	malaboda
	Horsfieldia iriya	iriya
Myrtaceae	*Syzygium firmum*	wal jambu
	Syzygium opeculatum	batadomba
	Syzygium caryophylatum	dan
	Syzygium rubicundum	pinibaru

Myrsinaceae	*Ardisia solanaceae*	baludan
	Apama siliquosa	tapasara bulath
Palmae	*Caryota urens*	kitul
(Arecaceae)	*Calamus digitatus*	kukulu wel
Polygalaceae	*Xanthophyllum geminiflorum*	kele gas
Proteaceae	*Grevillea robusta*	sabukku
Rhamnaceae	*Ziziphus napeca*	maha eraminiya
Rhizophoraceae	*Anisophylleades cinnamomoides*	welipiyanna
Rubiaceae	*Hedyotis fruticosa*	weraniya
	Ixora coccinea	wal rathmal
	Ophiorrhiza mungos	dathketiya
Rutaceae	*Acronychia pendunculata*	ankenda
	Evodia lunuankenda	lunu ankenda
	Toddalia asiatica	kudimirrisa
Sapindaceae	*Harpullia arborea*	na imbul
	Glenniea unijuga	malmora
	Nephelium lappaceum	rambutan
	Filicium decipiens	pihimbiya
Sapotaceae	*Madhuca fulva*	wanamee
	Isonandra lanceolata	mol padda
	Chrysophyllum roxburghii	laulu
Smilaceae	*Smilax zeylanica*	kabarasa wel
Sonneratiaceae	*Glochidion zeylanica*	kirilla
Symplocaceae	*Symplocus coccincinensis*	bombu
Ulmaceae	*Trema orientalis*	gadumba
Verbenaceae	*Tectona grandis*	teak
	Clerodendron infortunatum	gas pinna
	Vitex altisimma	milla
Zingiberaceae	*Costus speciosus*	thebu