Floristic and Phytosociological Studies of the Sacred Grove, Kayyath Nagam Kavu, Kannur District Kerala, India

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Abstract  Religious and traditional beliefs, cultural mores, and practices play a crucial role in the conservation of environment and biodiversity. Sacred groves are patches of land that are communally protected with religious zeal. Kerala is one of the states in India, where the sacred Groves are widely distributed from the West Coast to the Eastern high lands. Most of the sacred groves in Kerala are associated with water tanks, ponds, springs or streams. Many sacred groves are located in catchments near the origins are springs or streams. The present investigation reveals the ethnobotanical and phytosociological attributes of various plant species present in the sacred grove, Kayyath Nagam Kavu, Thaliparamba. 50 vascular plant species were enumerated from the sacred grove. Based on the calculations of frequency, density and abundance, IVI of each species was calculated. Of the various plant species available in the study area, the species *Hopea ponga* secured highest IVI of 32.612. The other species like *Canthium rheedi*, *Scleria lithosperma* were also showing highest IVI. In this site lowest IVI was shown by *Rungia pectinate*, *Justicia nagpurensis*, *Jasminum malabaricum*, *Pongamia pinnata*, *Mallotus philippensis*, *Olderlandia auriculata* and *Piper nigrum*.

Keywords: phytosociological, ethnobotanical, sacred groves, biodiversity, conservation

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1. Introduction

Conservation of nature and natural resources has been an important part of cultural ethos, especially in remote rural and indigenous communities in many part of the world, including India. These communities consider themselves connected with their biophysical environment in a web of spiritual relationship. These rural communities consider plant, animals or even rivers and mountains as their ancestors and protect them. The sacred groves are the relic forest segments preserved in the name of religion and culture. These groves are mostly associated with temples and are also culturally important. They manifest the spiritual and ecological ethos of rural indigenous communities. Various cultural and religious festivals are often arranged by local people within these patches, which they call ‘Mela.’ As a way of conservation of nature, sacred groves have proven to be a well-tried and tested method over thousands of years [1].

According to Malhotra et al., [2] groves are those area dedicated by local communities to their ancestral spirits or deities. They have immense value from genetic diversity as well as ecological point of view and rich in flora. They are repository of several medicinal and economically important plants attached with socio-cultural and religious sentiments there exist has undisturbed islands. But today these are adversely affected by human activities. However, such sacred groves are not restricted to India alone. These sacred groves may range in size from a group of few trees to a forest of trees [3]. Groves are important reservoirs of biodiversity, preserving indigenous plant species and serving as asylum of Rare, Endangered and Threatened (RET) species [4]. Even the smallest groves often harbor some olden magnificent specimens of trees and climbers [5]. The larger groves are treasure-trove for the naturalist, supporting many threatening species in the area and the becoming extinct with deforestation. As an ecosystem sacred groves help in soil and water conservation besides preserving biological wealth. But tragically they are slow disappearing under the influence of modernization [6]. There is a recent awakening among the environmentalists to preserve these groves. Some of the sacred groves need immediate attentions; they contain rare and threatening plants. Preservation of these groves is crucial need to this era. Assessment of biodiversity proves extremely practical for determining decreasing natural diversity, effect of exotic species, migration and threat to the species. Many taboos are associated with both the SGs, which help in managing resources well through ritual representation. Sacred groves, in general, are a valuable tool of...
biodiversity conservation. But people’s changing attitudes, erosion of traditional beliefs, and human impact have caused degradation of sacred groves over the years. Their conservation would not be possible without the active participation of the local people [7].

The ecological processes are well balanced by the influence of biodiversity, which is necessary for human survival. Therefore, the biodiversity-rich sacred groves are of immense ecological significance. They also play an important role in the conservation of flora and fauna. Keeping in view the role of the sacred groves as the treasure of repositories of variety of plant species, the present study is conducted to find out the plant diversity in sacred groves, Kayyath Nagam in Kannur district, Kerala.

2. Materials and Methods

Sree Kayyath Nagam Kavu is one of the keezhadams of Thaliparamba Sree Rajarajeswara Temple under TTK devaswom. This mystic place is located near to Pattuvam, Thaliparamba, Kannur (Figure 1). It is almost 5.1 km away from the Thaliparamba town. This Kavu lies between 12.0097° N latitude and 75.3462°E longitude. The climate is moderately hot and temperature ranging from 25°C to 36°C. The total annual rain fall is 3438 mm. This grove is spread over 2 acres with laterate soil. The kavu is a center of beauty and worship for many naturalists and believers.

![Figure 1. Sree Kayyath Nagam Kavu, Pattuvam, Thaliparamba, Kannur](image)

Kayyath Nagam temple has got a relevant place among snake temples in north Malabar. This temple is situated in midst of a river and three hills. The primary deity of this temple is Serpent God, Nagaraja.

2.1. Floristic Survey

This study envisages the estimation of floral wealth of the sacred grove and its role in conservation. A brief floristic survey of sacred grove vascular plants was carried out during 2019 to 2020. Plants are identified with the help of Madras Presidency [8], Flora of Cannanore [9] and also by using available field keys and taxonomic bulletins. The identification was further confirmed with the help of taxonomic experts in Botany.

2.2. Phytosociological Analysis

The minimum quadrate size of 1 x 1 was fixed by the species-area curved method of phytosociological observations. Each time 20 quadrats were laid by the randomized method in each site. The minimum number of quadrat required (ie. 10) was determined as described by Greig – Smith [10].

2.2.1. Frequency, Density and Abundance Were Calculated Using the Following Formulae

\[
\text{Frequency} = \left( \frac{\text{Number of quadrats in which the species present}}{\text{Total number of quadrats studied}} \right) \times 100
\]

\[
\text{Density} = \left( \frac{\text{Total number of individuals of the species in all quadrats}}{\text{Total number of quadrats studied}} \right)
\]

\[
\text{Abundance} = \frac{\text{Total number of species in all quadrats}}{\text{Number of quadrat of occurrence of species}}
\]

\[
\text{Basal area} = \Pi r^2
\]

Where,

\( \Pi = 3.14 \) and ‘r’ is the radius of the stem at the point of emergence.

Relative frequency, relative density and relative dominance were calculated from the following formulae:

Relative Frequency

\[
\text{Relative Frequency} = \left( \frac{\text{Number of occurrence of the species}}{\text{Number of occurrence of all species}} \right) \times 100
\]

Relative density

\[
\text{Relative density} = \left( \frac{\text{Number of individuals of the species}}{\text{Number of individuals of all species}} \right) \times 100
\]

Relative dominance

\[
\text{Relative dominance} = \left( \frac{\text{Total basal area of the species}}{\text{Total basal area of all species}} \right) \times 100
\]

\[
IVI = RD + RF + RD\text{Do}
\]

\[
RIVI = IVI / 3
\]

3. Result and Discussion

The present work revealed that sacred groves act as a gene pool or preservation plots and many of them harbour rare, endemic, endangered and economically and ethno medicinally very important plants because of the restraints exercised due to the fear of deities/spirits residing in these groves. The most of the groves of present study were small in size. Neglecting the smaller groves will lead to the disappearance of both vegetation and cultural diversity [11].

During study in Kayyath Nagam Kavu, Thaliparamba, a total of 51 vascular plants falling under 50 genera and 32 families were documented. Out of which, the angiosperms dominate with 50 members, while one is Pteridophyte. With respect to their habit, there are 16 herbs, 11 shrubs, 12 trees, 6 climbers, 2 woody climbers, 2 grasses, and 2 epiphytes. Among angiosperms dicots comprises 24 families, 39 genera and 40 species while monocot 7 families, 10 genera and 10 species. The relative proportion
of dicot with monocot species are shown in Table 1. The dominant families are Rubiaceae, Asteraceae, Acanthaceae, Fabaceae, Poaceae, Oleaceae with 5,4,4,3, and 3 species respectively.

| SL NO. | SPECIES                         | FAMILY    | HABIT    | MEDICINAL | COMMON NAME       |
|-------|--------------------------------|-----------|----------|-----------|-------------------|
| 1     | Abrus precocissimus              | Fabaceae  | Herb     | Medicinal | Vayalkattumuthira |
| 2     | Acetella villosa                | Fabaceae  | Herb     | Medicinal | Pailuvadanachedi  |
| 3     | Adenandra pinnata               | Fabaceae  | Tree     | Medicinal | Manjadimalam     |
| 4     | Ageratum conyzoides             | Fabaceae  | Tree     | Medicinal | Kattapa           |
| 5     | Aglaia elaeagnoides             | Malvaceae | Tree     | Medicinal | Cheeralam         |
| 6     | Allophylus cimicinum (L.) Staph | Poaceae   | Grass    | Medicinal | Venalpullu        |
| 7     | Aspidopoteris canarensis Dalz.   | Malpighiaceae | Climber  | Medicinal | Kannaravalli     |
| 8     | Breynia villosa                  | Phyllanthaceae | Tree     | Medicinal | Katturinuri      |
| 9     | Canthium rhedi D.C.             | Rubiaceae | Tree     | Medicinal | Edalimaram        |
| 10    | Carallia brachiatia (Lour.) Merr. | Lamiaceae | Tree     | Medicinal & Food | Vanghana |
| 11    | Carryota arenst L.              | Arecales  | Tree     | Medicinal | Pana              |
| 12    | Chassalia curviflora (Wall.) Thwaites | Rubiaceae | Sub-shrub | Medicinal | Vellakurinji      |
| 13    | Cissus latifolia Walp.          | Vitaceae  | Climbing shrub | Medicinal | Chunnambuvali   |
| 14    | Connarthus paniculatus Roxb.    | Connaraceae | Climber  | Medicinal | Valiyakuril       |
| 15    | Cyclea peltata Hook.f. &Thoms   | Menispermaeae | Shrub    | Medicinal orchid | Padathalli |
| 16    | Dendrobium ovatum (L.) Kraenzl   | Orchidaceae | Epiphyte | Medicinal | Veelilithil      |
| 17    | Dracaena ternifolia Roxb.       | Asparagusaceae | Sub-shrub | Medicinal | Manjukkantha      |
| 18    | Elephantopus scaber L.          | Acanthaceae | Sub-shrub | Medicinal | Neelambari        |
| 19    | Erichthium viride var. Viride   | Acanthaceae | Herb     | Medicinal | Anachuvadi        |
| 20    | Eriobotrya paniculata Roxb.     | Convolvulaceae | Woody climber | Medicinal | Nakkuvalli      |
| 21    | Espatorius odoratum L.          | Acanthaceae | Shrub     | Medicinal | Appachappu       |
| 22    | Fagraea ceylanica Thumb.        | Gentianaceae | Small tree | Timber | Modakam          |
| 23    | Hopia ponga (Dennst.)           | Dipterocarpaceae | Tree     | Medicinal | Kambakam         |
| 24    | Hugonia mystax L.               | Linaeae    | Climber   | Medicinal & Food | Mothirakanni |
| 25    | Ischaemum ciliarie Retz.        | Poaceae   | Herb     | Medicinal & Food | Chenkodipullu |
| 26    |Ixora coccinea L.                | Rubiaceae  | Shrub     | Medicinal | Chekki           |
| 27    | Jasionum flexile var.flexile    | Oleaceae  | Herb     | Medicinal | Kaumunnula       |
| 28    | Jasionum malabaricum lawii C.B. Clarke | Oleaceae | Climber   | Medicinal | Kaumunnula       |
| 29    | Justicia nampurenis V.A.W. Grah. | Acanthaceae | Herb     | Medicinal | Kattu weed       |
| 30    | Lepidagathis incerto Bach.-Ham. ex Don | Acanthaceae | Herb     | Medicinal | Setophuli        |
| 31    | Lesperis aspera (Willd.) Link   | Lamianaceae | Herb     | Medicinal | Thumba           |
| 32    | Lindernia caespitosa (Bl.) Panigrahi | Scrophulariaceae | Herb     | Timber | Krishna poo     |
| 33    | Macaranga peltata (Roxb.) Mull.Arg. | Euphorbiaceae | Tree     | Medicinal | Uppila           |
| 34    | Mallotus philippinensis Muell. Arg. | Euphorbiaceae | Tree     | Medicinal | Kumkumamaram   |
| 35    | Mimosa pudica L.(Laajavanti)    | Mimosaceae | Herb     | Medicinal | Thottavadi       |
| 36    | Musa endofonda L.               | Rubiaceae  | Shrub     | Medicinal | Vellila          |
| 37    | Oldenlandia auriculata (L.) K.Schum. | Rubiaceae | Weedy herb | Medicinal | Getakola         |
| 38    | Olea elisca Roxb.               | Oleaceae  | Tree     | Medicinal | Karivetti        |
| 39    | Opilopemas burmannii (Retz.) P Beauv. | Poaceae | Grass    | Medicinal | Vattappullu      |
| 40    | Piper nigrum L.                 | Piperaceae | Climber   | Medicinal | Karunulakuvalli  |
| 41    | Pongamia pinnata (L.) Pierre    | Fabaceae  | Tree     | Medicinal | Ungu             |
| 42    | Pothos scandens L.              | Asecales  | Climbing shrub | Medicinal | Anappurarva     |
| 43    | Rungia pectinata (L.) Nees      | Acanthaceae | Herb     | Medicinal | Tavasamuraungi   |
| 44    | Scleria lithosperma (L.) Sw.    | Cyperaceae | Herb     | Aesthetic value | Nakappullu |
| 45    | Selaginella roxhorgihi var. strigose (Ridl.) K.M. Wong | Selaginellaceae | Herb     | Medicinal | Chivothi        |
| 46    | Smilax zeylana L.               | Smilaceae  | Climbing shrub | Medicinal | Kallamara        |
| 47    | Stecchinos minor Dennst.        | Loganiaceae | Climbing shrub | Medicinal | Cherukandravalli |
| 48    | Symphyosma involucratum Roxb.   | Lamianaceae | Woody climber | Weed | njaramboladai    |
| 49    | Urena lobata L.                 | Malvaceae  | Herb     | Medicinal | Uthiram          |
| 50    | Uvaria narum Wall.              | Annonaceae | Climber   | Medicinal | Korandapazham    |
| 51    | Vanda tessellata (Roxb.) Hook.exG.Don | Orchidaceae | Epiphyte | Medicinal | Maravazha       |
There are about 11 red listed species in Kayyath Nagam Kavu in which 9 species are least concern they are Adenanthera pavonina, Agaratum conyzoides, Aglae eleoanoida, Lindernia caespitiosa, Caryot aurens, Mallotus philippensis, Pongamia pinnata, Scleria lithosperma and Vanda tessellate. Hopeaponga is the only single plant in endangered category and Aspidopteris cannarensis is the only one plant in vulnerable category. (Table 3). Red listed species in the study area indicates the conservation status of sacred area. Bhagwat et al., [12] said that the sacred groves are the last home of some endangered species and also are known to represent the only existing climax vegetation communities in Northeastern India. But the area under sacred groves is fast depleting due to the interplay of an array of factors. Sacred groves originally maintained in the form of untouched ecosystems dedicated to the deity are looked as a source of revenue. Role of sacred groves in maintenance of biodiversity is undoubtedly significant. It is very important therefore refresh this traditional establishment and its further conservation [11].

### Table 2. Species Composition in Kayyath Nagam Kavu, Taliparamba, Kannur

| Si No. | SPECIES                                      | QUANTITATIVE ATTRIBUTES | SYNTHETIC ATTRIBUTES |
|--------|---------------------------------------------|-------------------------|----------------------|
| 1      | Abruus pulchellus Thwaites.                | Frequency: 10%          | R.F. 1.2             |
| 2      | Acmella ciliata (Kunth) Cass.              | Abundance: 3 individuals/m² | R.D. 0.2638         |
| 3      | Adenanthera pavonina.                      | Density: 0.3 individuals/m² | R.D. 2.762          |
| 4      | Agaratum conyzoides L.                     | 0.7                     | 0.920               |
| 5      | Aglea elegaenoides (A.Juss) Benth.         | 10%                     | 2.4                  |
| 6      | Allopterus cimicina (L.) Stapf              | 0.3                     | 7.55                |
| 7      | Aspidopteris canarensis Dalz.              | 2.1                    | 4.52                |
| 8      | Breynanvis-idea (Burm.f.) C.E.C. Fisch.    | 32.5                    | 1.56                |
| 9      | Canthium rhedidi.D.C.                      | 3.2                    | 2.06                |
| 10     | Carallia brachiata (Lour.) Merr.           | 0.1                    | 0.63                |
| 11     | Caryota urens L.                           | 0.9                    | 3.71                |
| 12     | Chasalia curviflora (Wall.) Thwaites.      | 1.7                    | 0.45                |
| 13     | Cissus latifolias Walp.                    | 0.8                    | 0.52                |
| 14     | Connuus paniculatus Roxb.                  | 1.2                    | 0.13                |
| 15     | Cyedea peltata Hook.f. &Thoms              | 0.9                    | 0.71                |
| 16     | Denirothrum ovatum (L.) Kraenzl             | 0.6                   | 0.13                |
| 17     | Dracena termitifolia Roxb.                 | 0.3                    | 0.11                |
| 18     | Echinolus viride av. Viride               | 0.4                    | 0.3                 |
| 19     | Elephantopus scaber L.                    | 1.1                    | 0.99                |
| 20     | Eriche paniculata Roxb.                     | 2.4                    | 0.9                  |
| 21     | Exsorophy odorumatal.                      | 0.8                    | 0.3                  |
| 22     | Fagraea ceylanica (L.)                     | 0.2                    | 0.7                 |
| 23     | Hopea ponga (Dennst.)                      | 0.3                    | 0.1                  |
| 24     | Hugonia mystax L.                          | 0.7                    | 0.3                  |
| 25     | Ischeumum ciliare Reitz.                   | 0.3                    | 0.2                 |
| 26     | Isora coccinia L.                          | 0.6                    | 0.3                  |
| 27     | Jasminum flexile var. flexile.             | 0.4                    | 0.2                 |
| 28     | Jasminum malabaricumlawii C.B.Clarke       | 0.3                    | 0.2                 |
| 29     | Justicia nagarensis V.A.W. Grah.           | 0.5                    | 0.2                 |
| 30     | Lepidagathis incurva Buch.-Ham. ex Don      | 0.5                    | 0.2                 |
| 31     | Leucas aspera (Will.) Link                 | 1.3                    | 0.2                 |
| 32     | Lindernia caespitiosa (Bl.) Panigrahi      | 0.6                    | 0.2                 |
| 33     | Macareunga peltata (Roxb.) Mull.Arg.       | 0.4                    | 0.2                 |
| 34     | Mallopus philippensis Muell. Arg.          | 0.2                    | 0.3                 |
| 35     | Mimosa padicula L.(Lajivanti)              | 0.3                    | 0.2                 |
| 36     | Musa enallajosa L.                         | 0.4                    | 0.2                 |
| 37     | Oldenlandia silicicola (L.) K.Schum.       | 0.3                    | 0.2                 |
| 38     | Olea dioica Roxb.                          | 0.3                    | 0.2                 |
| 39     | Opilmenes burmanii (Retz.) P Beav.         | 0.4                    | 0.2                 |
| 40     | Piper nigrum L.                            | 0.2                    | 0.3                 |
| 41     | Pongamia pinnata (L.) Pierre               | 0.1                    | 0.2                 |
| 42     | Pozhos scandens L.                         | 0.4                    | 0.2                 |
| 43     | Rangia pectinata (L.) Nees                 | 0.3                    | 0.2                 |
| 44     | Scleria lithosperma (L.) Sw.               | 0.5                    | 0.2                 |
| 45     | Selaginella ruxbortgii var. strigose (Ridl.) K.M. Wong | 0.4 | 0.2                 |
| 46     | Smilax zeylanica L.                        | 0.1                    | 0.2                 |
| 47     | Styrchynus minor Denst.                    | 0.3                    | 0.3                 |
| 48     | Symphorema involueratum Roxb.              | 0.3                    | 0.2                 |
| 49     | Urenia lobata L.                           | 0.6                    | 0.2                 |
| 50     | Ususia narum Wall.                        | 0.5                    | 0.2                 |
| 51     | Vanda tessellata (Roxb.) Hook.exG.Don      | 0.6                    | 0.2                 |
Table 3. Red listed plants in Kayyath Nagam Kavu

| SI NO | SPECIES                                      | STATUS       |
|-------|----------------------------------------------|--------------|
| 1     | Adenanthera pavonina L.                      | Least concerned |
| 2     | Ageratum conyzoides L.                       | Least concerned |
| 3     | Aglae eleagnoeidea (A.Juss) Benth            | Least concerned |
| 4     | Aspidopteris canarensis s Dalz.             | Vulnerable    |
| 5     | Caryota urens L.                             | Least concerned |
| 6     | Hopea ponga (Dennst.)                        | Endangered   |
| 7     | Lindernia caespitosa (BL) Panigrahi          | Least concerned |
| 8     | Mallotus philippensis Mueill. Arg.           | Least concerned |
| 9     | Pongamia pinnata (L) Pierre                  | Least concerned |
| 10    | Scleria lithosperma (L.) Sw.                 | Least concerned |
| 11    | Vanda tessellata (Roxb.)Hook. ex G.Don      | Least concerned |

The quantitative ecological characters such as frequency, abundance, density and basal cover and synthetic characters such as relative frequency, relative density, relative dominance, importance value index and relative value of importance for the study species present in study areas Kayyath Nagam Kavu, Thaliparamba, Kannur is given in Table 2. Phytosociological analysis of a plant community is the first and foremost basis of the study of any piece of vegetation as it is a pre-requisite for the understanding of community structure and organization. For understanding the community structure and organization, species composition is foremost requisite. Species composition is one of the major characters of plant community [13].

Aspidopteris canarensis, Connarous paniculatus and Ixora coccinia have higher frequency value than rest of the species. Lowest frequency was shown by about 33 species. Scleria lithosperma and Ageratum conyzoides have distributed abundantly than the other constituent species. Lowest abundance is shown by 14 species.

Based on the basal cover Hopea ponga was considered to be dominant species and secured the basal cover of 73\(\text{mm}^2/\text{m}\). Next to the dominant species, Hopea ponga, the species such as Canthium rheedi, Aglae eleagnoeidea were occupied the highest basal cover. Aspidopteris canarensis, Scleria lithosperma and Hopea ponga were registered highest Relative frequency, Relative density and Relative basal cover respectively. The species Hopea ponga secured highest IVI of 32.612. The other species like Canthium rheedi, Scleria lithosperma were also showing highest IVI. In this site lowest IVI was shown by Rungia pectinate, Justicia nagpurensis, Jasminum malabaricum, Pongamia pinnata, Mallotus philippensis, Olderlandia auriculata and Piper nigrum (Figure 2).

Based on IVI score made by this species it is understood that there are poorly established species in the communities of the study site of sacred grove. Due to endemism, over exploitation, shifting cultivation and other socio economic activities the sacred groves are under threat. Therefore, there is urgent need for conservation and protection of sacred groves before it becomes completely disappear [14,15].

The study revealed that, main driving force behind the disturbance and degradation of the plant species occurs due to human activities. The increasing human interference has changed the structural and functional pattern of the landscape and has influenced the biodiversity significantly [16].

Figure 2. Species composition of KayyamN agamKavu, Taliprambha, Kannur with lowest IVI
The committee members of the Kavu dedicate man power and finance only for the development of shrine. Almost all want to protect this grove only on the basis of religious faith. During high tide, along with water, plastic waste enters into the grove and gets settled there. This is due to the absence of compound wall made with mesh. Snakes are animals that fascinate many people while frightening others. Good or bad, most people have strong feelings about snakes, but few people remain neutral [17]. The Lord Shiva, the god of gods wears a snake around his neck. It is believed that Shiva has given an important place for Nagas. So through these beliefs the Kayyath Nagam Kavu is protected. But some antisocial activities are still exciting there.

4. Conclusion

It is suggested that the studied sacred grove must be given conservation priority to protect valuable endangered medicinal species. Despite the seasonal changes, the anthropogenic were determined to be most influencing factor to affect the species composition and the quantitative ecological attributes of many sensitive species. Therefore construction activities, over grazing, collection of fire wood, tress passing, dumping of waste and many antisocial elements must be checked so as to protect the species in their habitats. Further, ecosystem- specific management plans must be developed to protect the individual species in these sacred groves. Protection of such activities aid in the regulation of ecological processes like energy flow, food chain, food web and cycling of materials which would result in ecological balance and stability of ecosystem.

There is disappearance of the traditional belief systems, which were fundamental to the concept of sacred groves. Thus the degraded sacred grove can be restored only by raising awareness among the rural people regarding the importance of sacred groves and its conservation. Also the local people are encouraged to grow indigenous tree species plantation. There is an urgent need for recognizing these traditionally valued natural systems at various levels and planning for their better management, ultimately aiming to conserve biodiversity. In this context, traditional values that help in conservation should be properly recognized and acknowledged.

In the sacred grove areas organization of awareness campaigns on the functional role is another strategy which also helps to attract more stakeholder groups to participate and jointly chalk out plant to manage and conserve the existing systems in the light of any possible threats like encroachment and habitat destruction in future.

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