### Environmental Education on Biodiversity and Forest Restoration via Exploring a Nature Tour at the IFS-Popham Arboretum in Sri Lanka

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#### ABSTRACT

IFS-Popham Arboretum is a sanctuary of tropical trees and a wildlife refuge, which had turned shifting cultivation land to a productive forest through a simple silvicultural method. The Arboretum had been gifted to the Institute of Fundamental Studies in 1989 for conservation, research and education. In 2005, the Arboretum was developed as a visitor and research center under the management of Ruk-Rakaganno, a national NGO. The key role of the Arboretum, since 2005, is to conduct workshops and awareness programs, stewardship programs, train naturalists, and provide nature tours for visitors. This study examines visitor information and relevant education methodologies of the IFS-Popham Arboretum used in educational and awareness programs conducted for school children, university students and naturalists from 2005 to 2013. The educational technologies mainly included integrating classroom teaching with field trips promoting self-studies, which is vital for learners to explore, visualize and to understand ecological processes and the nature in the dry zone naturalized forest ecosystem effectively. We evaluated the students' interests on the awareness program. The primary school kids were mainly interested in self-active learning methodologies i.e. observing, drawing the feeding behavior of jungle fowls, imitating birdcalls, while the middle school children were interested in learning seed bank collection of the dry zone plants, bird watching and plant-animal interactions. The university students were concerned about the silvicultural methods, taxonomy and ethno-botany of dry zone plants. We conclude that different integrated environmental education programs should be formulated according to the interest, nature and age of different focal groups.

Keywords: Biodiversity, environmental education, forest restoration, IFS-Popham Arboretum

### **INTRODUCTION**

Environmental education (EE) is a process that allows individuals to explore environmental issues, engage in problem solving, and take action to improve the environment. As a result, individuals develop a deeper understanding of environmental issues and have the skills to make informed and responsible decisions in future (Meredith, 2000). Exploring the environment is an essential component of science education in school, college and university curriculum. However, classroom teaching of the nature of the environment is not merely useful unless the teaching integrates field studies. Learning biodiversity and ecological processes *in-situ* environment is effective, since it opens learners to experience on environmental phenomena through visual observations. For example, learning plant-bird interaction is successful, when learners have a chance to observe bird behavior within the field. By understanding the importance of EE, government and non-governmental organizations facilitate a variety of environmental programs especially designed for school children and university students.

Sri Lanka is a country known for her scenic beauty and is recognized as one of the biodiversity hotspots in the world along with Western Ghats (Myres, 2000). Diverse vegetation types of the island mainly governed by climatic conditions i.e. varying rainfall patterns, and the elevation gradients.

Despite the country's ecological values, several forest reserves and wildlife parks have been declared as biodiversity conservation areas. IFS-Popham Arboretum is a sanctuary of tropical tees in the dry zone of Sri Lanka, which harbors a rich floristic composition resulting high faunal diversity. The Arboretum has historical importance since it was created from an abandoned shifting cultivation land using a simple silvicultual method adopted by Sam Popham (Popham, 1993). The Arboretum is a typical example for restoration of a degraded forest using assisted natural regeneration in the dry zone of Sri Lanka (Dilhan, 2006).

The key features of the management of the Arboretum are less labor intensive and cost effective. For example, it only takes eight consecutive labor days to manage an acre of the Arboretum at the fifth grass-cutting round (Jayantha Amarasinghe personnel communication). Furthermore, the average cost for the silvicultural management of the Arboretum in 2009 was US\$ 143/ha/year (Dilhan et al., 2009). There were only five laborers worked during Sam Popham era, the creator of the Arboretum, to manage ca. 15 ha of the Arboretum. The silvicultural managements practices adapted in the Arboretum were ground sanitation (i.e. seasonal grass cutting to trigger seedling germination), maintained firebreaks, thinned thorn and climbers, and application of chopped dead wood branches to soil (Dilhan et al., 2010).

The Arboretum is opened merely for the public during Popham time. In 1989, the Arboretum had been gifted to the Institute of Fundamental Studies (IFS) to hold in trust for the nation. The Arboretum was handed over to Jayantha Amarasinghe, a Curator of the Arboretum, by Popham when he left the country in 1999. From 1999 to 2005, the curator had been instrumental in managing the Arboretum with limited resources and funding. In 2005, RukRakaganno, a national NGO, undertook the management of the IFS-Popham Arboretum. Since 2005, the Arboretum has been opened for visitors and awareness programs and workshops, tours have been conducted. In addition, multi-scale research projects, training naturalists, guiding visitors, social networking outlets and maintaining plant nurseries have been implemented. There were three nature trails developed in the Arboretum: (a) Blue Trail meandering along the firebreak in the woodland towards the northern fringe of the Mee Ella Catchment and then goes east towards un-cleared scrub and turns North again to the cottage (b) Green Trail passes through the conserved low scrub in the woodland and (c) Yellow Trail starts behind the annex and goes north into the conserved low scrub (Fig. 1). It is important to monitor the success of the EE programs offered by the Arboretum. However, so far a limited information is available. This study examines the visitor information, interest and perception of visitors of the IFS-Popham Arboretum about educational and awareness programs conducted for school children, university students and naturalists from 2005 to 2013.

# METHODOLOGY

The visitor information for the Arboretum was documented from the list of donations/entrance fees records, visitors' guest book records, workshop participants and the student evaluation forms. The school awareness programs were conducted through visitor promotion campaigns, media awareness and sending invitations etc. We recorded the number of students and teachers attended the Arboretum from schools, universities and other institutions. A small stakeholder activities such as, identifying birds in nature trails, recording sounds within habitats, understanding seed dispersal mechanism etc. were assigned to small groups, when conducting workshops. The levels of interest of various activities, its feedback and the perception on adapted education methodologies were recorded using a piloted and structured questionnaire.



Figure 1. A map of the Popham Arboretum showing the three nature trails

Visitor perception on education methodologies were evaluated by participation observation (e.g. preschool children), structured interview (e.g. all categories of visitors), and structured questionnaire (school children in higher grades, university students, teachers and adult general public). We examined the visitor guest book to evaluate the naturalists interested in the arboretum. In addition, we evaluated the visitor's feedback on the Arboretum visits from "Sam Popham Arboretum Facebook" and the "Trip adviser web site".

### **RESULTS AND DISCUSSION**

#### Visitor records

Visitor records were accounted from 2005 formally with the management of *Rukrakaganno*. However, the first-year of the management (from 2005 to 2006) used up for developing the visitor center, creating the nature trails, and silviculturally managing the Arboretum. Thereafter, we paid much attention to bring school and university students to the Arboretum for the EE programs. Because of the time-lapse the results of student visitor attendance and general visitors attendance are presenting separately. Furthermore, students interest on the Arboretum activities are quantitatively analyzed to understand the best educational program and perceiving technologies for different cliental groups.

The results of the study showed that the largest number of school children (756 students with 49 teachers) have visited the arboretum in 2007. In 2010 and 2011, visitors for the Arboretum were comparable with visitor attendance doubling in 2012 (438 students and 23 teachers). The largest number of university students (131 students) visited the Arboretum in 2010 (Fig. 2). This increase in visitor participation resulted from effective school awareness programs and workshops for university students conducted through visitor promotion and media campaigns.



Figure 2. Student visits to the Arboretum from 2007 to 2013

The average monthly visitor attendance from the educational institutes for the Arboretum was 58 over 7 years. A few larger numbers of visitors visited the Arboretum in March and September in 2007 and November in 2012 (Fig. 3). There is a higher trend of visiting Arboretum in September and December. These results are related with the school children participation at the beginning of school after August vacation and before the December vacation.



Figure 3. Monthly student visits to the Arboretum from 2007 to 2013

We analyzed the information of local and foreign visitors' attendance at the Arboretum from 2005 to 2013 (Fig. 4).



Figure 4. Visitor information of the IFS-Popham Arboretum from 2005 to 2013

The local visitors' visiting the Arboretum is comparatively higher than that of foreign visitors' over the years. There is a peak of local visitors in 2006 resulted in visitor promotion campaign by hotels and media. However, foreign visitors' visiting the Arboretum is levelled off from 2005 to 2009 and thereafter it is increased.

We evaluated the students' interests for the activities conducted through the awareness program. The kids from the primary schools were mainly interested in self-active learning methodologies such as, observing and drawing the feeding behavior of jungle fowls (65%), imitating birds calls i.e. Whiterumped Shama (25%), and seeing visitor center museum (10%). In addition, kids were interested in fun activities such as, nature trails on the wooded bridge, rocky outcrop and the Arboretum creek (Fig. 5).

The middle school children were interested in learning seed bank collection of the dry zone plants (50%), bird watching (30%) and observation of plant-animal interactions (20%). The university students were concerned about plant systematics and ethno-botanical values of dry zone plants (73%), faunal taxonomy (14%), and landscaping of the Arboretum (13%).

The Arboretum is home to nocturnal animals, such as Grey Slender Loris (Fig. 6A) and therefore some visitors were accommodated in the Arboretum to observe the species (Vitarana and Weerarathna, 2008). The Arboretum is a refugee for Jungle fowls and visitors can observe them at the cottage often (Fig. 6B). The Arboretum appears as a living museum of biodiversity and therefore visitors are excited watching animals and rare plants.



Figure 5. The awareness programs conducted at the Arboretum. (A) Primary school children tour along the nature trails on the wooded bridge, (B) Awareness program for middle school children, (C) Rajarata University students participation for systematics and ethno-botany workshop, (D) Community awareness program on medicinal plants at rocky outcrop

![](_page_5_Picture_4.jpeg)

Figure 6. (A) Grey Slender Loris habitat at the rocky outcrop (B) Jungle fowls feeding point at the cottage

## Visitors' perception

Visitors' perception on education at methodologies and interest were evaluated by participation observation, structured interview, structured questionnaire, and visitors' suggestions published through web sites and "Face book". Results of visitors' perception on most preferable experiences and methodologies were recognized (Table 1). The different visitor groups show different interests and different methodologies to fulfil a broader understanding of natural ecosystem.

Table	01:	Visitor	perception	on	education	methodology/most	preferred	events	in	nature	
exploitation at IFS-Popham Arboretum in Dambulla											

Category of visitors	Highly preferred teaching methodologies/events in nature	Percentage of frequency
Pre-school and pre- adolescent age students (less than 10 years in age)	Integrated, active, flexible and students centered EE methodologies such as group activities and games (15 students per group). Examples, climb on trees, games, songs, imitate bird's behavior and sounds, collecting: flowers, leaves, fruits etc., and categorization according to shape and color, and make drawings. More attention is on animals. Maximum activity period is one hour.	68%
Adolescent (11-18 years) students at higher grades	They themselves make small groups (5-7 individuals) nature tours, exploration works. They seek more heavy works that is independent. Sometimes they attempt to withdraw from our schedule. They mostly preferred free self-innovation methodologies. For this group we act as guides for self-study. They were given some attention on diversity of plants, categorization and understanding seed dispersal mechanisms, and plant animal relationships. They questioned mainly on nighttime birds and animals as well as poisonous snakes. In addition, they were more interested with knowledge of nature by discussion, couple with their school curriculum. They preferred spending more time to do self-evaluation of nature. Even they preferred night camps. Additionally, they paid attention on nature conservation.	56%
University students	They preferred recognizing more advanced phenomena in the dry zone ecosystem. They were keen in adapting theoretical knowledge in the real world scenario. Additional knowledge was required for them to identify the plants and its ethno-botanical values and animals (especially birds). We provided field guidebooks as references. In addition, they were interested in regeneration ecology, silvicultural practices, plant-animal interaction, biomass carbon accumulation, soil litter and formal activities and dynamics of forests etc. They were interested on basic floristic and ecological surveys on forest ecosystem. They highly concerned on protection of nature.	75%
General public	Diverse interest, mainly they preferred recreational tours with explaining about the history of the place, architectural design of the cottage, nature trail visits and wildlife gardening, and creating mini Arboretum in their premises. Most of the people in this category preferred to spend only 3 to 6 hours' time to explore the Arboretum	50%

Environmental educators should be able to fulfill diverse clientele's needs with different appropriate approaches. To sustain the task instructors in EE centers have to be trained developing their teaching-learning methods to fulfill the multidisciplinary nature and the physical setup of the center also has to be arranged accordingly. In addition to the above mentioned client groups we highly recommend to conduct workshops, seminars and educational visits to school teachers and community leaders. There

are numerous strategies that have been employed to develop the EE competencies of both pre-service and in-service teachers (UNESCO, 1987). These strategies include required courses in EE for preservice teachers, infusion of competency developing experiences in pre-service methods courses, inservice workshops, graduate courses, degrees, and conferences. IFS-Popham Arboretum will be a good living museum, which provides nature friendly environment to enhance EE knowledge for educators.

#### CONCLUSIONS

We conclude that different integrated EE programs should be formulated according to the interest, nature and age of different focal groups. The EE programs directed at school children and naturalists in the Arboretum have influenced learners' keen interest in protecting the valuable plants and/or planting trees in their home gardens to support wildlife gardening.

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