KFRI Research Report 360

Establishment of Three Model Bioparks for Promoting Awareness on Nature Conservation

George Mathew

K. Yesodharan

Kerala Forest Research Institute

Peechi-680 653, Kerala, India

November 2010

KFRI Research Report 360

Establishment of Three Model Bioparks for Promoting Awareness on Nature Conservation

(Final Report of the project KFRI/508/2006

Submitted to the Western Ghats Cell, Planning and Economic Affairs Department, Government of Kerala, March 2006 to December 2006)

George Mathew

Forest Health Division

K. Yeshodharan

Division of Forest Ecology and Biodiversity Conservation

Kerala Forest Research Institute
Peechi-680 653, Kerala, India

K F R I

November 2010

Abstract of Project Proposal

Project No. KFRI/508/2006

Title of the Project: Establishment of three model Bio-parks for promoting awareness on nature conservation

Objectives:

- To establish Bio-parks through student participation to generate conservation awareness.
- Promote imagination and creativity of students by enabling them to make observations on plants and animals in the parks established.

Date of Commencement: March 2006

Scheduled Date of Completion: March 2007

Project team:

Principal Investigator: Dr. George Mathew, Scientist, Entomology Discipline, Forest Protection Division

Associate: Dr. K. Yesodharan, Scientist, Botany Discipline, Division of Forest Ecology and Biodiversity

Study Area: Model Boys' Higher Secondary School, Trichur and Centre for Water Resources Development and Management, Kozhikode

Duration of the study: One year

Project Budget: Rs. 4, 50, 000/ -

Funding Agency: Plan Grants

Contents **Page No.**

Abstract *i*

1. Introduction 1

II. Materials and Methods 3

Ill. Results 4-12

1. Selection of institutions for setting up Bio-park

2. Park establishment

3. Components of the park

4. Constraints in setting up Bio-parks in Schools

IV. Conclusions 13

V. Acknowledgements 13

VI. References 14

Fig. 1. General design of a Bio-park
Fig. 2. Design of Bio-park established at CWRDM, Calicut
Fig. 3. Design of Bio-park established at Model Boys'H.S.S. Trichur
a- Entrance; b- Trek path; c- Butterfly Garden; d- Aqua Garden;
e- Star Forest; f- Rock Garden; g- Medicinal Plants Garden;
h- Lawn.

Abstract

With a view to promote conservation awareness among students and the public, two Bio-parks were established- one in a School (Trichur Model Boys' H.S.S., Trichur) and the other in an Academic Institution (Centre for Water Resources Research, Development and Management, Kozhikode). The park comprised distinct functional themes such as star forest, medicinal plants garden, butterfly garden, rock garden, ferns and epiphytes as well as an aqua garden. Constraints in the establishment and maintenance of Bio-parks are also briefly discussed.

1. Introduction

India, with its diversified ecosystems ranging from the snow-clad boreal forests of the Himalayas to the wet evergreen forests of the Western Ghats and the deserts of Rajasthan, is one among the twelve mega diversity countries in the world supporting a rich and varied assemblage of biodiversity. Depletion of flora and fauna, mainly due to human interference is a major factor leading to loss of biodiversity. It has been stated that at the present rate of habitat loss, about one third of biodiversity in India would face extinction by 2030 (Nayar, 1997). Species loss has tremendous implications on the survival of mankind in this universe.

Species found in the Indian sub continent are highly diverse being drawn from different biogeographical realms as indicated by their affinities. Out of the various biomes present in India, the tropical forests and the oceans are the most important in terms of biological diversity. However, because of the large human population in India, there is considerable pressure on forests as well as oceans. As a result, a major share of biodiversity present in these ecosystems is being depleted at a fast pace leading to disappearance of many species of life forms. While the large organisms attract attention of the conservationists, the smaller organisms belonging to the lesser known groups are largely ignored. It is a well established fact that many of the lower groups of organisms play an important role in the functioning of natural ecosystems. Apart from their ecological value, they are also presumed to have great economic value as possible sources for many newer generation medicines and for various commercial uses. Considering the ecological and economic significance of these life forms, they need to be conserved. Creation of awareness among the children and the public is very essential for the success of any conservation programme. It was with this intention that this project was formulated under the Chief Minister's Special Programme. The specific objectives of this project are:

i) To establish Bio-parks through student participation to generate conservation awareness, and

ii) To promote the imagination and creativity of students by enabling those to make observations on plants and animals in the parks established.

Outline of the project

Kerala, situated in the southwest corner of India, covers an area of about 38863 km^2. Geographically, three zones are present- the coastal zone, the mid land and the high ranges. Each of these zones has very specialised biota. However, due to the developmental activities of man, most of the natural ecosystems are under stress leading to the disappearance of characteristic flora and fauna. Under this programme, it was proposed to assemble plants belonging to different taxonomic categories in a Bio-park so that their ecological and economic significance could be demonstrated to the students and the public. Animals depend on vegetation for their sustenance. Activities involving introduction of plants in various functional groups such as medicinal plants, orchids, aquatic plants, xerophytes and succulents, gymnosperms, ferns, grasslands and Star plants in the Bio-park will eventually lead to the formation of typical habitats for a variety of organisms ranging from insects and spiders to reptiles and birds, many of which at present are facing threats of extinction due to the unprecedented developmental activities of man. Being an action-oriented programme involving student participation, this programme will eventually generate interest among children to foster nature and biodiversity.

II. Materials and Methods

Selection of institutions for setting up Biopark

Several rounds of discussions were made with various Institutions in each of the zones for selecting an appropriate institution.

Design of the park

Since the major objective of the Bio-park is to enable to familiarize the students with various groups of plants and animals, the park was designed in such a way that representative flora drawn from various plant groups such as epiphytes, xerophytes, aquatic plants, gymnosperms and ferns were introduced. Since the area available for setting up a Bio-park in many Schools is rather limited, one of the targets was to go for a miniature or modular Bio-Park which could be accommodated within the bare minimum area. When the area available is rather limited, plants representing various themes may be introduced in a mosaic manner. When sufficient land is available, the plants can be introduced in distinct functional themes such as star forest and medicinal plants garden, butterfly garden and aqua garden in order to highlight the significance of biodiversity in culture and well being of humanity. A plot of 25m x 25m covering an area of about 625 m^2 area was found to be quite sufficient for setting up a small Bio-park with all the above components.

The main entrance to the garden can be through a main gate depicting a logo indicating the themes involved. The main components were set up on either side of a trek path of about 1.2 m width leading from the main entrance. The path can be paved with laterite or country bricks based on availability and either side of the path can be landscaped, with provision for irrigation and maintaining sufficient humidity, so as to set up appropriate habitats for introducing epiphytes, aquatic plants, xerophytes and succulents and so on.

III. Results

1. Selection of institutions for setting up Bio-park

A number of government schools were short listed in the three zones and several rounds of discussions were held with the school authorities on the possibility of setting up the Bio-park in their school. Most of the school authorities were reluctant to have this facility due to various reasons such as scarcity of land, water shortage, security constraints, lack of infrastructure for maintaining the facility, possible transfer of staff, reluctance to involve students (mainly due to the fear that it might affect their academic performance) or due to apprehensions about running the facility after the project period. Since most of the government school authorities were reluctant, it was decided to consider research institutions as well. After several rounds of search for locating an appropriate institution in the three geographical zones in the State, the following institutions were selected:

1. Centre for Water Resources Research, Development and Management, Calicut.
2. Model Boys' Higher Secondary School, Trichur Centre for Earth Science Studies, Trivandrum.
3. Centre for Earth Science Studies, Trivandrum.

2. Park establishment

Depending upon the extent of land available in each of the institutions selected above, separate designs were prepared for each of the institutions selected. The park design for the various institutions is presented below.

<u>Centre for Water Resources Research, Development and Management (CWRDM), Calicut.</u>

A site of 150m x 30m adjacent to the Water Museum in CWRDM campus was selected. The land was weeded and a 150 m long undulating trek path of 1.2 m width was laid out

using laterite blocks. The area was landscaped so as to introduce various themes such as lawn, star forest and medicinal plants garden, butterfly garden and aqua garden. Necessary infrastructure including gate, fence, arches for growing creepers, gadgets for irrigation and watering the plants as well as public amenities (benches, drinking water etc.) were set up (Figs. 1, 2).

Model Boys' Higher Secondary School, Trichur

A site of 30m x 15m located between two school blocks in the campus was selected. The land was weeded and a 50 m long undulating trek path of 1.2 m width was laid out using concrete blocks. The area was landscaped so as to introduce various themes such as lawn, star forest and medicinal plants garden, butterfly garden and aqua garden. Necessary infrastructure including gate, fence, arches for growing creepers as well as gadgets for irrigation and watering the plants public amenities were also set up (Figs. 2, 3).

Centre for Earth Science Studies, Trivandrum

A site (45m x 25m) adjacent to the main office building was selected. Design and estimates were prepared. However, the work could not be implemented due to technical difficulties.

Components of the park

As indicated above, out of the three locations selected, Bio-parks could be established only at two locations *viz*, at the Model Boys' Higher Secondary School, Trichur and at CWRDM, Calicut. In the former, an area of only 450^2 m was available and hence the plants were introduced in a mosaic manner. In the latter, 4500 m^2 was available and the plants were organized into distinct functional themes. Separate sign boards displaying details of each theme along with separate labels for the plants introduced were set up in the garden. The project area was fenced. Details of the various components of the Bio-park are furnished below.

1. *Medicinal plants garden*

Medicinal plants belonging to 15 families were introduced as r detailed in Table 1.

Table 1. List of medicinal plants introduced in the Bio-park

Family	***Species***
Amaranthaceae	*Achyranthes aspera, Aerva lanata, Alternanthera sessilis*
Aristolochiaceae	*Aristolochia indica, Thottea siliquosa*
Liliaceae	*Asparagus racemosus, Gloriosa superba*
Scrophulariaceae	*Bacopa monnieri*
Fabaceae	*Bauhinia acuminate, Cassia tora, Clitoria ternatea Desmodium gangeticum, Desmodium gyrans, Mimosa pudica, Saraca asoca, Biophytum candolleanum.*
Oxalidaceae	*Boerhaavia diffusa*
Asclepiadaceae	*Calotropis gigantea, Gymnema sylvestre, Hemidesmus indicus, Holarrhena pubescens Tylophora indica*
Apocynaceae	*Catharanthus roseus*
Rutaceae	*Citrus medica, Glycosmis pentaphylla, Murraya koenigii*
Capparidaceae	*Cleome viscose*
Verbenaceae	*Clerodendron paniculatum, Gmelina arborea*
Lamiaceae	*Coleus parviflorus*
Zingiberaceae	*Curcuma aromatica, Costus speciosus, Kaempferia galangal, Zingiber officinale*
Poaceae	*Cynodon dactylon, Datura metel*
Solanaceae	*Solanum violaceum, Eclipta prostrate*

Most of these plants generally available in our homesteads were either collected or purchased from nurseries.

2. Butterfly garden

Butterfly gardening is a method of *in situ* conservation through careful choice of host plants and creating appropriate habitats (Mathew and Mary Anto, 2007). It is also an excellent way to exhibit local butterflies in their natural settings. In the sustenance of butterflies, plants have a significant role. The immature stages of butterflies (larvae) are voracious feeders and show specific preference to host plants. For instance, the Grass Yellows feed on Leguminosae, the Common Crow on cherry and ficus, the Lime Butterfly on orange or lime, Danaine butterflies on milkweeds, Bird-Wings on aristolochia plants and so on. The adults (butterflies) feed at a variety of flowers such as *Lantana, Clerodendron, Ixora,* and *Zinnia* on nectar. *Aristolochia indica, Citrus, Cycas, Thottea siliquosa, Alseodaphne semiecarpifolia, Cinnamomum, Polyalthia, Miliusa tomentosa, Michelia champaca,* and *Murraya koenigi* were some of the butterfly larval host plants introduced in the garden. In addition to these, a variety of flowering and ornamental plants such as *Begonia, Cuphea, Cycas, Gardenia, Hibiscus, Ixora, Jasminum, Doxantha, Kalanchoe, Mussaenda, Ocimum*, Rose, *Tabernaemontana, Vinca rosea, Zinnia, Lantana, Crotalaria, Clerodendon* and *Asclepias* were introduced in the garden for providing nectar for the butterflies.

Other than host plants, butterflies require specific environmental conditions which were created through careful landscaping of the area. Habitats such as open areas, bushes, lianas, streams, waterfalls, rock gardens etc. are preferred by different groups of butterflies. A rock garden was also set up where host plants suited for dry season butterflies were introduced.

2. Aqua garden (Aquatic plants)

In order to familiarise the aquatic flora found in our waters, representatives of common aquatic flora were introduced in ponds set up in the garden (Table 2).

Table 2. List of aquatic plants introduced in the Park

Family	***Species***
Scrophulariaceae	*Bacopa monnieri*
Apiaceae	*Centella asiatica*
Cyperaceae	*Cyperus pangoiie*
Pontederiaceae	*Eichornia crassipes*
Hydrocharitaceae	*Hydrilla verticellata*
Convulvulaceae	*Ipomoea aquatica*
Scrophulariacea	*Lindernea* sp.
Onagraceae	*Ludwigia octovalvis*
Marsileaceae	*Marsilea minuta*
Nymphaeaceae	*Nymphaea pubescens* *Nymphaea stellata* (rose) *Nymphaea stellata* (white)
Poaceae	*Saccharum spontaneum*
Salviniceae	*Salvinia molesta*
Typhaceae	*Typha angustata*

Plants representing 13 plant families were introduced.

3. Rock garden (Xerophytes and succulents)

Xerophytes and succulents belonging to ten families were collected and planted in a rock garden. Plants used for introduction are given in Table 3.

Table 3. List of xerophytes and succulents introduced in the Park

Family	**Species**
Agavaceae	*Agave victoriae- reginae*
Amaryllidaceae	*Aloe variegata*
Liliaceae	*Asparagus racemosus*
Vitaceae	*Yucca whipplei*
Crassulaceae	*Cissus quadrangularis* *Kalanchoe blossfeldiana*
Cactaceae	*Opuntia falcate* *Opuntia spp*
Pandanaceae	*Pandanus sanderi*
Liliaceae	*Sansevieria cylindrica*
Asclepiadaceae	*Sarcostemma acidum*
Euphorbiaceae	*Euphorbia antiquosum* *Euphorbia* spp.

4. Epiphyte garden (Orchids)

Common epiphytes and orchids were introduced on suitable substrata such as trees or logs present in the garden. The following species were introduced:

1. *Malaxis rheedii*
2. *Bulbophyllum cylindraceum*
3. *Vanda parviflora*

5. Gymnosperms

Gymnosperms are important as a group of ancient vegetation. Only one species of Gymnosperms *viz., Cycas circinalis* was locally available for introduction in the park.

6. Ferns

Ferns, considered to be quite ancient in their origin are known to be the major contributors of fossil fuels such as coal and oil that we use. They are elegant and graceful vegetation which are currently used very extensively in gardens all over the world. Species belonging to 11 families (Table 4) were collected and introduced in the park.

Table 4. List of ferns introduced in the Park

Family	***Species***
Polypodiaceae	*Acrostichum aureum*
Adiantaceae	*Adiantum indicum*
Angiopteridaceae	*Angiopteris evecta*
Aspleniaceae	*Asplenium formosa*
Blechanaceae	*Blechnum occidentale* *Blechnum gibbum*
Davalliaceae	*Davallia feejiensis*
Schizaeaceae	*Lygopodium microphyllum*
Oleandraceae	*Nephrolepis exaltata*
Ophioglossaceae	*Ophioglossum vulgatum*
Pteridaceae	*Pteris vittata*
Selaginellaceae	*Selaginella inequalifolia*

7. Star forest

Identification of specific plants as representative of each astrological star was a method adopted for biodiversity conservation by our ancestors. Attributing religious sentiments had a positive impact on conservation of several rare and threatened taxa and hence, a special theme on ‘Star Forest’ was also introduced in the Bio-park. The plants associated

with the 27 stars are listed in Table 4. Children will be encouraged to nurture species belonging to his/her star. Stars and plants representing each star are given in Table 5.

Table 5. List of plants representing various stars of the horoscope introduced in the Park

No.	Star	Tree	Botanical name
1	Aswathi	Kanjirum	*Strychnosnux-vomica*
2	Bharani	Nelli	*Phyllanthus emblica*
3	Karthika	Atthi	*Ficus racemosa*
4	Rohini	Njaval	*Syzygium cumini*
5	Makayiram	Karingali	*Acacia catechu*
6	Thiruvathira	Karimaram	*Diospyros ebenum*
7	Punarthum	Mula	*Bambusa bambos*
8	Pooyam	Arayal	*Ficus religiosa*
9	Ayilyam	Nangu	*Mesua ferrea*
10	Makam	Peral	*Ficus bengalensis*
11	Pooram	Plasu	*Butea monosperma*
12	Utthiram	Itthi	*Ficus microcarpa*
13	Attham	Ambazham	*Spondias pinnata*
14	Chitthira	Koovalam	*Aegle marmelos*
15	Chothi	Neermathalam	*Crataeva magna*
16	Visakam	Vayyankaitha	*Flacourtia montana*
17	Anizham	Elenji	*Mimusops elengi*
18	Thriketta	Vetti	*Aporusa lindleyana*
19	Moolam	Payin	*Vateria indica*
20	Pooradam	Vanji	*Salix tetrasperma*
21	Uthradam	Plavu	*Artocarpus heterophyllus*
22	Thiruvonam	Erukku	*Calotropis gigantea*
23	Avittam	Vanni	*Prosopis juliflora*
24	Chathayam	Kadambu	*Anthocephalus cadamba*

25	Pooruruttathi	Thenmavu	*Mangifera indica*
26	Uthrattathi	Karimbana	*Borassus flabellifer*
27	Revathi	Irippa	*Madhuca longifolia*

4. Constraints in setting up Bio-parks in schools

Fund availability

The main constraint for setting up Bio-parks in schools is fund availability. The two Bio-parks set up under this project were with a one time grant from the Kerala State Council for Science Technology and Environment under the Chief Minister's Special Programme. Perhaps, we may have to explore the possibility of mobilising funds from various Government Departments (Education, Forest etc.) or through contributions from PTA funds in Schools.

Maintenance of the parks

The day to day activities of the park such as watering, tending of plants etc. were proposed to be carried out by the students themselves. For this, it was proposed to form Eco-clubs under the charge of a teacher and the members of the club have to take the responsibility of maintaining the Park. In Schools, there could be constraints since the students in higher classes or those preparing for the Entrance Examination may not be willing to cooperate. In that case, students in junior classes may be encouraged to take part in the Bio-park activities. Also, children residing in the vicinity of the school may be in a better position to participate in the activities compared to those coming from far off places. Perhaps, one hour per week may be exclusively allocated for nature conservation activities. Routine visits / follow up actions of experts are necessary in the initial phases for park establishment and for sustaining the interest of the student in maintaining the park.

IV. Conclusions

Various attempts have been made for conservation of biological diversity- through legislation and setting aside Protected Areas and Wildlife Sanctuaries. Participation of the public is essential for the success of any conservation programme. For this, we have to generate interest among the public for conserving biodiversity. Students form the most important target group in conservation programmes. Hence, attempts have to be made to generate conservation awareness among school children. Formation of Bio-parks in schools through students' participation is a very effective method to achieve this.

Apart from generating conservation awareness, Bio-parks also form an important activity in conserving local biota. Due to the developmental activities of man, most of the native flora and fauna have been destroyed and much of the local biodiversity is on the verge of extinction. Species loss has tremendous implications on the survival of mankind in this universe and we need to develop strategies for conserving the biological diversity. Since the components of the Bio-park covers a variety of indigenous plant groups, which in turn support characteristic fauna ranging from invertebrates to vertebrates, it is an effective method for conserving native wild flora and fauna. Apart from this, school children will derive immense satisfaction through nurturing plants and animals both in the premises of the educational institutions as well as in their homesteads. Hence, popularisation of Bio-parks in academic / educational Institutions will be significant step towards environmental conservation.

V. Acknowledgements

We are grateful to our colleagues Dr. C. Renuka, Dr. K.C. Chacko and Dr. K.V. Bhat for kindly going through the manuscript and for offering useful suggestions. This project was funded by the Kerala State Council for Science, Technology & Environment, Trivandrum.

VI. References

Mathew, G. and Mary Anto 2007. *In situ* conservation of butterflies through establishment of butterfly gardens: a case study at Peechi, Kerala, India. Current Science 93(3): 337- 347.

Nayar, M.P. 1997. Biodiversity challenges in Kerala and science of conservation biology. In: Pushpangadan, P. P. and Nair, K.S.S. (eds.) Biodiversity and Tropical Forests: The Kerala Scenario. The State Committee on Science, Technology and Environment, Trivandrum.

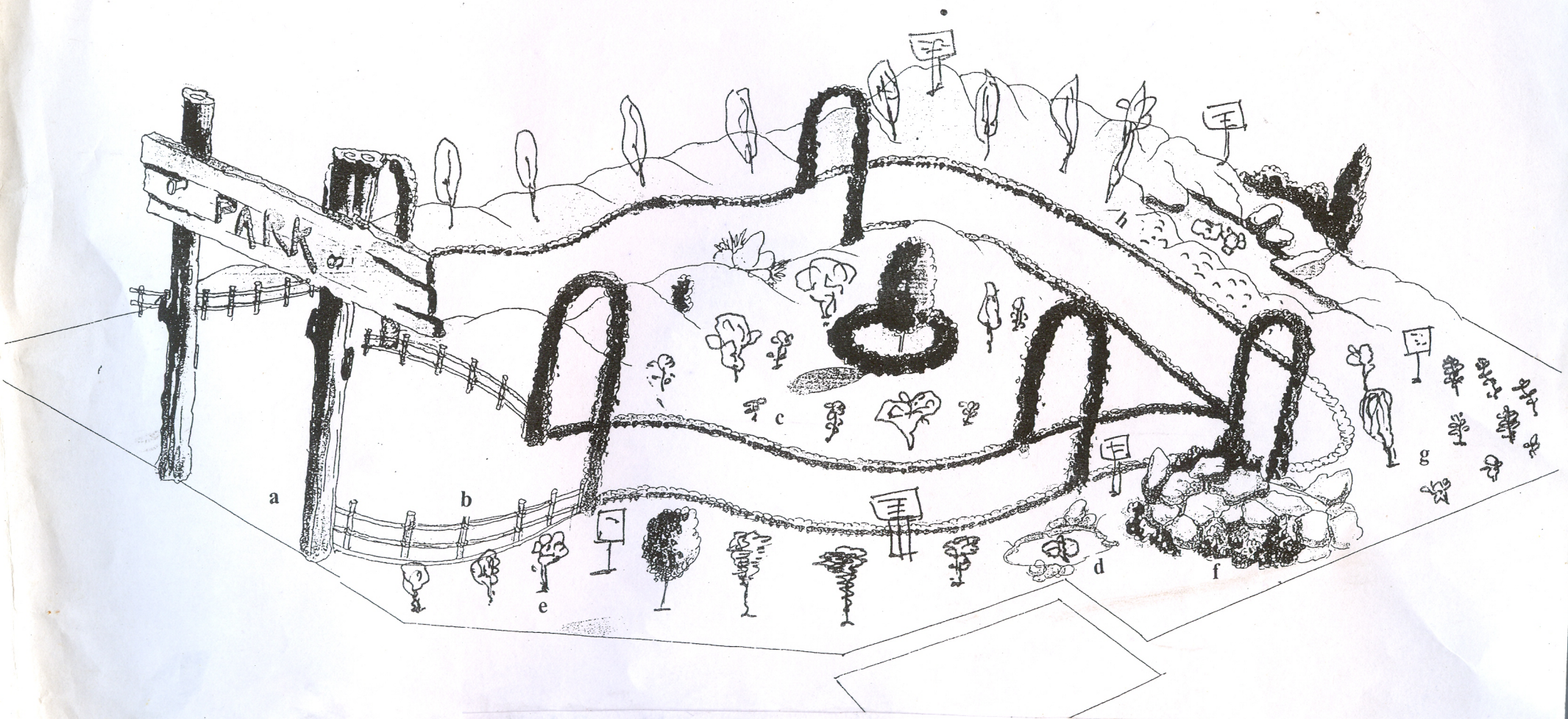

Fig. 3. Design of Bio-park established at Model Boys'H.S.S. Trichur
a- Entrance; b- Trek path; c- Butterfly Garden; d- Aqua Garden;
e- Star Forest; f- Rock Garden; g- Medicinal Plants Garden;
h- Lawn.

Fig. 2. The main entrance of the Bio-park established at CWRDM, Calicut.

Fig. 3. The main entrance of the Bio-park in the Model Boys' H.S.S., Trichur.