KFRI Research Report No: 406 ISSN 0970-8103

DOCUMENTATION AND CONSERVATION OF SMALL MAMMALS IN THE SACRED GROVES OF KERALA, PENINSULAR INDIA

(FINAL REPORT OF THE PROJECT KFRI 478/2005)

P. PADMANABHAN

WILDLIFE DEPARTMENT

FOREST ECOLOGY AND BIODIVERSITY CONSERVATION

KERALA FOREST RESEARCH INSTITUTE
PEECHI, KERALA - INDIA
SEPTEMBER – 2009

ABSTRACT OF PROJECT PROPOSAL

Project No: KFRI

Title: Documentation and conservation of small mammals in the sacred groves of Kerala, Peninsular India.

Objectives:

- To identify and enlist small mammal diversity of sacred groves in Kerala
- To document endemic and endangered species
- To record threats to the groves like fragmentation, habitat, alteration, grazing, poaching, modernization of temples associated with the groves, etc. which serve as animal corridors
- To measure and compare disturbance of groves
- To formulate conservation strategy and action plan for economically important small mammals through participatory management practices.

Date of commencement	: April 2005
Scheduled date of completion	: September 2009
Funding agency	: Plan Fund
Principle investigator	: P. Padmanabhan
Technical assistant	: K. Prabhavathy

CONTENTS

ABSTRACT

A survey of small mammals (weighing less than 5 kg) was conducted in the sacred groves of Kerala from 2005 to 2009. About 300 sacred groves are documented. The animals found in the sacred grove were of two types, namely the group of organisms like snakes, frogs, lizards, lower and higher group of fauna which nested there and those which visited the grove temporarily for food and shelter. The floristic composition was highly influenced due to the anthropogenic pressures, cattle grazing, edaphic and climatic factors. The biodiversity of these areas is quite distinct from that of the surroundings.

Survey and socio-cultural aspects of sacred groves was studied and threats to the sacred groves documented. The role of small mammals in the sacred grove ecosystem was analyzed. Protection was comparatively higher in religiously protected scared groves. Sixty species of small mammals were documented, of which 75 % were bats and rodents. Numbers of small mammals documented were 3 species of Insectivore, 27 species of *Chiroptera*, one species of *Primates*, one species of *Pholidata*, 14 species of *Rodentia*, 4 species of Carnivore, one species of *Lagomorpha* and one species of *Artiodactyla*. Fragmentation of sacred groves, urbanization, disappearance of old belief system, waste disposal, alteration of habitat, removal of biomass, fragmentation of sacred groves due to partition of joint families and formation of nuclear families, felling of old trees and thereby destruction of roosting sites of small mammals were main threats. Sacred groves which were religiously protected and bigger in size gave more protection to mammals. Prevention of further fragmentation, giving economic remuneration and award for protection of groves, declaring sacred groves as community forestry center with assistance from Government agencies will prevent further fragmentation and protect biodiversity rich sacred groves from extinction.

INTRODUCTION

The existence of sacred groves in India dates back to ancient pre-agrarian hunter-gathering era and their presence has been documented since the early 1800's. Believing trees as the abode of deities and ancestral spirits, many communities set aside sanctified areas of forest and established rules and customs to ensure their protection. The rules varied from grove to grove, but often prohibited felling of trees, collection of any material from the forest floor and the killing of animals. The prevailing belief was that the presiding deities administered punishment, often death, to individuals who violated the rules and sometimes to the entire community in the form of disease or crop failure. As a result of such restrictions, several endemic and endangered plant and animal species have survived on sacred groves for countless number of years. They are storehouses of medicinal plants valuable to village communities as well as modern pharmacopoeia and they contain wild relatives of crop species that can help to improve cultivated varieties. Sacred groves also provide for the water needs of nearby communities. Many sacred groves contain water resources such as ponds and streams and the vegetative mass that covers the floor of a grove can absorb water during rainy season and release it during times of drought. Trees also improve soil stability, prevent topsoil erosion and provide Irrigation for agriculture in dry climate. There has been no comprehensive survey of sacred groves in India, so their exact number and area are unknown. At least 13,720 sacred groves have been reported in various regions of the country, but experts estimate that the actual number is likely 1, 00,000 to 1, 50,000.

In Kerala, it is the common practice among the Hindus to assign a part of their land near the Tharavadu or house as the abode of goddess Durga, Serpent God Naga or Shasta and the place is called Kavu or Sarpakavu. Sacred grove represents the major effort to recognize and conserve biodiversity (ethnic diversity) traditionally. Sacred groves otherwise *Sindhravana* or *Pavithravana*, *Devarkadu* (in Kannada), *Deoban* or *Devraj* (in Marathi), *Orans* (in Rajasthan), *Kavu* (in Malayalam), *Sarpakadu* (in Tamil) are religiously protected forests and there is a widespread practice of not felling for fear of incurring the wrath of the presiding deities. Extent wise they vary in size from $1m^2$ to 1 million m^2. They provide a countrywide network of protected areas wherein inherent diversity of flora and fauna is preserved for the best proposition for studying endemism.

The age old system of every village having a temple, a tank and associated sacred grove explains the ancient method of water harvesting and sharing and may be considered as the backbone of village economy. People were prohibited from felling trees and even removing a twig was considered as taboo. On a rough estimate, Kerala has about 2000 scared groves which are distinct and unique in biological diversity. Only very few are reported from the foothills and the high ranges. The size of the sacred grove in Kerala varies as small as one cent to 20 or more hectares. The vegetation in the undisturbed groves is luxuriant and with multi layered trees mixed with shrubs, lianas and herbs. The ground is humus laden and abundant with fungus and ferns. Literature pertaining to the distribution of sacred groves of Kerala is scanty. Balasubramanian and Induchoodan (1996) estimated 761 major sacred groves in Kerala. A detailed account of the animal diversity in the *kavus* of northern Kerala was reported by Unnikrishnan (1995). It cannot be expected that isolated sacred groves would shelter any major mammals. But, they harbor numerous birds, butterflies and bats, apart from, primates and small mammals (Chandran, 1993). In ponds associated with the groves, hundreds of white tortoises are protected. The worshippers of the groves feed these tortoises. The serpent groves of Kerala are well known for various snake species, including cobra, viper, krait and python. Nine species of frogs have been reported from these groves in Kerala. Sacred groves are also the home for fruit bats and hornbills. More than 400 species of birds recorded from Kerala have been spotted in the *kavus* of Northern Kerala. Nilgiri langur (*Presbytis johni*) a threatened species of monkey is found in sacred groves (Unnikrishnan, 1995).

Comparatively, few studies have been conducted to determine the diversity of vertebrates in sacred groves. About 100 species of mammals, 476 species of birds, 156 species of Reptiles, 91 species of amphibians and 196 species of fishes were reported from Kerala. Major threats to the existence of sacred groves in Kerala are the disappearance of old joint family system and partition of family properties along with changing socio-economic scenario. In most of the cases the *kavu* and surrounding areas will be handed over to a generation, who has no faith or less faith in keeping the integrity of the *kavu*. In such instances either the *kavu* will be totally denied or sometimes, only the deity will be retained and big trees and associated habitat will be totally converted for other purposes. In some cases symbolic representation of grove is allowed to remain by preserving the oldest and largest tree in the grove. The second major threat is the anthropogenic activities

and cattle grazing. As the demand for land is always high in Kerala, the shrinkage of grove was one of the inevitable causes. Encroachment has resulted in the shrinkage of one of the largest *kavus* in Ernakulam and Kannur Districts. In some case the old trees in the *kavu* may be uprooted by natural calamities and this will be taken as a reason for reducing the area of *kavu*.

Cutting of trees for temple and associated purpose had also been reported from some areas. Since the locations of these virgin ecosystems are in the middle of the people, cattle grazing, collection of dry leaves and firewood is common. Sacred groves have existed in India from time immemorial as patches of densely wooded areas, venerated on religious grounds. Sacred groves have preserved many rare and endemic wild plant species, many of which hold potential benefit to man as medicine, for agriculture and industry. In fact, sacred groves represent the ancient Indian way of *in situ* conservation of genetic diversity. Reverence for all forms of life human, animal or plant, characterizes our ancient thought and continues to this day as a legacy laced with spirituality, humility and recognition of the importance of the elements and nature. Sanctity attached to places where nature shows her bounty was both spiritual and secular. These places were considered 'sacred', as Gods were supposed to bless them and naturally their protection was considered a sustainable resource, ensuring the basic capital intact. These sacred groves are therefore valuable gene pools.

Snakes of different categories, frogs, lizards, millipedes, termites, ants, earthworms, and snails form a very important component of the sacred grove ecosystem. Termites, ants and earthworms play an important role in the make up of the soil. Many birds like crow, kite, owl, herons, mynas, and parrots, etc. nest in these sacred groves. Bats, Humming birds and insects like mosquitoes, wasps, honey-bees, butterflies and beetles seem to be closely connected with pollination mechanism of various plants. Monkeys, most of the birds, rodents like rats, mice, bandicoots, squirrels, mongoose and hare which are also inhabitants of these sacred groves besides preserving biological wealth. But tragically, they are slowly disappearing under the influence of modernization (Gadgil and Vartak, 1976). The ponds and streams usually adjoining the groves are perennial water sources. These groves are good repositories of humus, which is formed by the adjoining agro ecosystems like paddy fields, tapioca and rubber plantations. The floral diversity of these groves is very high. It is also interesting to note that particularly some members are

represented in most of the groves. A best description have been provided by Vartak (1983), who describes them as natural museum of living giant trees, a treasure house of rare endemic species, a paradise for nature lovers and a laboratory for environmentalist. Sacred groves are invariably associated with certain Gods and Goddesses. In Kerala, they are normally associated with goddess *Durga*, *Aiyappa* or *Nagaraja* and are never destroyed for fear of incurring the wrath of the presiding deity. Sacred groves are characterized by rare species preserved on isolated land with social and religious beliefs of people (Kulkarni and Shindikar, 2005). The way of conserving natural biodiversity through preservation plots in forest areas or sacred groves is a unique feature in Indian culture. The larger groves are a treasure – trove for the naturalists, supporting many threatening species in the area and are becoming extinct with deforestation.

Sacred groves are relics from a past socio cultural, aspects which served to transmit the cultural heritage generation from pre historic time onwards. Conservation in natural resources in the past involved may taboos, rituals and other religions practices and sacred groves was such a traditional socio-cultural mechanism aiming at nature conservation that integrated socio-cultural aspects for conservation. The changing life styles and rapid modernization are death traps from the age old conservation practice.

Small mammals

Out of the total 4629 species of mammals, there are 2021 species of rodents and 428 species of insectivores (Wilson and Reeder, 1993). They together constitute nearly 50 % of the mammalian spectrum. Chiropteran, the bats, forms the second largest group (20 %). The geographical distribution of these three taxa is so expansive that they occur in almost all the six zoogeographical realms. Insectivore occurs in all geographical realms except the Australian where its niche is occupied by the marsupials and very few occupy the Neotropical realm (Corbet and Hill, 1991). It is often mistaken that only the larger mammals are susceptible to endangerment and face extinction. About 330 species of rodents are considered as threatened.

Being a comparative term, it is difficult to define what a small mammal (Walker, 1999). Delany (1974) used the term to include only the insectivore and rodent species weighing less than 120 g. Burlier (1975) considered any mammalian species up to 5 kg in weight as small mammal. Chew (1978) suggested that small mammals be defined as the size range within which the majority of species have diets at least partly dependant on

seeds or insects and or require a burrow for protection from extreme environmental temperatures and predators. We follow the definition of Burlier (1975) in the present study.

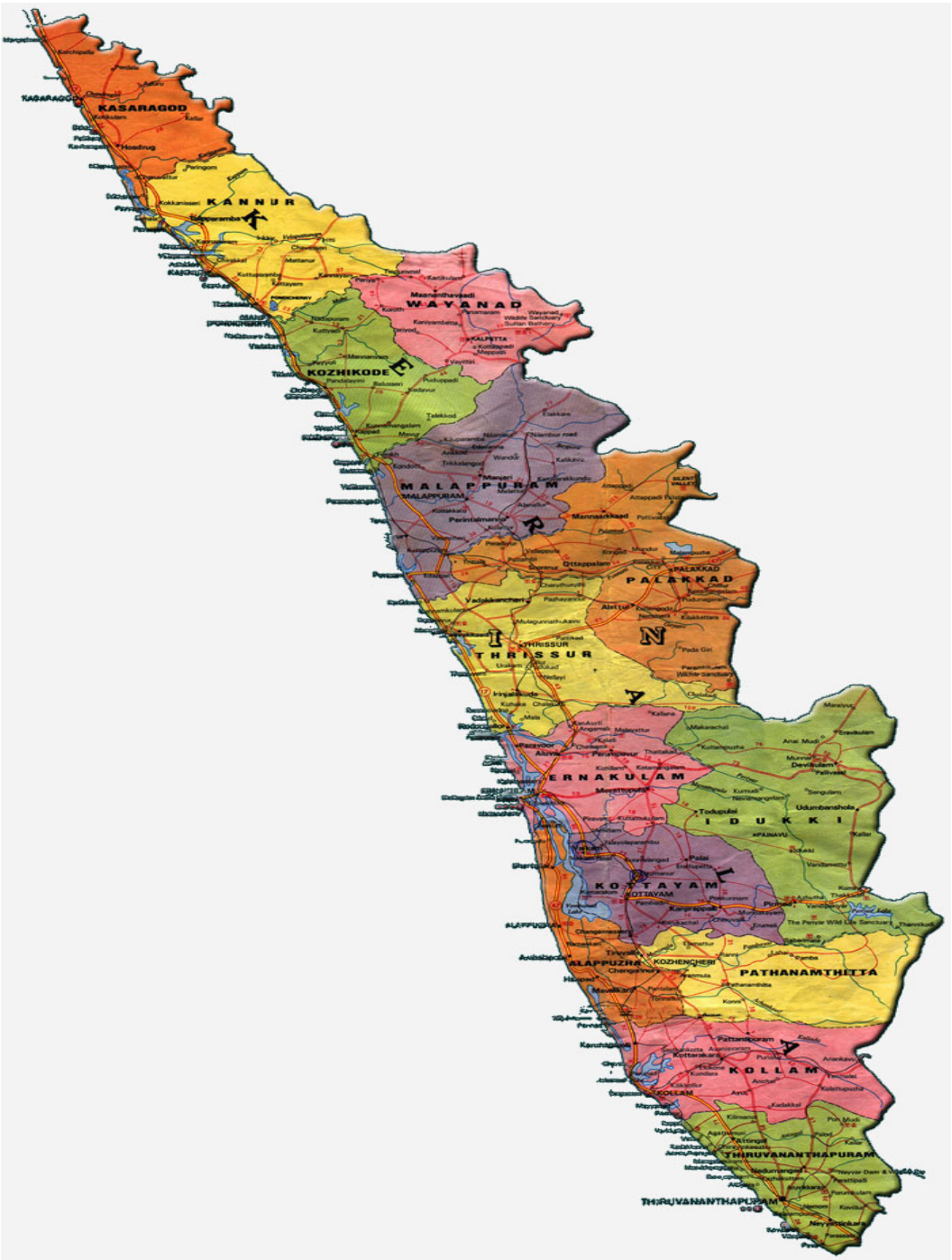


Fig. 1. Kerala State, the study area

REVIEW OF LITERATURE

Early explorations on mammals began after Linnaeus, in Pre Hodgson period. Belanger, Leschenaultii, Jacquemontii, Duracell, Geoffrey and Blainvillea were the pioneer mammologist and many Indian species were named by them. Pallas and Erxlenben also contributed by describing new species during this period. Another period of Indian Mammalogy is the Hodgson- Jerdon period. Hodgson, during 1818-1858, made extensive collection from India and Nepal and described several new species. Blyth, the curator of museum of Asiatic Society of Bengal published accounts on small mammals, rodents and bats.

The Blanford- Anderson period during 1865-1910 was gifted by the Fauna volume (two parts) by Blanford (1888 and 1888-91). The mammalian survey became active when the Bombay Natural History society, the pioneering conservation agency, came into being. The Society made extensive surveys during 1911-1929 and about 25,000 specimens were collected with adequate field data. These surveys brought out an idea on the faunal picture of India (Hinton, 1918a, b c and d; Thomas and Wroughton, 1915; Thomas, 1919, 1922 and 1923; Wroughton, 1920 a and b). Based on these surveys, Pocock (1923 and 1939-1941) published Fauna of India covering the primates and carnivores. Finn (1929) revised Sterndale's (1884) popular work and published the Mammalia of India.

MATERIALS AND METHODS

The study was conducted in Kerala State, southern peninsular India. During field visits 300 miniature sacred groves covering an area of 13.1 hectare were surveyed and information was gathered on sacred trees, taboos, deities, festivals, priests and cultural aspects through personal contacts and questionnaires and by interviewing villagers, temple authorities and various social organizations. The respondents informed about the presence of variety of deities. Often a rough stone with some carving on it may represent a deity. A deity is considered an essential nature of a god as supremely good or powerful. Some of them seem to be old and traditional and some are recent additions. The male deity associated with the majority of the sacred forest is "Nagaraja" and the female deity is "Mariamman".

Quadrate and transect studies were also undertaken. First hand information about the existence of sacred groves was gathered from literature, personal contacts with village men, temple authorities, environmental action groups and various social organizations. When a sacred grove was visited, the neighboring people and temple worshipers were interviewed in addition to this, information available from earlier study on small mammals of Kerala with special relevance to endangered species, and information from Western Ghats Division, of ZSI, Calicut, were also consulted.

RESULTS

Sacred groves as Community forests

Community forestry aims to assist local people to improve their livelihood by successfully managing their natural resource, particularly trees and forest, through forestry and forestry related projects. The animals of all community projects are two fold: First, they enrich and improve the well being of human community and second, they help preserve the World's Biological Diversity. As can be seen from the numerous examples, when local inhabitants are included in the decision making process and given the responsibility for and the benefits from the sustainable management of local wildlife, projects are more likely to be assured of success and the resource is more likely to be protected. Our ability to manage the fragmented sacred groves as pools of flora and fauna and which serve as animal corridors for small and medium sized mammals is crucial. The most critical factor is the conflicting interests in managing the privately owned fragments. List of sacred groves in Kerala is given in Table.1

Table 1. List of sacred groves in Kerala

S.No.	Name of the groves	Name of the deity	Area (m^2)
1.	Anchalumoottil	Naga	440
2.	Cheppallil Kavu	Siva/Naga	8080
3.	Cherukkara Kavu	Naga	3300
4.	Kaithavanam Nallaveettil Kavu	Naga	800
5.	Kajoor Kavu	Bhagawathi/Naga	11,000
6.	Kalavoor Kavu	Naga	560
7.	Kottinadu Kavu	Naga	404
8.	Kuzhivelil Kavu	Bhagawathi/ Naga	3000

9.	Mannarassala	Naga	52,800
10.	Panikkasseril Kavu	Bhagawathi/Naga	880
11.	Pavuruthu Kavu	Bhagawathi/ Naga	880
12.	Siva Temple Kavu	Siva/ Naga	1,600
13.	Tampuran Kavu	Naga	4400
14.	Thekkemankuzhi	Bhagawathi,Naga	41,400
15.	Valiyaveettil Kavu	Naga	1320
16.	Vandanum Kavu	Naga	11,000
17.	Velamkudi Devi Kshetram	Bhagwathi/ Naga	840
Ernakulam District			
18.	Ameda Kavu	Naga	1,3200
19.	Chempakasseril Kavu	Naga	200
20.	Choorakkattu Kavu	Naga	2400
21.	Iringole Kavu	Bhagawathi	2,00,000
22.	Kavumpattu Kavu	Bhagawathi	4040
23.	Velanmutayil Kavu	Bhagawathi	600
Idukki District			
24.	Kolana Kavu	Vanadaya	4040
Kannur District			
25.	Bhuthathar Kavu	Bhuthathan	4040
26.	Edattu Kavu	Naga	2020
27.	Edeangal Family Kavu	Naga	8080
28.	Kolichar Veeran Kottam	Kalichan	13,200
29.	Madayi Kavu	Bhagawathi	10,000
30.	Munda Kavu	Naga	3000
31.	Muthukadu Kavu	Sastha	11000
32.	Pararathu Kavu	Naga	10,000
33.	Poongodu Kavu	Naga	1,000
34.	Siva Temple	Siva/ Naga	8800
35.	Thazhek Kavu	Bhagawathi	10,000
36.	Undiyalam Nagaru Kavu	Naga	800
37.	Varikkara Kavu	Bhagawathi/Thayippara dhavatha	12,000
Kasargode District			
38.	Cheruppadi Kavu	Bhagawathi/ Naga	4040
39.	Dharma sastha Kavu	Sastha	40,400
40.	Edaneer Kavu	Sastha	35,200
41.	Hundi Kavu	Bhagawathi/ Naga	11,000
42.	Kachamaram Kavu	Kalichal	4040
43.	Karakka Kavu	Bhagawathi	60,700
44.	Mannupurathu Kavu	Bhagawathi/ Naga	18,000
45.	Naik Kavu	Spirit	200
46.	Puthiyaparambil Kavu	Vishnu/ Bhagawathi	17,600
47.	Sree Bhadra Kavu	Bhagawathi/ Naga	4400
48.	Theyottu Kavu	Bhagawathi	1,80,000
49.	Vishnumoorthi Kavu	Vishnu	4040
Kollam District			
50.	Ayiravally Bhagavathi Kavu	Bhagawathi/ Naga	550

51.	Charakkal Kavu	Naga	-
52.	Elengireethil Kavu	Naga	400
53.	Endalayappan Kavu	Naga	850
54.	Kannan Kavu	Naga/Bhagawathi	650
55.	Karalathu Bhagawathi Kavu	Bhagawathi, Naga	200
56.	Karalathu Kavu	Naga	200
57.	Kelethu Kavu	Naga	400
58.	Klariyil Kavu	Naga	250
59.	Kalavara Sarpa Kavu	Naga	800
60.	Kuzhikkal Kavu	Naga	500
61.	Madampithara Kavu	Naga	250
62.	Mavidi Temple	Naga	250
63.	Mulliyakkadu Kavu	Naga	4040
64.	Naduloor Kavu	Naga	200
65.	Neelimana Kavu	Naga	1000
66.	Ondi Kavu	Naga	26,400
67.	Panamoottil Kavu	Naga	800
68.	Pariyarathu Kavu	Naga	2820
69.	Pattupurakkal Kavu	Naga	200
70.	Pazhangala Dharma Sastha Kavu	Sastha	860
71.	Puliyan Kulangara Kavu	Naga	450
72.	Sasthakotta Temple	Sastha	6050
73.	Siva Temple	Naga	1000
74.	Sree Krishna Swamy Temple	Naga	200
75.	Thamarakudi	Naga	1000
76.	Udhayakovil Bhagawathi Temple	Bhagawathi/ Naga	400
77.	Velamkudi Devikashetrum	Bhagawathi	450
Kottayam District			
78.	Kannezhathu Kavu	Naga	4400
79.	Koypathi Kavu	Naga	2200
80.	Nattithara Kavu	Naga	10,001
81.	Vallal Kavu	Naga	1,200
82.	Manathattil Kavu	Naga	1,400
83.	Ayyan Koil Kavu	Sastha	440
84.	Padathu Kavu	Naga	800
85.	Nellezhathu Kavu	Naga	820
86.	Kumbala Pallil Kavu	Naga	1010
87.	Nagampuzhimana Kavu	Naga	8000
88.	Kottarathil Kavu	Naga	1200
89.	Kollarathil Kavu	Naga	400
90.	Perumbali mana Kavu	Naga	200
Kozhikode District			
91.	Arayankode Sree Thalassiva	Thalassiva/Kirthamoorthy	8903
92.	Bhayan Kavu	Naga	320
93.	Bhayan Kavu	Vanadurga & Bhadrakali	20,234
94.	Chembakkottu Kavu	Siva and Bhagavathi	12,140
95.	Chimmanath Kavu	Naga	8093
96.	Gururkkan Kavu	Naga	2420

97.	Huayil Kotta	Durga	38,444
98.	Kalarikkal Kotta	Naga	2023
99.	Karimala	Karimala Temple	40,468
100.	Kariyathan Kavu	Naga	1214
101.	Kilipparambu Kavu	Naga	1000
102.	Kuttiattu Kavu	Naga	2023
103.	Mandakathinkal Kavu	Naga	1011
104.	Mankudi Kavu	Bhagawathi	1,000
105.	Muchukunnu Kavu	Siva sastha, Bhagawathi	19,800
106.	Nagathankotta	Naga	81
107.	Nelikkavu	Naga	2023
108.	Otakali	Kali	2023
109.	Paramannil Sree Nagali Kshethram	Naga Temple	2023
110.	Peralan Kavu	Puliyankal Siva	6070
111.	Perumpally Kavu	Kizhakkovil	4046
112.	Petiyathu Kavu	Naga	1011
113.	Pishari Kavu	Bhagavathi	6,600
114.	Poil Kavu	Durga	44,514
115.	Thazheppurakkal Kavu	Thazheppurakkal	2023
116.	ThechottuPalliarkotta	Ittikkurumba and Bhadrakali	11,533
117.	Thurayil Kavu	Naga	600
118.	Tikkotoor Kavu	Naga/Ganapathi	5,000
119.	Vallikkattu Kavu	Vanadurga	63,737
120.	Vanadurga Kavu	Vanadurga	39,600
121.	Vatekkavu	Naga	1011
122.	Vayappurathu Kavu	Naga/Bhagawathi	8,000
123.	Vellikkattu Kavu	Bhagawathi	16,000
Malapuram District			
124.	Bhagawathi Kavu	Bhagawathi	28,000
125.	Adhikaraykkotta Kavu	Naga	2100
126.	Shobhapparambu Kavu	Bhagawathi/ Naga	1500
Palakkadu District			
127.	Murthikkavu	Naga	4400
128.	Naythamangalam	Nagaraja, Nagayakshy Siva Ayyappan	81
129.	Kallingal	Nagaraja Maninagam	1,619
130.	Chemmala	Nagaraja, Maninagam, Chithrakoodakallu	445
131.	Karimkulathi Kavu	Nagaraja Anjana Maninagam, Aiswarya kallu	364
132.	Thekkaeveetil Kavu	Nagaraja,Anjana Maninagam	1,214
133.	Puthiyamundayathu Kavu	Nagaraja	4,856
134.	Gurikkanmar Kavu	Nagaraja	12,141
135.	Pathallu Kavu	Nagaraja	22,258
136.	Valluthan Kavu	Nagaraja Nagayakshy	4,047
137.	Kizhakkaeveetil Kavu	Nagaraja Nagayakshy	809
138.	Kizhhaveetil Kavu	Nagaraja Maninagam Utramala	405

		Bhagavathy	
139.	Chumathan Kavu	Nagaraja	809
140.	Kalarivathukkal Kavu	Nagaraja	4,047
141.	Kunnathu Kavu	Nagaraja, Maninagam, Utramala Bhagavathy	405
142.	Vadakkae kalathil Kavu	Nagaraja Maninagam Brahmarakshas	8,094
143.	Valiaveetil Kavu	NagarajaAnjana,Maninagam Cithrakoodakkalu	566
144.	Naythamangalam	Nagaraja, Nagayakshy Siva Ayyappan	81
145.	Kallingal	Nagaraja Maninagam	1,619
146	Chemmala	Nagaraja, Maninagam, Chithrakoodakallu	445
147	Karimkulathi Kavu	Nagaraja Anjana Maninagam, Aiswarya kallu	364
148	Thekkaeveetil Kavu	Nagaraja,Anjana Maninagam	1,214
149.	Puthiyamundayathu Kavu	Nagaraja	4,856
150.	Sharathu	Nagaraja Chithrakoodakallu	405
151.	Angaval parambu	Nagaraja	202
	Mandapam pambum Kavu	Nagaraja	1,619
152.	Cheeramthy puthan	Nagaraja Nagayakshy	20,235
153.	Thottupurayil	Snake mound	61
154.	Kollathu	Nagaraja Maninagam,Utramala Bhagavathy	20
155.	Vadakkaenada	Nagaraja Maninagam Brahmarakshas	81
156.	Thekkae parambil	Nagaraja Anjana Maninagam Cithrakoodakkalu	40
157.	Sharathu	Nagaraja Chithrakoodakallu	405
158.	Angaval parambu	Nagaraja	202
159.	Mellaeveetil	Nagaraja Chithrakoodakallu	97
160.	Mukkolathu	Nagaraja	73
Pathanamthitta District			
161.	Kodiuyattu	Naga	1320
162.	Choorakkunnu	Bhagawathi/Naga	600
163.	Idathitta Kavu	Bhgawathi/Naga	4040
164.	Vadakkedathu Kavu	Naga	2000
165.	Chamak Kavu	Bhagawathi/Naga	17,600
166.	Nellurathu Kavu	Naga	4040
167.	Kaliyikkal Kavu	Naga	4040
168.	Karingodathu Kavu	Naga	1200
169.	Enathu Kavu	Naga	200
170.	Kadakkattu Kavu	Naga	4400
Thiruvanathapuram District			
171.	Alakkattu Kavu, Liamba	Naga	80
172.	Ayaniyerathaladevi Temple Kavu, Karimamoola	Naga	1400
173.	Ayiravilli Temple Kavu, Liamba	Naga	600

174.	Bhadrakali Temple Kavu, Azhakikonam	Naga	200
175.	Bhagavathi Kavu, Karippur	Naga	600
176.	Bhagavathi Kavu, Pulimuttathu, Poovar	Naga	2025
177.	Chamundeswary Kavu, Neelakesi	-	400
178.	Chathambarakonathu Kavu, Chathambara	Naga	1200
179.	Chavar Kavu, Pulluvila, Nagaroor	-	400
180.	Chavaru Kavu, Njekkadu	Manthramurthy	800
181.	Chavaru Kavu, Vellarackal	Madan, Marutha, Mayamayakki	1000
182.	Cheennivila Kavu, Karingal, Kattakada	Naga	800
183.	Chenavila Kavu, Uchakkada	Naga	1200
184.	Cherukulathu Kavu, Aryanadu	Naga	200
185.	Cherukulathu Sree Mannadi Kavu, Changa	Bhagavathi	240
186.	Cherukulathoor Kavu, Vellanadu	Naga	80
187.	Cherunilakkodu Kavu, Pangappara	Naga	280
188.	Chittalloor Devi Temple Kavu, Ambalamukku	Naga	1200
189.	Chokkan Kavu, Pachalloor	Naga	4000
190.	Erathu Kavu, Thokkadu, Panayara	Naga	400
191.	Erumakavu, Chirayil Keezhu	Naga	550
192.	Erumkulangara Bhagavathi Temple Kavu, Manacaud	Naga	3200
193.	Erumkulangara Kavu, Manacaud	Naga	200
194.	Gurunagappan Kavu, Chirayinkeezhu	Naga	600
195.	Idivizhunna Kavu, Kidarakuzhi	Naga	600
196.	Iiamkulam Mahadevan Kavu, Sreekaryam	Naga	40
197.	Indalayappan Kavu, Venkode	Naga	8800
198.	Irinjayamkavu, Irinjayam.	Naga	400
199.	Kallarathekkal Kavu, Liamba	-	40
200.	Kamukarakkonam Kavu, Vattappara	Madan	400
201.	Kanjirathummoodu Kavu, Kulathoor	Naga	205
202.	Kannamkkottu Kavu	Naga, Nagayekshi	800
203.	Karathala Kavu (a), Balaramapuram	Naga	400
204.	Karathala Kavu (b), Balaramapuram	Naga	330
205.	Karichayil Kavu, Velamkonam	Naga, Nagayekshi	200
206.	Karimbi Kavu	-	120
207.	Karimkada Kavu, Karimkada	Naga	400
208.	Karingal Thottikkara Nagaru Kavu, Kattakada	Naga	100
209.	Karingottu Kavu, Mevarkara	Naga	40
210.	Karumbichivila Nagaru Kavu, Pattom	-	200
211.	Kavil Sree Bhagavathy Temple Kavu, Pangode	Naga	1200
212.	Kavinmoola Kavu	Naga	600
213.	Kizhettikavu, Pongummoodu	Naga	2600
214.	Kochalummoodu Devi Temple Kavu, Chathambara	Naga	1200
215.	Kochalummoodu Devi Temple Kavu, Chathambara	Naga	1200

216.	Kulangara Kavu	Naga	660
217.	Kunnuvila Devi temple Kavu, Kesavadasapuram	Naga	320
218.	Madan Kavu (b), Meverkara	Naga	400
219.	Madankavu, Karimamoola	Madan, Naga	80
220.	Madan Kavu, Nedumangadu	Madan	40
221.	Madan Kavu, Veyiloorkonam, Kumarapuram	-	400
222.	Madanada Kavu, Kallara	Naga	400
223.	Madan Temple Kavu, Paruthippara	Naga	40
224.	Madanada Kavu, Chathambara	Naga	1200
225.	Madanda Temple Kavu, Plakkodu, Chathambara	-	1200
226.	Madankavu, (a), Meverkara	-	1600
227.	Madanthamburan Kavu, Erattakulangara	Naga	800
228.	Madathil Kavu, Kazhakkoottam	Naga	800
229.	Madavilakathu Kavu, Chathambara	-	40
230.	Manchadimoodu Kavu	Naga	700
231.	MannadyDevi temple Kavu, Ambalamukku	Naga	400
232.	Manthuruthu Kavu, Chippanchira	Naga	400
233.	Maruthumangalam Madom Kavu, Muttappalam	Naga	1200
234.	Mathanathu Kavu, Manikkal	Madan	200
235.	Mechamkode Kavu, Vattappara	-	160
236.	Moopuram Kavu, Kollamkkodu	Sastha, Naga	6000
237.	Mulampallikonam Kavu, Kattakada	Naga	200
238.	Mulloor Kavu, Chowwara	Naga	600
239.	Murava Kavu, Kulathoor	Naga	200
240.	Myvalli Ela Kavu, Ayilam	Naga	200
241.	Nagarkavu, Keezhathalakuzhi, Kavalakkulam	Naga	410
242.	Nagaramma Kovil Kavu, Thiruppuram	Naga	1600
243.	Nagarkavu, Plavilakom, Kulathoor	Naga	400
244.	Nagaru Kavu, Karimamoola	Naga	200
245.	Nagaru Kavu, Kazhakkoottam	Naga	40
246.	Nagaru Kavu, Kottiyottu, Attinal	Naga	1200
247.	Nagaru Kavu, Puliyoorkonam, Nalanchira	Naga	200
248.	Nagaru Kavu, Nedumangadu	Naga	60
249.	Nagaru Kavu, Ullorkonam	Naga	810
250.	Nagaru Kavu, Velamkonathu	Naga	280
251.	Nagayekshi Kavu, Ayilam	Nagayekshi, Naga	80
252.	Nagayekshi Kavu, Thennoorkonam	Naga	400
253.	Nakramkodu Kavu, Avanavamchery	Naga	520
254.	Nanniyode Kavu, Nanniyode	Naga	4000
255.	Neelakesi Kavu, Marayamuttam, Neyyattinkara	Naga	6075
256.	Nilami Nagar Kavu, Neyyattinkara	Naga	610
257.	Onathuthodi Kavu, Velamkonam	-	400

258.	Oorankudi Kavu, Chirayinkeezhu	Naga	800
259.	Ottavettil Kavu	Naga	400
260.	Padayarakam Kavu, Thiruvallam	Naga	1200
261.	Padinjatte Kavu, Thachottu	-	600
262.	Panayarathala Kavu, Perumpazhuthoor	Naga	410
263.	Pannikonam Kavu, Thiruthippally	Naga	200
264.	Parambarathala Kavu, Karingal, Kattakada	Naga	200
265.	Parayaru Kavu, Nedumangadu	Naga	400
266.	Parottukonam Kavu, Parottukonam	Naga	400
267.	Pattupurak Kavu, Chittayikkode, Kallambalam	Naga	4000
268.	Pazhanchira Devi Temple Kavu, Pazhanchira	Naga	280
269.	Perin Kavu, Mevarkara	Naga	40
270.	Pillathamburan Kavu, Veettukonam, Pothenkode	Naga	6000
271.	Pillaveedu Kavu, Kesavadasapuram	Naga	200
272.	Ponnumthuruthu Kavu	Naga	2200
273.	Poolanthara Kavu, Manikkal	Naga	160
274.	Poovampara Kavu, Mevarkara	Rakshassu	80
275.	Poovathoor Kavu, Poovathoor	Naga	600
276.	Puliyankeezhu Kavu, Chiayinkeezhu	Naga	800
277.	Pulickal Bhagavathi Kavu, Pongummoodu	Naga	400
278.	Pulickal Kavu, Pongummoodu	Naga	120
279.	Pulivalam Mulelthottam Devi Temple Kavu, IIamba	Naga, Nagayekshi	400
280.	Pulivila Sree Dharma Sastha Kavu, Pachalloor	Naga	200
281.	Punnakkattu Edathara Nagaru Kavu, Chemmaruthy	Naga	400
282.	Punnattu Sri Thampuran Kavu, Kazhakkoottam	Naga	120
283.	Puthanvila Kavu, Iiamba	Naga	4000
284.	Siva Temple Kavu, Ambalathara	Naga	200
285.	Sree Aryankuzhi Bhagavathi temple Kavu, Kamaleswaram	Naga	80
286.	Sree Bhadrakali Temple Kavu, Pachalloor	Naga	2000
287.	Sree Bhagavathi Temple Kavu, Nelliyode	Naga	800
288.	Sree Bhoothathan Kavu, Kudappanakunnu	Naga	80
289.	Sree Bhoothathan Kavu, Vazhayila	Naga	200
290.	Sree Dharma Sastha Kavu, Amaravila	Naga	210
291.	Sree Dharma Sastha Kavu, Pirayil	Naga	40
292.	Sree Dharma Sastha Kavu, Thachttu	Naga	4000
293.	Sree Dhurga Devi Temple Kavu, Kaduvayilkonam, Thottakkadu	Naga, Nagayekshi	400
294.	Sree Eswari Bhoothathan Kavu, Kanjikuzhi	Naga	800
295.	Sree Indalayappan Kavu, Karumam	Naga	1600
296.	Sree Thamburan Kavu, Punamkulam	Naga	200
297.	Sree Thamburan Kavu, Thampanoor	Naga	160

298.	Sri Bhagavathi Kavu, Kariprathala	Naga	200
299.	Sri Dharma Sastha Kavu, Karyavattom	Naga	200
300.	Sri Dharma Sastha Kavu, Thuruthippally	Naga	400
301.	Sri Dhurga Temple Kavu, Thoppil	Naga	400
302.	Sri Kunnathu Mannadi Bhagavathi Temple Kavu, Mekkepattom	-	200
303.	Sri Naduvathan Kavu, Kazhakkoottam	Naga	40
304.	Sri Raja Rajeswary Devi Temple Kavu, Thennoorkonam	-	600
305.	Thachoor Kavu, Avanavamchery	Manthramurthy	400
306.	Thachottu Madan Kavu, Thachottu	Madan, Marutha, Mayamayakki	2000
307.	Thannimmoottil Kavu, Oruvathilkotta	Naga	800
308.	Thaivilakom Sri Nagaraja Kavu	Naga	400
309.	Thannikkattu Kavu, Kazhakkoottam	Naga	80
310.	Thekkekonam Dhurga Kavu, Chowwara	Bhagavathi	320
311.	Thengazhiyathu Kavu, Thottakkadu	Naga	800
312.	Therikunnathu Nagaru Kavu, Karingal, Kattakada	Naga	4000
313.	Thiruchittoor Kavu, Nedumangadu	Naga	800
314.	Thoppilmele Sri Nagaru Kavu, Maruthoorkonam	Naga	200
315.	Thottakkadu Devi temple Kavu, Pongummoodu	Naga	1200
316.	Thripporittakavu, Panayara	Naga	2000
317.	Udavan Kavu, Edavattom	Naga	800
318.	Vadakkathil Kavu, Avanavamchery	Naga	40
319.	Vadakkodu Kavu, Thottakkadu	Naga	2000
320.	Vadavila Sree Dharma Sastha Kavu, Pangode	Naga	600
321.	Valiya Kavu, Chittayikkodu	Naga	4000
322.	Valiya Thoppil Kavu	Naga	800
323.	Valiyaveettil Thekkedathu Kavu, Nedumangadu	Naga	400
324.	Venmaranelloor Kavu, Thirumannom	-	2000
325.	Viruthiyottu Kavu, Attingal	Madan	1000
Thrissur District			
326.	Polanchery Kavu	Bhagawathi/ Naga	2020
327.	Nijayapalli Illam	Naga	8080
328.	Vallathu Kavu	Naga	800
329.	Kottathu Bhagawathi	Bhagawathi	2020
330.	Koothu Parambil Kavu	Naga	300
331.	Pampumekkattumana	Naga	44025
332.	Sankulangara Kavu	Siva/Naga	6600
333.	Eramangalam Kavu	Naga	1212

Classification of sacred groves

The sacred groves found in India can be classified under three categories: (1) Traditional sacred groves - It is the place where the village deity resides, who is represented by an elementary symbol. (2) Temple groves– here a grove is created around a temple and conserved (3) Groves around the burial or cremation grounds.

Ecological significance

Conservation of biodiversity – The sacred groves are important repositories of floral and faunal diversity that have been conserved by local communities in a sustainable manner. They are often the last refuge of endemic species in the geographical region.

Recharge of aquifers – The groves is often associated with ponds, streams or springs, which help meet the water requirements of the local people. The vegetative cover also helps in the recharging the aquifers.

Soil conservation – The vegetation cover of the sacred groves improves the soil stability of the area and also prevents soil erosion.

Distribution of sacred groves in India

In India, sacred groves are found all over the country and abundantly along the Western Ghats in the State of Kerala and Karnataka. Although, there has been no comprehensive study on the sacred groves of the entire country, experts estimate the total number of sacred groves in India could be in the range of 100,000.

Table 2. List of sacred groves in India.

State	**Local term for sacred Groves**	**No. of documented sacred groves**
Kerala	**Kavus**	**2000**
Arunachal Pradesh	*Gumpa* forests (sacred groves attached to Buddhist monasteries)	91
Andhra Pradesh	-	750
Assam	*Than, Madaico*	40
Chhattisgarh	*Sarna, Devlas, Mandar, Budhadev*	600
Goa	-	55
Gujarat	-	29
Haryana	-	248
Himachal Pradesh	*Deo Bhumi*	5,000
Jharkhand	*Sarana*	29
Karnataka	*Devara Kadu*	1,424
Madhya Pradesh	*Devkot, Matikot, Devsthali, Budhadev*	21

Maharashtra	*Devrais*	2,837
Manipur	*Gamkhap, Mauhak* (sacred bamboo reserves)	365
Meghalaya	*Law Lyngdhoh*	103
Orissa	*Jahera, Thakuramma*	322
Pondicherry	*Kovil Kadu*	108
Rajasthan	*Orans, Kenkris, Jogmaya*	225
Sikkim	*Gumpa* Forests	56
Tamil Nadu	*Kovil Kadu*	528
Uttaranchal	*Deo Bhumi, Bugyal* (sacred alpine meadows)	18
West Bengal	*Garamthan, Harithan, Jahera, Sabitrithan, Santalburithan*	670

Table 3. List of small mammals in the sacred groves

Sl. No.	Order	Species	Common name	Distribution	Status
1	Insecitvora	*Hemiechinus micropus* (Horsfield), 1851	Pale hedgehog	Kottayam District	Endemic to India LR/lc
2	Insecitvora	*Suncus murinus* (Linnaeus), 1758	Grey musk shrew	Throughout Kerala	LR/lc
3	Insecitvora	*Suncus dayii* (Dobson), 1888	Day's shrew	Ernakulam and Thrissur District	VU, endemic to India
4	Chiroptera	*Cynopterus sphinx (Vaval)*	Short nosed fruit bat	Throughout Kerala	LR/lc
5	Chiroptera	*Petropus giganteus (Brunrich)*	Indian flying fox	Throughout Kerala	LR/nt
6	Chiroptera	*Rousettus leschenaulti* (Desmarest)	Fulvous fruit bat	Throughout Kerala	LR/lc
7	Chiroptera	*Taphozous melanopogon* (Jemmnic), 1838	Beard sheath	Thiruvanathapuram/ Ernakulam, Thrissur Districts	LR/lc
8	Chiroptera	*Taphozous longi manus* (Hard wicki) 1825	Long winged tomb bat	Ernakulam District	LR/nt
9	Chiroptera	*Taplozous saccolaimus* (Temminc)	Pouch bearing bat	Thrissur and Ernakulam Districts	?
10	Chiroptera	*Megaderma lyra* (E. Geoffrey)	Indian false vampire	Throughout Kerala	LR/lc
11	Chiroptera	*Megaderma spasma* (Linnaeus)	Mulay false vampire	Thrissur, Ernakulam, Thiruvanathapuram, Palakkad Districts	LR/lc
12	Chiroptera	*Hipposideros*	Fulvous leaf	Ernakulam District	LR/nt

		fulvus (Gray)	nosed bat		
13	Chiroptera	*Hipposideros speoris* (Schneider)	India house shoe bat	Kozhikode, Ernakulam, Thiruvanathapuram Districts	LR/nt
14	Chiroptera	*Hipposideros ater* (Temppleton)	Dusky leaf nosed bat	Thiruvanathapuram, Alappuzha, Ernakulam, Kozhikode, Thrissur Districts	LR/nt
15	Chiroptera	*Hipposideros pomona* (Andersens's)	Andersens's leaf nosed bat	Thrissur and Alappuzha Districts	?
16	Chiroptera	*Rhinolophus rouxii* (Temminck)	India horse shoe bat	Thrissur, Ernakulam, Malappuram, Palakkad, Kannur, Districts	LR/nt
17	Chiroptera	*Rhinolophus lepidus* (Blyth's)	Blyth's horse shoe bat	Kozhikode, Kollam, Silent Valley	LR/nt
18	Chiroptera	*Rhinolophus hipposideros* (Beddomii)	Lesser wooly horse shoe bat	Wayanad, Palakkad, Kannur, Thrissur Districts	?
19	Chiroptera	*Tadarida aegyptica* (E. Geoffrey)	Egyptian free tailed bat	Thrissur and Ernakulam Districts	LR/nt
20	Chiroptera	*Kerivoula picta* (Pallas)	Painted bat	Kottayam, Thrissur, Kozhikode, Kannur Districts	LR/nt
21	Chiroptera	*Pipistrellus ceylonicus* (Kelaart)	Kelaart's pipistrelle	Wayanad and Thrissur Districts	LR/lc
22	Chiroptera	*Pipistrellus coromandra* (Grey)	Indian pipistrelle	Malabar	LR/nt
23	Chiroptera	*Pipistrellus* (Temminck)	Least pipistrelle	Thrissur and Ernakulam Districts	LR/lc
24	Chiroptera	*Pipistrellus affinis* (Dobson)	Chocolate pipistrelle	Wayanad District	?
25	Chiroptera	*Pipistrellus dormeri* (Dobson)	Dormer's bat	Thrissur District	LR/nt
26	Chiroptera	*Scotophilus heathii* (house field)	Yellow house bat	Thiruvananthapuram. Ernakulam, Thrissur Districts	?
27	Chiroptera	*Scotophilus kuhlii* (Leach)	Common yellow bat	Palakkad District	LR/nt
28	Chiroptera	*Tylonycteris pachypus*	Bamboo rat	Thrissur District	LR/nt
29	Chiroptera	*Myotis*	Peshwari bat	Palakkad, Kozhikode	UV

		horsfieldii (Temmnick)		Districts	
30	Chiroptera	*Myotis montivagus* (Wrongthow & Ryby) 1913	Burmese whiskered bat	Kozhikode District	EN
31	Primates	*Loris lyddekerianus* (Linnaeus)	Slender loris	Wayanad	UV
32	Pholidota	*Manis crassicaudata* (Gray)	Indian pangolin	Thrissur, Palakkad Districts	LR/nt
33	Rodentia	*Funambulus palamarum* (Linnaeus)	Three striped palm squirrel	Throughout Kerala	LR/nt
34	Rodentia	*Funambulus sublineatus* (water house)	Dusky striped squirrel	Thiruvanathapuram, Ernakulam, Wyanad Districts	LR/nt
35	Rodentia	*Petinomys fuscocapillus* (Jerdon)	Small Travancore flying squirrel	Pathanamthitta, Kannur, Ernakulam Districts	UV
36	Rodentia	*Tatera indica (*Hardwickeii)	Indian gerbil	Throughout Kerala	LR/lc
37	Rodentia	*Bandicota bengalensis* (Gray)	Lesser bandicoot rat	Throughout Kerala	LR/lc
38	Rodentia	*Bandicota indica* (Bechsterin)	Bandicoot rat	Throughout Kerala	LR/nt
39	Rodentia	*Rattus rattus* (Linnaeus)	Common house rat	Throughout Kerala	LR/lc

40	Rodentia	*Rattus blanfordi* (Thomas)	Unite tailed wood rat	Thiruvanathapuram, Ernakulam, Thrissur	LR/nt
41	Rodentia	*Vandeleuria oleracea* (Bennett)	Indian long tree mouse	Idukki, Wayanad Districts	LR/lc
42	Rodentia	*Mus musculus (*Linnaeus)	House mouse	Throughout Kerala	LR/lc
43	Rodentia	*Mus booduga*	Common Indian field mouse	Throughout Kerala	LR/lc
44	Rodentia	*Mus cookeii (*Ryley), 1914	Ryle's spiny mouse	Kannur District	LR/lc
45	Rodentia	*Rattus norvegicus* (Berkemhont), 1796	Brown rat	Throughout Kerala	LR/LC
46	Rodentia	*Hystrix indica*	Indian	Throughout Kerala	LR/lc

		(Kerr) 1790	porcupine		
47	Carnivora	*Paradoxurus hermaphroditus* (Pallas) 1777	Toddy cat	Throughout Kerala	LR/lc
48	Carnivora	*Viverricula indica* (Desmorest), 804	Small Indian civet	Throughout Kerala	LR/nt
49	Carnivora	*Herpestes edwardsii* (Geoffroy)	Mongoose	Throughout Kerala	Endemic to W.G.E.N
50	Carnivora	*Felis chaus*	Jungle cat	Throughout Kerala	VU
51	Lagomorpha	*Lepus nigricollis* (F. Cuvier) 1823	Blacknaped hare	Throughout Kerala	LR/Ic
52	Artiodactyla	*Moschola meminna* (Erxlenben) 1777	Mouse deer	Throughout Kerala	LR/nt

Plate 1. Iringole Kavu scared grove in Ernakulam District

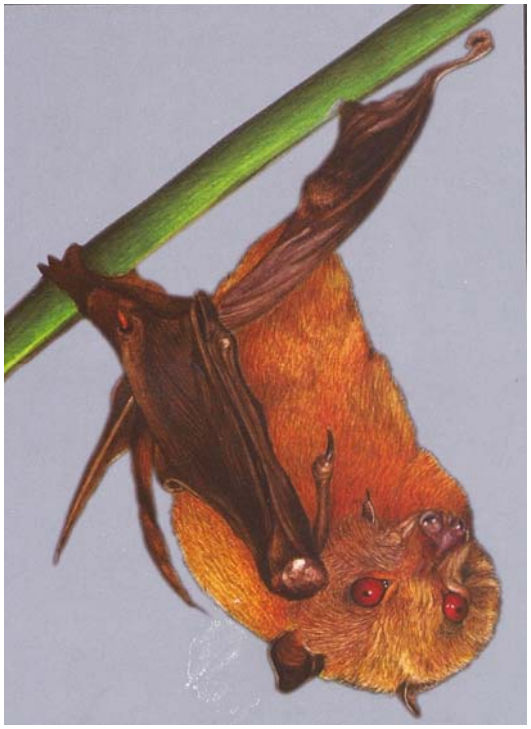
Plate 2. A sacred grove in Thrissur District

Plate 3. Habitat of rodents and bats in sacred groves

Plate 4. *Cynopterus sphinx*

Plate 5. *Cynopterus brachyotis*

Plate 6. *Latidens salimalii*



Plat 7. *Pteropus faunulus*

Plate 8. Pond in the sacred grove

Plate 9. Habitat alteration

Ecology of bats

Sacred groves serve as roost sites and feeding grounds under natural conditions. The holes and cracks in the trunk of trees and rotting woodpecker holes serve as ideal roosts for about 50 different animal species. Among them, bark crevices and loose bark can serve as hiding place. Protection of roost sites, tree holes, fulfill several basic functions throughout the year. Bats use a large variety of tree roost and woodpecker holes served as ideal habitat for bats. Woodpecker conservation is beneficial to bat conservation, because they offer a number of roost sites to bats. A 120 year old tree has permanently provided 25 to 30 tree holes. Ecologically, these mini forest (Sacred groves of older days) endowed man, with all the service of a tropical forest ecosystem.

Threats to the sacred groves: Fragmentation of sacred groves

1. Fragmentation of sacred groves

Habitat fragmentation is a significant threat to conservation due to two reasons. First it leads to the fragmentation of contiguous, large population into several small and isolated populations. These small populations are prone to extinction from several threats that are well known. Second the habitat fragments decay in the long run due to change in the macro and microhabitat conditions. This process is often aggravated by human activities. The impact of habitat fragmentation differs among species, depending on their biology, ecology and social behavior. Species that are rare, endemic and habitat specialist are more adversely affected and tend to be lost fast than other species. Similarly more complex and species rich habitats are much more adversely affected than other habitats.

2. Modernization of temples and habitat alteration

Because of the modernization of temples and constructions of concrete protection walls to the temples, habitat of bats and rodents are destroyed in large.

3. Removal of biomass.

Removal of biomass from the sacred groves largely affects the micro habitat of ground nesting forms like rodents and removal of old walls also affects the roosting sites of bat. In addition, the area under sacred grove is fast deteriorating due to many reasons

including the cost of performing rituals, modernization, evolution of nuclear families at the cost of joint families, etc.

Plate 10. Invertebrates

Plate 11. Seeds

Socio economic importance of sacred graves

In Kerala, based on owner patterns, sacred groves can be broadly categorized into three groups namely, those managed by individuals group of families and the statutory bodies like youth clubs, schools, forest department, municipality and local Panchayath. Sacred groves (Kavukal) are seen throughout Kerala having varied forms of cultural practices and belief systems. This primitive tribal culture are of Dravidian and is mostly distributed along the plains and lower elevations *i.e.* means sea level to 450 m altitude, near settlements and away from the forest. Kollam, Alappuzha and Pathanamthitta Districts in the South and Kannur, Kasargode and Kozhikode District in the North have been described as the hotspot of sacred groves of Kerala. Even though the groves are more or less disturbed and reduced in size, many of them are still rich in biodiversity.

Associated with faith, taboos and believed over the years, local people have developed a strong affinity towards the temple and the sacred grove. The local people of each sacred grove in general also believe that their livelihood, security and cultural existence are complementary to the blessings of the deity. However belief in super natural forces can be traced back to time immemorial. Behind each belief, we can find stories connecting it with the purpose of pleasing someone, or the fear of something, although the sacred groves are profited by social taboos, they are not minimum to anthropogenesis like developmental activities, grazing, poaching, invasive, weed collection of wood and timber etc. The present work reveals that, sacred groves act as preservation plots and often harbor rare, endemic, endangered and economically and medically important plants. Neglecting the small groves will lead to the disappearance of both vegetation and cultivated biodiversity.

CONCLUTIONS

Since the 1990's sacred places have emerged as a new frontier for interdisciplinary research on their own merits and also for their actual or potential relevance for biodiversity conservation. This reflects the emerging recognition in many sectors of the important role that religion and spirituality can play in environmentalism. In some ways attention to these phenomena is a natural development. Even secular approaches to

environmental protection often become a kind of sacralization of a space, such as pursuing wilderness as an ideal. This is exemplified by John Muir (1838-1914), who experienced the forested mountains of the Western United States as a sacred place, and who was especially influential in the creation of the national park system. Many students of sacred places and related subjects are convinced that there is a demand for a fundamental rethinking and reworking of contemporary spirituality, Human ecology, environmentalism, and conservation are interconnected. They believe that the recognition and protection of sacred places in nature may be needed more than ever before for the survival of biodiversity and accordingly that of humankind in the 21st century. Aldo Leopold (1887-1948), a prominent pioneer in Wildlife Biology and Conservation, stated most succinctly the essence of a viable eccentric environmental ethic in his classic essay the "Land Ethic": "A thing is right when it tends to preserve the integrity, stability, and beauty of the biotic community. It is wrong when it tends other wise." This ethic applies as well to sacred places and their role in biodiversity conservation. Preservation of sacred groves is an important necessity in this era of dwindling forest cover; but the problem is difficult to tackle, as the number of sacred groves is many and the agencies in charge of them are diverse. Hence a common approach in all cases may not be feasible. However following are some suggestions to save the relics from total extinction.

RECOMMENDATIONS

1. Government may encourage the owners, who are willing to conserve their groves by granting them incentives in the form of maintenance grants or awards.

2. Create awareness among the public about the importance of the sacred groves and the necessity for their preservation through mass media.

3. Two conservation measure urgently required are (1) Prevention of any reduction in the area of sacred groves (2) Prevention of any further degradation.

4. Completely ban the removal of biomass for maintaining the sustainability of ecosystem.

5. Creation of awareness among local people and all stakeholder groups.

6. Identification of the type of contribution of stakeholder group which will help in managing the sacred grove.

7. Encouragement for all stakeholders in the management of sacred groves taking into consideration the wisdom and interest of the major stake holder groups.

8. Do not disturb trees, covers, buildings or any other roosting sites.

9. Do not cut down trees that have bat roosts.

ACKNOWLEDGEMENTS

I express my heart felt gratitude to the former directors of the Institute Dr. J.K. Sharma, Dr. R. Gnanaharan and present Director Dr. K.V.Sankaran for their constant guidance and encouragement. I acknowledge the financial assistance by the Science Technology, Environment Council (STEC) Plan Fund. Assistance received from Technical Assistants K. Prabhavathy and M.N. Shaji is gracefully acknowledged. Thanks are also due to Dr. E.A. Jayson, Scientist F, who revised the manuscript and offered many suggestions. Dr. K.K. Ramachandran and Dr. P. Vijayakumaran Nair offered critical comments on the draft report.

REFERENCES

Balasubaramanian, K. and Induchudan, N.C. 1996. Plant diversity in the sacred groves of Kerala *Evergreen* 36: 3-4.

Blandford, W.T. 1888. The fauna of British India including Ceylon and Burma. Mammalia Part I. Taylor and Francis, London.

Burlier, F. 1975. Mammals small and large: the implication of size. *in*: Small mammals: their productivity and population dynamics, 1-8 pp. F.B. Golle, K. Petrusewicz and Ryskowski (*Eds.*) Cambridge University Press, Cambridge.

Chandran, M.D.S. 1993. On the ecological history of the Western Ghats. *Current Science* 73: 149-155.

Chuvan Robort, M. 1978. The impact of small mammals in ecosystem studies and function *In*: Population of small mammals in India 167-180 pp. Das, D. Sugeth, P. (Eds.) Special Publication Service, Plmaluming Laboratory of Ecology, University of Pittsburgh.

Corbet, G.B. Hill, J.E. 1991. A World list of Mammalian species, Third Edition. British Museum (Natural History) Publication, London.

Gadgil, M. and Vartak, V.D. 1976. Sacred groves in the Western Ghats of India. *Eco. Bot.* 30:152-160.

Unnikrishnan, E. 1995. Sacred groves of North Kerala –an eco folklore study (in Malayalam), Jeevaraksha, Thrissur.

Wilson, D.E. and Reeder, D.M. 1993. Mammal species of the world. A Taxonomic and Geographic reference. Smithsonian Institution Press, Washington.

Wroughton, R.C. 1920 a. scientific results from the Mammal survey No. XXIV. *Bombay Natural History Society* 27: 249-250.

Appendices

Appendix I. Fauna of the sacred groves

Sl.No	Zoological Name	Common Name	
		English	Malayalam
	Amphibians		
1.	*Rana hexadactyla*	Green/ Pond frog	Thavala
	Reptiles		
2.	*Bungarus caeruleus*	Krait	Vellikkettan
3.	*Calotes versicolor*	Garden lizard	Onthu
4.	*Ahaetulla nasuta*	Green whip snake	Pachalapampu
5.	*Mabuya carinata*	Common skink	Arana
6.	*Naja naja*	Cobra	Nagam, Moorkhan
7.	*Xenochrophis piscator*	Freshwater snake	Neerkoli
8.	*Coluber mucosus*	Rat snake	Chacra
9.	*Varanus bengalensis*	Monitor lizard	Udumpu
10.	*Vipera russellii*	Russell's viper	Anali
	Aves		
11.	*Acridotheres tristis*	Common myna	Myna
12.	*Phoenicurus auroreus* sp.	White brested waterhen	Kulakozhi
13.	*Ardeola grayii*	Paddy bird/Pond heron	Kokku
14.	*Bubo nipalensis*	Forest eagle owl	Kattu munga
15.	*Bubo oriental*	Owl	Munga
16.	*Centropus sinensis*	Crow pheasant	Uppan/ Chempothe
17.	*Ciconia episcopus*	Whitenecked stork	Karimkokku
18.	*Corvus macrorhynchos*	Jungle crow	Kattu kakka
19.	*Corvus splendens*	House crow	Kakka
20.	*Egretta alba*	White egret	Vellakokku
21.	*Eudynamys scolopacea*	Asian koel	Kuyil
22.	*Falco tinnunculus*	Common kestrel	Pullu
23.	*Galerida malabarica*	Crested lark	Kompan vanampadi
24.	*Glaucidium radiatum*	Jungle owlet	Chempan nathu
25.	*Gorsachius melanolophus*	Tiger bittern	Thavittu kokku
26.	*Gracula religiosa*	Common hill myna	Kattu myna
27.	*Halcyon smyrnensis*	Whitebreasted Kingfisher	Ponman
28.	*Haliastur indus*	Brahminy kite	Garudan/Krishnaparunthu
29.	*Milvus migrans*	Pariah kite	Chakkiparunthu
30.	*Nycticorax nycticorax*	Night heron	Pathira kokku
31.	*Oriolus kundoo*	Indian oriole	Manja kili
32.	*Oriolus xanthornus*	Blackheaded oriole	Manja karuppan
33.	*Psittacula krameri*	Roseringed parakeet	Mothirathatha
34.	*Pycnonotus jocosus*	Blackcrested bulbul	Irata thalachi
	Mammals		
35.	*Bandicota indica*	Bandicoot rat	Thurappan

36.	*Canis aureus*	Jackal	Kurukkan/Oolan
37.	*Funambulus palmarum*	Palm squirrel	Annarakannan
38.	*Herpestes edwardsii*	Mongoose	Kurangu
39.	*Lepus nigricollis*	Indian hare	Moyal, Chaviyan
40.	*Macaque radiata*	Bonnet macaque	Kurangan
41.	*Mus musculus*	Mouse	Chundeli
42.	*Paradoxurus hermaphroditus*	Palm civet	Marapatti
43.	*Pteropus giganteus*	Fruit bat/Flying fox	Vouwal
44.	*Viverricula indica*	Small civet	Veruke
45.	*Cynopterus sphinx*	Shortnosed fruit bat	Vouwal
46.	*Rattus rattus*	House rat	Eli
47.	*Mus booduga*	Little Indian field mouse	Veedu Eli

Adapted from the final report of the D.O.E N. Sponsored project entitled "Studies on the Sacred Groves of Kerala" conducted by Dr. K.K. Ramachandran and Dr. C.N. Mohanan., Center for Science Studies, Thiruvanathapuram.

Appendix II. Name of the Grove: Mulakunnath Kavu

Observer's name	**P. Padmanabhan**			**Date & time of observation**	**26/01/2008**
District	Taluk	City/Town/ Village	Location Name	Elevation from sea level	
Thrissur	Thrissur		Mulakunnath Kavu	500 m	
Sacred grove situated in/ area	Temple				
Road	Forest	Private Place	Temple	Others	
Name of deity worshipped		Naga		Taboo	
Area					
Presence of pond: Yes/No					

Threat information 9e.g., disturbance, killings, habitat loss):		Habitat loss
Protection information (e.g., Temple , sacred groves, sanctuary) : sacred groves		
Notes & Comments: Modernization of the sacred.		
Photographs of the groove (showing details as well as surrounding area): Yes		

Example of Observation sheet

Appendix III. Mammals of sacred groves in Northern Malabar

Sl.No	**Scientific name**	**Common name**
1.	*Suncus mucenius*	Grey musk show
2.	*Mus booduga*	Indian field mouse
3.	*Rattus rattus*	Common house rat
4.	*Bandicota indica*	Bandicoot rat
5.	*Tatera indica*	Indian gerbil or Antelope rat
6.	*Hystrix indica*	Indian porcupine
7.	*Funambulus palmarum*	Three- striped palm squirrel
8.	*Pteropus giganteus*	Indian flying fox
9.	*Cynopterus sphinx*	Short- nosed fruit bat
10.	*Megoderma lyrce*	Indian false vampire
11.	*Pipistrellus ceylonicus*	Indian pipistrelle
12.	*Lepus nigricollis*	Blacknaped hare
13.	*Herpestes edwardsii*	Common mongoose
14.	*Paradoxurus hermaphrodites*	Palm civet
15.	*Canis aureus*	Jackal
16.	*Vulpes bengalensis*	Indian fox
17.	*Felis chaus*	Jangle cat
18.	*Trachypithecus johnii*	Nilgiri langur

19.	*Macaca radiata*	Bonnet macaque
20.	*Loris lydekkerianus*	Slender loris
21.	*Felidae bengalensis*	Leopard cat
22.	*Viverricula indica*	Small Indian civet
23.	*Lutrogale perspicillata*	Small Indian otter
24.	*Manis crassicaudata*	Pangolin

Unnikrishnan, E. (1995)

Appendix IV. Observation sheet

No.	Animals observed	Time of observation	No. observation	Group size	Nature of observation	Site of observation	Remarks

Name of the Grove: Iringole Kavu