MUNNAR LANDSCAPE PROJECT

KERALA

FIRST YEAR PROGRESS REPORT

(DECEMBER 6, 2018 TO DECEMBER 6, 2019)

SUBMITTED TO

UNITED NATIONS DEVELOPMENT PROGRAMME
INDIA

Principal Investigator
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KERALA STATE BIODIVERSITY BOARD
KOWDIAR P.O., THIRUVANANTHAPURAM - 695 003

CONTENTS

1. ACRONYMS

%	Percentage
ABS	Access and Benefit Sharing
AYUSH	Ayurveda, Yoga & Naturopathy, Unani, Siddha and Homoeopathy
BC	Before Christ
BHS	Biodiversity Heritage Sites
BMC	Biodiversity Management Committees
CR	Critically endangered
GIS	Geographic Information System
HRML	High Range Mountain Landscape
HVBAs	High-Value Biodiversity Areas
IUCN	The International Union for Conservation of Nature
IYM	International Year of Mountains
JNTBGRI	Jawaharlal Nehru Tropical Botanic Garden and Research Institute
KFD	Kerala Forest Department
KFRI	Kerala Forest Research Institute
KSCSTE	Kerala State Council for Science, Technology and Environment
MoEF	Ministry of Environment, Forest and Climate Change
MODIS	Moderate Resolution Imaging Spectroradiometer
NP	National Park
NTFPs	Non-timber forest products
NWFPs	Non-wood forest products
PBR	Peoples' Biodiversity Register
PRA	Participatory Rural Appraisal
RET	Rare, Endangered and Threatened species
RRA	Rural Rapid Appraisal
Spp.	Species
SRTM DEM	Shuttle Radar Topography Mission Digital Elevation Model
TK	Traditional knowledge
UNDP	United Nations Development Programme
UNGA	United Nations General Assembly

VSS	✇	VanaSamrakshanaSamithi
WLS	✇	Wildlife Sanctuary
WWF	✇	World Wide Fund for Nature

2. EXECUTIVE SUMMARY

The UNDP funded 'High Range Mountain Landscape Project' is being implemented by Kerala State Biodiversity Board in 11 selected Grama Panchayats in the three Districts Idukki, Ernakulum and Thrissur. During the first month of the project appointments of staff were completed and equipments and peripherals required for documentation were procured. The work plan included two studies and the major activities during the reporting period included PBR updation, documentation of flora and fauna particularly in the RET and endemic categories, Documentation of tradable bio-resources and identification of Biodiversity important areas, documentation of ecological change (land use and land cover changes), documentation of development history in production sector through interview, PRA, GIS & remote sensing techniques.

The key outcomes during the review period from January 1, 2019 up to November 30, 2019 are

Field visits were conducted in Adimali, Munnar, Devikulam, Marayoor, Kathalloor, Vattavada, Chinnakanal, Mankulam, Kuttampuzha and Athirapilly

- Focal Discussions with knowledge providers conducted in 10 panchayats
- Classes, awareness programmes and interactive sections were conducted for Panchayaths officials and BMCs in 10 panchayats.
- Identified the relevant gap areas in the existing PBR
- Two state level workshops and three consultative meetings with experts/ consultants held for developing a PBR updation methodology
- Based on the knowledge gaps in PBR Checklist of Mosses and liverworts, lichens, algae, medicinal plants as well as commercially potential bioresources of the study area were prepared.
- Seven sectors were prioritized for analysing land use changes and the required maps procured
- Visited 15 tribal settlement during the field work and most of the people face problems of poor transportation facilities, less availability of medical care, water scarcity, increase in man and animal conflict and cultural erosion.

Future Work plan

- Field trip to Edamlakudy and conducting RRA and PRA.

- Analyzing the conservation status of flora and fauna, documenting the illegal and unsustainable wildlife smuggling/ trade.
- Video documentation of specific case studies related to bio-resources and associated Traditional knowledge (TK)/ Biodiversity conservation.
- Documentation of the impact of landslides/ floods on selected ecosystems and keystone/ indicator species.
- Natural resource mapping and Identification of Biodiversity important areas
- Geospatial analysis of various development activities, projects, drivers of change, and their impacts landscape.
- Reviewing impacts of development trajectories on the indigenous and migrant settler communities in the HRML.

Knowledge products under development

Methodology manual for PBR preparation

Dr. V. Balakrishnan **Dr. S. C. Joshi, IFS (Retd.)**

(Member secretary) **(Chairman)**

3.TECHNICAL DETAILS

1. **Project Title**

a) Documentation and compilation of existing information on various taxa (Flora and Fauna), and identification of critical gaps in knowledge in the GEF-Munnar landscape project area

b) Review of ecological and development history of various sectors and changes in selected ecological units in GEFMunnar landscape project area

2. **Project duration: 12 months**

3. **Total Budget** : Rs. 39,99,600/- (Twenty Three Lakh Ninety Nine Thousand Seven Hundred Sixty Rupees and Zero Paisa Only)

4. **Project No. and Date of Sanction** : Project No. 87493; Agreement dated: 06/12/2018

5. **Name and Designation of Principal Investigator (PI)** : Dr. S. C. Joshi, IFS (Retd.), Chairman, KSBB

6. **Name and Designation of Co-Investigators (Co-PIs)** : Dr. V. Balakrishnan Member secretary, KSBB

7. **Name of Staff** :

   Dr. N. Preetha, KSBB (Technical Associate)

   Project Staff : Mr. A. L. Aneeshkumar, KSBB (Research Associate), Mr. M. K. Justin, KSBB (Research Associate), Mr. Reshnu Raj R.S, KSBB (Project Assistant), Miss. A. Bindya, KSBB (Project Assistant)

8. **Institution where work will be carried out** : KERALA STATE BIODIVERSITY BOARD, Kailasam T.C.4/1679 (1), No. 43, Belhaven Gardens, Kowdiar P.O.,Thiruvananthapuram - 695 003, Ph.No: 0471 - 2724740, Telefax : 0471 2448234. E-mail: keralabiodiversity@gmail.com, Website: www.keralabiodiversity.org

9. **Study Area** :

   Adimali, Munnar, Devikulam, Marayoor, Kathalloor, Vattavada, Chinnakanal, Mankulam, Edamalakudy, Kuttampuzha, Athirapilly

4.Introduction

Herbal-human interaction started since 12,000 years BC. The healing demands of herbal extracts are well documented. The plants which grows on the high altitudes, contain unique novel molecules, which are still unexploited in the modern scientific community, however a large number of species are under the IUCN Red listed categories. All over the world, the demands of plant based herbal products; drugs as well as secondary metabolites of plants are growing rapidly. The conservation status showed that species loss is between 100 and 1000 times higher than the expected natural extinction rate and that the earth is losing at least one potential major drug in every two years.

The IUCN and WWF (World Wide Fund for Nature) reports showed 50,000 and 80,000 flowering plant species are used for medicinal purposes world wide. Among these, 15,000 species are threatened with extinction from overharvesting and habitat destruction and 20 % of their wild relatives have already been nearly exhausted with increasing human consumption. Although this threat has been known for decades, the accelerated loss of species and habitat destruction worldwide has increased the risk of extinction of medicinal plants, especially in India, China and Nepal. The natives inhabiting in the mountain areas developed their own practical methods especially in the field of agriculture, medicine and society's status and values and rituals which are preserved for centuries.

27 % of the world's land surface is covered with mountain environments and 22 % of the world's people depend on these mountain environments for water, energy, timber, food, and opportunities for recreation and spiritual renewal. Mountains are the host of unique ethnic communities, diverse remnants of cultural traditions, ecological acquaintance, habitat adaptations, valuable agricultural gene pools and conventional management practices. Conservation of mountain biodiversity is essential for ecological, economic, social and cultural sectors such as agriculture, forests, tourism, hydropower and mining. So, the prime challenge is to sustainably manage mountain regions for the eradication of poverty and hunger.

In India, 30 % of landmass is covered by mountains (MoEF, 2009) and more than 90 % of hotspots are under this area. The Sahyadris (Western Ghats) of the Indian peninsular plateau runs viz. the six states of India (Gujarat, Maharashtra, Goa, Karnataka, Tamil Nadu and Kerala) which cover 4.8 % of India's land area (Nair, 1991). The major vegetation types in the Western Ghats are Tropical wet evergreen, montane evergreen, moist deciduous, dry thorn and scrub forests and high altitude shola-grasslands ecosystems. The present High Range Mountain Landscape (HRML) area (9038' -10021' N and 76033' - 77018' E) is located in three districts of Kerala (Idukki, Thrissur

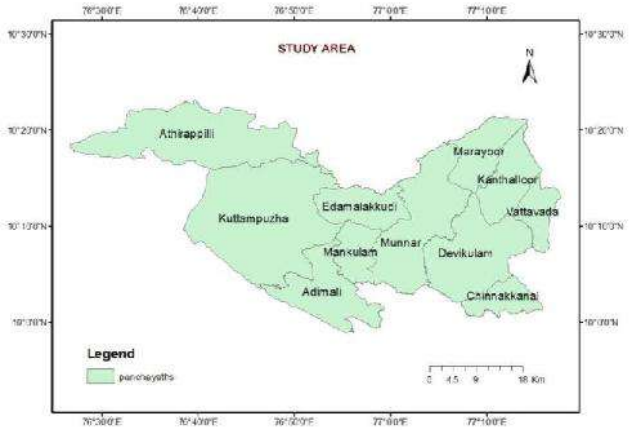
and Ernakulum). Geographically it is a horseshoe shaped region with a few high ridges, steep rugged terrain and highly dissected valleys forming the source of two major river systems (Periyar and Chalakkudi). The study area comprises of Anjunad and other connecting areas encompassing Munnar, Devikulam, Chinnakanal, Kanthalloor, Vattavada, Edamalakudi, Marayoor, Mankulam, Adimali, Kuttampuzha and Athirappilly Grama panchayath comprising a total area of 2198.78 km2.

Mountain ecosystems are vast stretches of high-value biodiversity areas (HVBAs). These landscapes contain higher level of endemism and species richness compared to adjoining lowlands. Endemic species are inhabited at the medium altitudes of mountains than lower altitudes in the tropical region. Mountains are the sites of in situ speciation for the taxa. Those taxa found in the higher altitudes of mountains have narrow habitat tolerance and low dispersal capacity; hence these taxa are at high risk from the environmental hazards of climate change.

Now-a-day, mountain landscape face a series of threats particularly habitat fragmentation and overexploitation, which leads to extinction of flora and fauna and rising poverty and hunger for the dependant inhabitants. In view of the importance of mountains landscapes The United Nations General Assembly (UNGA) proclaimed 2002 as the International Year of Mountains (IYM) for the sustainable development of mountain regions.

Landscape is defined as the natural and physical attributes of land together with air and water which change over time and which is known by people's evolving perceptions and associations such as beliefs, uses, values and relationships. The importance of landscapes is mainly concentrated in three major sectors: economic, socio-cultural and ecologic.

The vegetation of Munnar Landscape areas chiefly consists of sholas, grasslands, dry mixed deciduous forest, moist deciduous forest, forest plantations (Eucalyptus, wattle, pine, teak, sandal), commercial plantations, agri-horticultural field and mixed farms. The land use



pattern in areas such as Munnar, Marayoor, Mankulam, Malayattoor, Kothamangalam other than Protected areas (Eravikulam National Park (NP), Chinnar WLS (Wildlife Sanctuary), Idukki WLS, Kurinjimala WLS, Anaimudi NP, Pampadum shola NP, Mathikettan shola NP, Thattekkad Bird Sanctuary) arise as a result of commercial plantations like tea, cardamom, coffee, mixed cultivation and human dominated home gardens. Sandal Reserves of Marayoor are the only compact tract of Sandal forest with mature sandal trees remaining in the country. The Chinnar WLS was formed from the erstwhile Marayoor Range of Munnar Division. It is located in the rain shadow region of Western Ghats and represents a large number of flora and fauna unique to thorny vegetation. It is the only habitat in the state where the endangered Grizzled Giant Squirrel and Indian Star Tortoise were seen. It is an abode of reptilian fauna and the richest in Kerala in terms of the number of species. Eravikulam NP is located in the High Ranges (Kannan Devan Hills) of the Southern Western Ghats in the Devikulam Taluk of Idukki district, having grassland, sholas and shrub forest. Sholas are highly fragile and endangered in the tropics, it has been referred as living fossil. The shola habitat of Anamalai Bio geographical region of Western Ghats has high amount of diversity richness and endemism and it is threatened by anthropogenic pressure. The floral habitat of shola comprise of stunted tress with an umbrella shaped canopy, epiphytic mosses, ferns, lichens and orchids and faunal habitat consisting of insects, amphibians, birds, reptiles and mammals, many of conservation concern.

Anayirankkal Dam, Munnar, Idukki

India's agro-climatic conditions in the Hilly area of Munnar are conducive for the growth of highly diversified floral species which are ecologically and economically vital for the day-to-day livelihoods of natives. The area is phytogeographically unique with highest mountain peaks, river valleys and shola in the windward side and rain shadow region of vertical cliffs on the backward side with diurnal temperature variations. The protected areas are in danger due to encroachments and forest fellings leading to biodiversity loss.

5.PROJECT 1

Documentation and compilation of existing information on various taxa (Flora and Fauna), and identification of critical gaps in knowledge in the GEF-Munnar landscape project area

5.1 AIM

To generate a comprehensive documentation of information on various taxa of Munnar landscape for developing strategies for the conservation of this unique and biodiversity rich landscape of Western Ghats.

5.2 OBJECTIVES

1. Systematic Group wise and Taxa wise documentation and compilation of available information.
2. Documentation of the economically important plants, animals, microbes, insects etc., based on primary and secondary data, their commercial utilization and their threat status.
3. Systematic documentation of the impact of landslides/floods on selected ecosystems and keystone/indicator species.
4. Updation of PBR of the region and development of a digital platform in ePBR.
5. Identification of the research and management priorities for long term conservation of Munnar landscape.

The review meeting conducted on June 18, 2019 with consultative subject experts as well as Technical Agencies from GoI-UNDP-GEF India High Range project, suggested that the work should provide the following outputs.

1. Preparation of checklist of Rare, Endangered and Threatened species (RET) and endemic flora of Anjunad valley.
2. Identification of Biodiversity Heritage Sites (BHS) and sites for Eco restoration.
3. Preparation of checklist of illegal and unsustainable wildlife Smuggling/trade.
4. Video Documentation of best practices related to Traditional knowledge (TK)/ Biodiversity conservation.
5. Data of bio-resources. with commercial potential and Access and Benefit Sharing

Ficus benghalensis L., Sandal Forest Division, Marayoor

5.3 METHODOLOGY

The objectives of the present studies were categorized in to three divisions (1) Documentation (2) PBR updation and (3) ABS. The following major activities and methodologies was adopted for the study.

a. Documentation

1. Collection and compilation of Secondary data (Group/taxa/subject wise) from University libraries, research institutions, journals, websites etc.
2. Primary data collection (Group/taxa/subject wise). Transect/Pollard walk or multiple quadrat/ plot method or Point count senses or focal-animal sampling with the participation of subject experts.
3. The documentation of bio-resources with commercial potential with the support of representatives of stakeholders via focus group discussions/survey.
4. Assigning the threat status of bio-resources based on the primary/secondary data and study will focused on how this affected the HRML ecosystem (with the support of subject experts).
5. Documentation of best practices related to Traditional knowledge (TK)/ Biodiversity conservation.

b. PBR updation

1. Document critical gap areas in the PBR: based on consultation with BMCs/exisitng PBR registers/panchayath committees/local communities etc.
2. Developing a standardised methodology for PBR preparation based on the gaps identified in the existing PBR.
3. Check the present status of bio-resources (assign rank based on the % of loss/gain with respect to the secondary data. Also, the Group/taxa/subject wise updation of PBR and its digitization (e-PBR).
4. Identification of Biodiversity Heritage Sites (BHS) and sites for Eco restoration and Studying the ongoing changes and forces driving changes in Bio-resources/landscapes and its impact in the livelihoods of native people.

c. Data of bio-resources. with commercial potential and Access and Benefit Sharing

1. Compilation of primary and secondary data especially of the economically important bioresources (Group/taxa/subject wise) via Rural Rapid Appraisal (RRA) and Participatory Rural Appraisal (PRA) methods.
2. Assigning an index/Rank (category wise) of biological resources involved in Indigenous use/ trading purpose/illegal overexploitation for ABS linking.
3. Analyzing the long-term availability/ IUCN status /trade channels/marketing networks/financial transactions of key bioresources thereby improving native people's life.

Identification of critical gap areas by compiling the three objectives and prioritizing research priorities to overcome it.

5.4. DETAILED PROGRESS REPORT

1. Consultants were identified in various sectors. Three expert consultative meetings were held. First consultative meeting was held on March 12, 2019 in the Head Quarters of Kerala State Biodiversity Board, Thiruvananthapuram (**Annexure I**). Second consultative meeting was held on June 26, 2019 (**Annexure II**). Third consultative meeting was held on November 21 and 22, 2019

2. During the first half year of the project, Research personnel (one Research Associate and one project assistant) were appointed.
3. Quarterly progress report was presented to the Technical Agencies for the GoIUNDP-GEF India High Range Mountain Landscape Project meeting, held at Hotel Hycinth, Thiruvananthapuram on June 18, 2019 (**Annexure III**).

4. Visited the Libraries of Forest HQ, KSCSTE-JNTBGRI, KSCSTE-KFRI Thiruvananthapuram for secondary data collection. Data on floral and faunal diversities gathered from published literature, scientific papers, new distribution records etc.

5. Field level studies were initiated at Adimali, Munnar, Marayoor, Kanthalloor and Devikulam Grama panchayats from 06/05/2019 to 17/05/2019. Classes, awareness programmes and interactive sections were conducted about the importance of the present study and its activities including PBR and its updation, sustainable utilization of bio-recourses, BHS, legal as well as illegal trade of economically relevant biological resources, ecologically significant flora and fauna and its conservation etc. to the Panchayath officials, Biodiversity Management Committees (BMC),

Interactive sections of members of Tribal extension office, Adimali with the research team.

Project fellows, Vaidyas, Government and Non-Governmental officials, farmers, environmental activists etc.

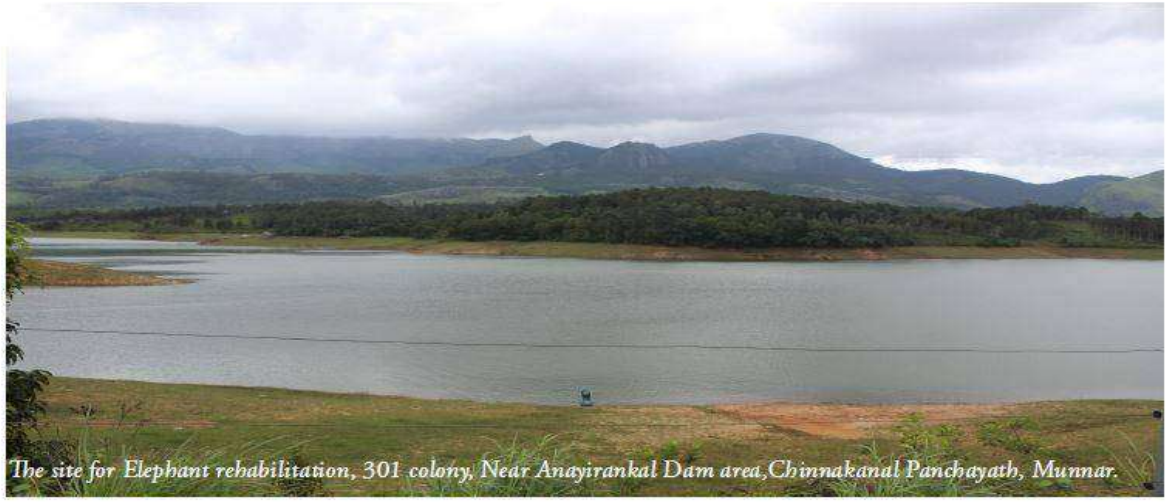
6. Questionnaire format was developed for conducting PRA and RRA for Commercially Potential Bio-resources of HRML study area **(Annexure IV and V).**

A model tribal Hut, Rajeev Gandhi Nature Park, Marayoor

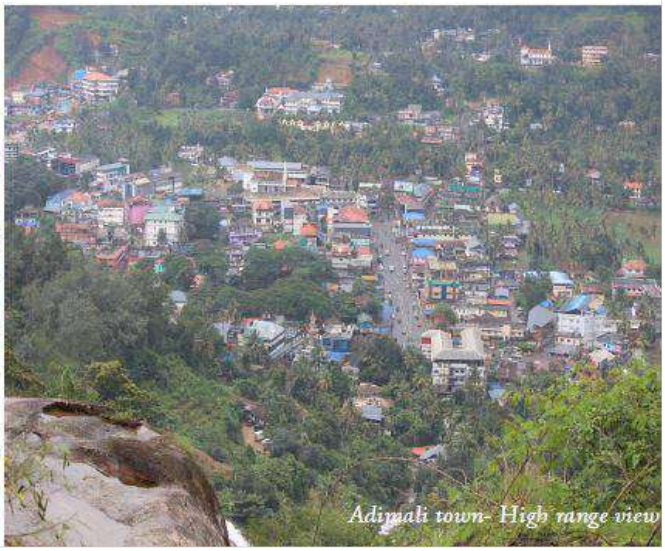
Muthuvan community in Thalanirappan kudi, Adimali

7. State level consultation with various stakeholders, scientific experts etc. was held for the identification of gaps in PBR. **(Annexure VI).**

8. For field level data collection, 10 BMC meetings were conducted in 10 Grama Panchayath, except Edamalakudy which could not be done due to bad climate condition and inadequate transport facility.


The site for Elephant rehabilitation, 301 colony, Near Anayirankal Dam area,Chinnakanal Panchayath, Munnar.


Adimali town


Adimali town- High range view

a. DOCUMENTATION OF FLORISTIC DIVERSITY

As the first phase the gaps in Knowledge of lower groups of plants and rare and endangered species overexploited for medicinal value was addressed and secondary data was compiled. Floristic diversity refers to the variety and variability of plants in a given region. The present study area includes southern montane wet temperate forests (sholas) and the adjoining grasslands (beyond an elevation of 1200 ASL).

Details of the following species were compiled:

a. A Total of 95 Algal species found in the HRML study area, Anjunadu valley, Kerala (**Table 1**).

b. A total of 194 species of Lichen found in the HRML study area, Anjunadu valley, Kerala (**Table 2**).

c. A total of 202 species of Bryophyta found in the HRML study area, Anjunadu valley, Kerala (**Table 3**).

d. Total of 1148 medicinal plants found in the HRML study area, Anjunadu valley, Kerala (**Table 4**).

Strobilanthes kunthiana T.Anderson ex Benth.

e. 96 species of wild edible fruits found in the HRML study area, Anjunadu valley, Kerala (**Table 5**).

f. List of 17 selected tradable bio-resources in the HRML study area, Anjunadu valley, Kerala (**Table 6**).

Algal diversity of Idukki during pre-monsoon, monsoon and post-monsoon were analyzed of which phytoplankton's are more rampant during the pre-monsoon followed by postmonsoon and monsoon season. Five groups such as Cyanophyceae (Blue-green algae), Chlorophyceae (Green algae), Bacillariophyceae (Diatoms), Dinophyceae (Dinoflagellates) and Desmids represent the phytoplankton community in Idukki reservoir. Majority of the species comes under the classes Phaeophyceae, Conjugatophyceae, Florideophyceae, Ulvophyceae and Cyanophyceae. 47 % of algal species are Zygnemataceae family followed by Nostocaceae and Oscillatoriaceae (**Table 1**).

The present study area contains large number of species of ecological as well as medicinal important species. A total of 194 species of Lichens were identified, of which 43 % comes under

the family Parmeliaceae (**Table 2**). Majority of these lichens are found in Mannavanshola, Marayoor. A total of 202 species of mosses were documented in the present study area (**Table 3**).

A total of 1148 medicinal plants under 135 families were recorded in the HRML area. Among them, Acanthaceae (40 spp.), Apocynaceae (52 spp.), Asteraceae (47 spp.), Leguminosae (134 spp.), Poaceae (47 spp.) and Rubiaceae (44 spp.) are the prominent families (**Table 4**). Tribal practitioners have been using medicinal plants for treating several diseases. However, a valid scientific data on the usage of such plants is obscure. A wide variety of those plants are coming under RET and endemic category.

b. DOCUMENTATION OF FAUNISTIC DIVERSITY

Lanius schach

The WLS and NP are the in situ conserved areas of RET and endemic faunal species of Amphibians, Reptiles, Mammals, Birds and Insects.

Indian Giant Squirrel or Malabar Giant Squirrel (*Ratufaindica*) is an endemic species found in the Eravikulam National Park, Idukki and Thattekad Wildlife Sanctuaries of Southern Western Ghats. The habitat of species is restricted to tropical evergreen, semi-evergreen and moist deciduous forests. The current population status of this species is declining due to habitat fragmentation and hunting. According to the traditional life style of some tribal's, they used to capture this species for bush meat. This species have a pivotal role in the dispersal of seeds and pollination.

NilgiriTahr (*Nilgiritragushylocrius*) is an endangered and endemic species that inhabits the open montane grassland of the South Western Ghats, India. It is listed in schedule I of The Wildlife (Protection) Act, 1972. It is the only species of mountain ungulates that exists in Eravikulam National Park, which has the largest existing wild population of NilgiriTahr in the world. The Tahr population got reduced due to the spread of wattle *Acacia mearnsii*, poaching, extensive cattle grazing and climate change. They mainly feed on various grasses and forbs such as *Eulalia phaeothrix*, *Andropogon polyptichus*, *Chrysopogon aciculatus*, *Eupatorium adenophoru* and *Strobilanthes kunthianus*.

Nilgiri Pipit (*Anthus nilghiriensis*) is a vulnerable and endemic species that inhabits grasslands and rocky areas of high altitude mountains of southern India. Their population is declining due to ecosystem stresses

such as habitat alteration (conversion of grasslands into plantations of tea and eucalyptus), forest fire, climate change; human intrusions. Invasive species as *Cytisus scoparius*, *Andropogon polyptichus* creates another long term threats to this species.

Palani Laughingthrush (*Trochalopteronfairbanki*) is an endemic species with restricted distribution only to the higher region of Palani hills extending into the Anamalai hills in western

Tamil Nadu and Munnar in Kerala. Based on IUCN red list it is a Near Threatened species. The population status of this species has not been properly studied. Due to its restricted-range, research focussed on their life history and ecology, habitat and monitoring population is urgently needed.

Pied Bushchat (*Saxicolacaprata*) is a least concern species. It inhabits wetlands, shrub lands and grasslands. Its habitat is mainly in open terrain with low to mid-height.

c.COMMERCIALLY EXPLOITED BIO-RESOURCES

Dried stem of Kattu kurumulaku

The economic potential of herbal products in India facilitated rapid growth of phytopharmaceuticals, perfumery and allied industries. One of the major issues the destructive harvesting has brought about is the depletion and scarcity of plant species which are highly exploited for medicine and trade. The collection of species from the wild sources, lead to irreplaceable loss of genetic stock of those species.

There are 28 tribal hamlets under Adimali Scheduled Tribe (ST) Department of which Muthuvan community are high in number which is followed by Mannan community. Hill pulayans and Muthuvans are present in Marayoor also. Sugarcane and Ragi were mainly cultivated in the tribal settlements of Kanthalloor Grama panchayath. In Devikulam Grama panchayath, 400 ha area is under the cultivation of winter crops and vegetables. The Main crops are kale, cabbage, cauliflower, green peas, carrot, fenugreek, beet root, potato, garlic, rose, jasmine, strawberry, passion fruit and tomato etc.

The natives depend on tropical wet evergreen and semi evergreen forest, tropical moist deciduous and dry deciduous forest, montane sub-tropical temperate shoals and grass lands for collecting firewood's, gums and resins, tubers, gooseberry, bark and roots of food and medicinal plants. The unsustainable utilization or overexploitation of those resources (particularly for agriculture and shelter) leads the major cause of depletion of indigenous floral diversity. The development of sustainable utilization and ecofriendly approaches are the promising steps for saving the natural hill ecosystem.

Data was gathered from 'AngadiMarunnu' shops, spices shops, vaidyashalas' etc. Tribals collecting Non-wood forest products (NWFPs), Medicinal plants (Fresh, dried as well as processed materials) and spices from the forests as well as fringe areas, sell the produce to wholesale and retail shops at below marginal amounts. Recently people have started cultivating cash crops like Cardamom, Pepper and Cocco rather than medicinal plants. From the forest they collect enormous quantity of Kattupadavalam, Kattuthippali, Kattukurumulaku, and Karuvapatta.

Chilla' is a non-profitable organization under VanaSamrakshanaSamithi (VSS) in Kerala Forest Department (KFD); they provide facilities to the tribes to sell the Non-timber forest products (NTFPs) through auction. They also help to sell the products into other states particularly in Tamil Nadu. Butterbeans, Kattupadavalam (177 per kg), Lemon grass, sugarcane, Large and small honey, Kodampuli, Ragi, Gooseberry, Kadukka, Padavalakodi are the main products collected by the tribes.

The residents of the tribal settlement on the periphery of the sanctuaries collect NWFPs without any regulatory mechanisms and the rights to NWFP under the Forest Rights Act are yet to be

settled. The quantity of NWFPs is not available with the management authority and there are no regulatory mechanisms to quantify the same still now. The quantity of materials collected by the tribes has been taken into prime consideration to ensure fair and equitable sharing of benefits of commercial utilization of bioresources.

There are 96 plant species of wild edible fruits documented from the HRML study area. The inhabitants of adjoining areas generate income from marketing these fruits (**Table 5**). Karikurinji, Pinari, Marotti and Pachottitholi are the most marketable-value plant species found in the study area (**Table 6**).

Marayoor- Kanthalloor belt in the Marayoor Sandal Reserve Forest is the hub of the largest natural sandalwood species (*Santalum album*) in the Western Ghats. A large number of temples, sandalwood oil factories, ayurvedic drug manufactures and handicrafts developers are the main buyers of Marayoor sandalwood because of its high quality wood and oil content. It has been fetching an average of 1.25 crore per tonne to the exchequer. The class 10 variety, 'Jaipokal', which is of high demand in the industry (sold at 10,500-11,000 per kg in Kerala, however, the same variety is sold at 5,500-6,000 per kg in Karnataka). There were nine cases registered in Marayoor in connection with sandalwood smuggling in 2016. Now, there has been a visible decline in the illegal smuggling of sandalwood, only one case was registered in 2017. Even though, illegal felling is still prevalent in private lands.

Sugarcane was widely cultivated in Pattam colony, Mashi, Koodavayal, Peradipallam and Meladi of Marayoor-kanthalloorpanchayaths. Marayoor jaggery balls (undasharkara) - the sweetest jaggeries from Sugarcane (*Saccharumofficinarum*) made using traditional methods. Ten years ago jaggery balls sold to an amount of Rs. 60 per kg, now the price has fallen to 40 per kg. The costs of sugarcane cultivation and jaggery production is increased, making this unprofitable effecting their livelihood. The farming area has reduced from 2500-2700 ha to 1200-1500 ha and now only 832 farmers were engaged in sugarcane farming in these panchayaths out of 2000 in 10 years ago. The future of remaining farmers is in limbo due to uncertainty of prices and low-quality jaggery from Tamil Nadu under the same label of Marayoor jaggery (Rs 35 to 48 per kg).

5.5.Conclusion

The summary of the progress report of the work including each activities, its progress, key insights, major challenges and deliverables are tabulated (**Table 7**).


Hill view, Munnar


Jasmine cultivation in Devikulam


Eucalyptus plantation in Kanthalloor

List of Tables

Table 1. Algal diversity in the HRML study area, Anjunadu valley, Kerala

S. No.	Species name	Family
1	*Anabaena beckii* G.De Toni	Nostocaceae
2	*Anabaena iyengarii* Bharadwaja	Nostocaceae
3	*Anabaena oscillarioides* Bory ex Bornet & Flahault	Nostocaceae
4	*Anabaena torulosa* Lagerheim ex Bornet & Flahault	Nostocaceae
5	*Aphanothece stagnina* (Sprengel) A.Braun in Rabenhorst	Aphanothecaceae
6	*Aulosira fertilissima* S.L.Ghose	Fortieaceae
7	*Bambusina borreri* (Ralfs) Cleve	Desmidiaceae
8	*Calothrix fusca* Bornet & Flahault	Rivulariaceae
9	*Calothrix marchica* Lemmermann	Rivulariaceae
10	*Cephaleuros virescens* Kunze ex E.M.Fries	Trentepohliaceae
11	*Chaetomorpha antennina* (Bory) Kützing	Cladophoraceae
12	*Cladophora vagabunda* (Linnaeus)	Cladophoraceae
13	*Coleofasciculus chthonoplastes* (Thuret ex Gomont) M.Siegesmund, J.R.Johansen & T.Friedl	Coleofasciculaceae
14	*Cylindrospermum stagnale* Bornet & Flahault	Nostocaceae
15	*Geitlerinema earlei* (N.L.Gardner) Anagnostidis	Coleofasciculaceae
16	*Herposiphonia insidiosa* (Greville ex J.Agardh) Falkenberg	Herposiphonieae
17	*Herposiphonia secunda* (C.Agardh) Ambronn	Herposiphonieae
18	*Herposiphonia tenella* (C.Agardh) Ambronn	Herposiphonieae
19	*Kamptonema animale* (C.Agardh ex Gomont) Strunecký, Komárek & J.Smarda	Oscillatoriaceae
20	*Kamptonema chlorinum* (Kützing ex Gomont) Strunecký, Komárek & J.Smarda	Microcoleaceae
21	*Kamptonema jasorvense* (Vouk) Strunecký, Komárek & J.Smarda	Microcoleaceae
22	*Lyngbya confervoides* C.Agardh ex Gomont	Oscillatoriaceae
23	*Microcoleus paludosus* Gomont	Microcoleaceae
24	*Microcystis smithii* Komárek & Anagnostidis	Microcystaceae
25	*Mougeotia adnata* M.O.P.Iyengar	Zygnemataceae
26	*Mougeotia cherokeana* Taft	Zygnemataceae
27	*Mougeotia parvula* Hassall	Zygnemataceae
28	*Mougeotia recurva* (Hassall) De Toni	Zygnemataceae
29	*Mougeotia tenuissima* (De Bary) Czurda	Zygnemataceae
30	*Nostoc amplissimum* Setchell	Nostocaceae
31	*Nostoc calcicola* Brébisson ex Bornet & Flahault	Nostocaceae
32	*Nostoc carneum* C.Agardh ex Bornet & Flahault	Nostocaceae
33	*Nostoc linckia* Bornet ex Bornet & Flahault	Nostocaceae
34	*Nostoc punctiforme* Hariot	Nostocaceae
35	*Nostoc sphaericum* Vaucher ex Bornet & Flahault	Nostocaceae
36	*Nostochopsis lobatus* H.C.Wood ex Bornet & Flahault	Nostochopsidaceae
37	*Oedogonium munnarensis* Panikkar & Ampili	Oedogoniaceae
38	*Oscillatoria major* Vaucher ex Forti	Oscillatoriaceae
39	*Oscillatoria ornata* Kutzing ex Gomont	Oscillatoriaceae
40	*Oscillatoria princeps* Vaucher ex Gomont	Oscillatoriaceae

S. No.	Species name	Family
41	*Oscillatoria subbrevis var. major* (G.S.West) Umezaki & Watanabe	Oscillatoriaceae
42	*Oscillatoria tenuis* C.Agardh ex Gomont	Oscillatoriaceae
43	*Phormidesmis molle* (Gomont) Turicchia, Ventura, Komarkova & Komarek	Oscillatoriaceae
44	*Phormidium acula* (Bruhl & Biswas) Anagnostidis & Komarek	Leptolyngbyaceae
45	*Phormidium lucidum* Kutzing ex Gomont	Oscillatoriaceae
46	*Phormidium stagninum* Anagnostidis	Oscillatoriaceae
47	*Scytonema guyanense* Bornet & Flahault	Oscillatoriaceae
48	*Scytonema mirabile* Bornet	Scytonemataceae
49	*Scytonema simplex* Bharadwaja	Scytonemataceae
50	*Scytonema tolypothrichoides* Kutzing ex Bornet & Flahault	Scytonemataceae
51	*Sirocladium himalayense* Santra & Adhya	Scytonemataceae
52	*Sirocladium kumaoense* Randhawa	Zygnemataceae
53	*Spirogyra ampilii* Ushadevi & Panikkar	Zygnemataceae
54	*Spirogyra baileyi* Schmidle	Zygnemataceae
55	*Spirogyra bullata* C.-C.Jao	Zygnemataceae
56	*Spirogyra crenulata* R.N.Singh	Zygnemataceae
57	*Spirogyra dictyospora* C.-C.Jao	Zygnemataceae
58	*Spirogyra flavescens* (Hassall) Kützing	Zygnemataceae
59	*Spirogyra goetzei* Schmidle	Zygnemataceae
60	*Spirogyra hymerae* Britton & B.H.Smith	Zygnemataceae
61	*Spirogyra jaoensis* Randhawa	Zygnemataceae
62	*Spirogyra jogensis var. minor* Iyengar	Zygnemataceae
63	*Spirogyra marchica* H.Krieger	Zygnemataceae
64	*Spirogyra minutifossa* C.-C.Jao	Zygnemataceae
65	*Spirogyra rhizobrachilis* C.-C.Jao	Zygnemataceae
66	*Spirogyra rhizopus* C.-C.Jao	Zygnemataceae
67	*Spirogyra tenuissima* (Hassall) Kützing	Zygnemataceae
68	*Spirulina labyrinthiformis* Gomont	Spirulinaceae
69	*Temnogyra punctiformis* (Transeau) Yamagishi	Zygnemataceae
70	*Tetraedron gracile* (Reinsch) Hansgirg	Hydrodictyaceae
71	*Tolypothrix magna* Bharadwaja	Tolypothrichaceae
72	*Trichormus fertilissimus* (C.B.Rao) Komárek & Anagnostidis	Nostocaceae
73	*Trichormus variabilis* (Kützing ex Bornet & Flahault) Komárek & Anagnostidis	Nostocaceae
74	*Westiellopsis prolifica* Janet	Hapalosiphonaceae
75	*Zygnema atrocoeruleum* West & G.S.West	Zygnemataceae
76	*Zygnema collinsianum* Transeau	Zygnemataceae
77	*Zygnema cruciatum* (Vaucher) C.Agardh	Zygnemataceae
78	*Zygnema cyanosporum* Cleve	Zygnemataceae
79	*Zygnema exuvielliforme* (C.-C.Jao) Krieger	Zygnemataceae
80	*Zygnema gedeanum* Czurda	Zygnemataceae
81	*Zygnema guineense* (Gauthier-Lièvre) Stancheva, J.D.Hall, McCourt & Sheath	Zygnemataceae
82	*Zygnema heydrichii* Schmidle	Zygnemataceae

S. No.	Species name	Family
83	*Zygnema himalayense* Randhawa	Zygnemataceae
84	*Zygnema quadrangulatum* C.-C.Jao	Zygnemataceae
85	*Zygnema schwabei* Krieger	Zygnemataceae
86	*Zygnema spontaneum* Nordstedt	Zygnemataceae
87	*Zygnema talguppense* (M.O.P.Iyengar) Krieger	Zygnemataceae
88	*Zygnema vaginatum* Klebs	Zygnemataceae
89	*Zygogonium arjunanii* Usha Devi & Panikkar.	Zygnemataceae
90	*Zygogonium capense* (Hodgetts) Transeau	Zygnemataceae
91	*Zygogonium ericetorum* Kützing	Zygnemataceae
92	*Zygogonium jayaii* Ushadevi et Panikkar	Zygnemataceae
93	*Zygogonium sakunthalanii* Ushadevi et Panikkar	Zygnemataceae
94	*Zygogonium sinense* C.-C.Jao	Zygnemataceae
95	*Zygogonium wilsonii* Ushadevi et Panikkar	Zygnemataceae

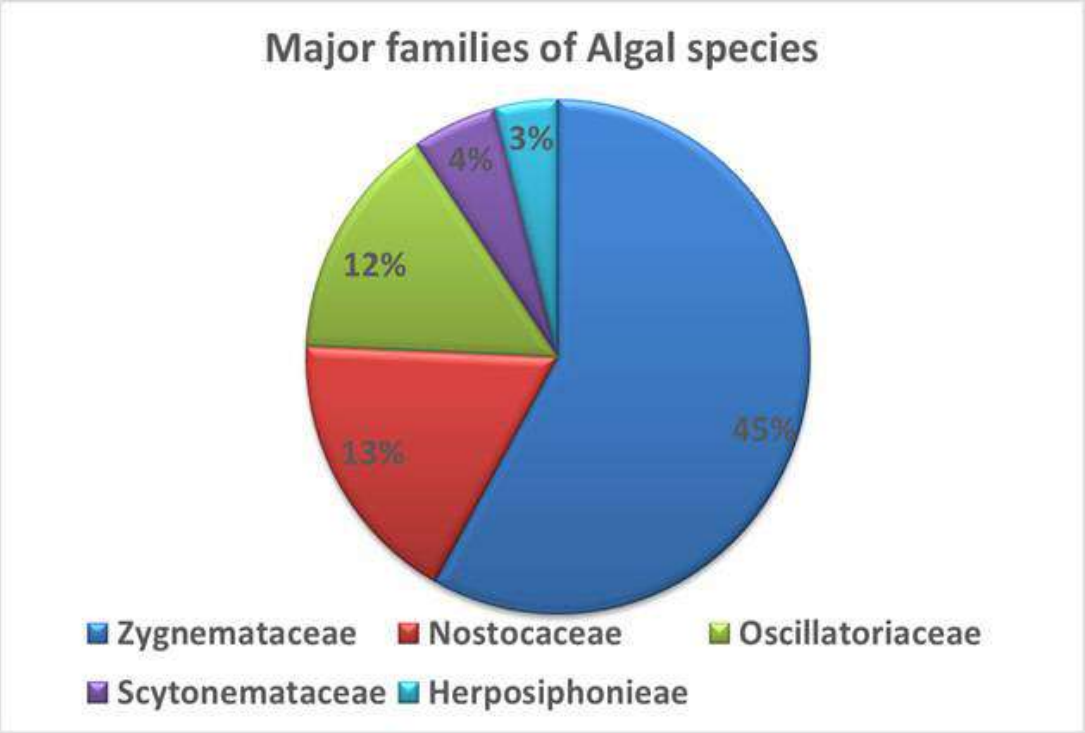


Table 2. **Lichen diversity in the HRML study area, Anjunadu valley, Kerala**

S. No.	Species	Family	Habit	Habitat	Distribution
1	*Baeomyces soridiifer* Nyl.	Baeomycetaceae	Fruticose	Saxicolous	Chinnamala; Anaimudi, Munnar
2	*Brigantiaea fuscolutea* (Dicks.) R. Sant.	Lopadiaceae	Microlichen	Crustose	Peerumade
3	*Calopadia fusca* (Müll. Arg.) Vězda	Pilocarpaceae	Microlichen	Crustose (Epiphyllous)	Thekkady forest
4	*Canoparmelia texana* (Tuck.) Elix & Hale	Parmeliaceae	Foliose	Corticolous	Eravikulam National Park, Munnar; Mannavanshola, Marayoor
5	*Cladonia carneola* (Fr.) Fr.	Cladoniaceae		Terricolous	Anaimudi, Munnar
6	*Cladonia ceratophylla* (Sw.) Spreng.	Cladoniaceae		Corticolous	Kattapara shola
7	*Cladonia coniocraea* (Flörke) Spreng.	Cladoniaceae		Corticolous	Pettimudi, Rajamala, Munnar
8	*Cladonia decorticate* (Flörke) Spreng.	Cladoniaceae		Corticolous	Mannavanshola, Marayoor
9	*Cladonia fimbriata* (L.) Fr.	Cladoniaceae		Saxicolous	Mannavanshola, Marayoor
10	*Cladonia foliacea* (Huds.) Willd.	Cladoniaceae		Saxicolous	Uppupara, Periyar Tiger Reserve
11	*Cladonia parasitica* (Hoffm.) Hoffm.	Cladoniaceae		Saxicolous/ Corticolous	Kallar Estate; Silent Valley Estate, Munnar
12	*Cladonia ramulosa* (With.) J.R. Laundon	Cladoniaceae		Tericolous/ Corticolous/ Saxicolous	Mannavanshola, Marayoor; Rajamala; Anaimudi, Munnar
13	*Cladonia scabriuscula* (Delise) Nyl.	Cladoniaceae		Tericolous/ Corticolous/ Saxicolous	Eravikulam National Park; Silent Valley Estate, Munnar; Mannavanshola, Marayoor
14	*Coccocarpia erythroxyli* (Spreng.) Swinscow & Krog	Coccocarpiaceae		Corticolous/ Saxicolous	Mannavanshola, Marayoor; Uppupara, Periyar Tiger Reserve; Kattapara shoal
15	*Coccocarpia palmicola* (Spreng.) Arv. & D.J. Galloway	Coccocarpiaceae		Corticolous/ Saxicolous	Chinnamala; Anaimudi, Munnar; Uppupara, Periyar Tiger Reserve; Kattapara shola
16	*Coccocarpia pellita* (Ach.) Müll. Arg.	Coccocarpiaceae		Corticolous/ Saxicolous	Eravikulam National Park, Munnar; Uppupara, Periyar Tiger Reserve
17	*Collema flaccidum* (Ach.) Ach.	Collemataceae	Foliose	Corticolous	Kallar Estate, Munnar
18	*Collema subflaccidum* Degel.	Collemataceae	Foliose	Corticolous	Kallar Estate, Munnar

S. No.	Species	Family	Habit	Habitat	Distribution
19	*Crespoa carneopruinata* (Zahlbr.) Lendemer & B.P. Hodk.	Parmeliaceae	Foliose	Corticolous	Mannavanshola, Marayoor
20	*Dermatocarpon vellereum* Zschacke	Verrucariaceae	Foliose	Saxicolous	Rajamala, Munnar
21	*Eumitria baileyi* Stirt.	Parmeliaceae	Fruticose	Corticolous	Mannavanshola, Marayoor
22	*Eumitria pectinata* (Taylor) Articus	Parmeliaceae	Fruticose	Corticolous	Mannavanshola, Marayoor
23	*Fibrillithecis halei* (Tuck. & Mont.) Mangold	Graphidaceae	Microlichen	-	Devikulam; Cardamom hills; Kumily
24	*Heterodermia comosa* (Eschw.) Follmann & Redón	Physciaceae	Foliose	Corticolous	Mannavanshola, Marayoor
25	*Heterodermia dactyliza* (Nyl.) Swinscow & Krog	Physciaceae	Foliose	Corticolous	Eravikulam National Park; Silent Valley Estate; Anaimudi slope, Munnar
26	*Heterodermia diademata* (Taylor) D.D. Awasthi	Physciaceae	Foliose	Corticolous	Eravikulam National Park, Munnar
27	*Heterodermia dissecta* (Kurok.) D.D. Awasthi	Physciaceae	Foliose	Corticolous/ Saxicolous	Uppupara, Periyar Tiger Reserve; Kattapara shola
28	*Heterodermia flabellata* (Fée) D.D. Awasthi	Physciaceae	Foliose	Corticolous	Uppupara, Periyar Tiger Reserve; Kattapara shola
29	*Heterodermia incana* (Stirt.) D.D. Awasthi	Physciaceae	Foliose	Corticolous	Pettimudi; Silent Valley Estate, Munnar; Kattapara shola
30	*Heterodermia koyana* (Kurok.) Elix	Physciaceae	Foliose	Corticolous/ Saxicolous	Silent Valley Estate, Munnar
31	*Heterodermia obscurata* (Nyl.) Trevis	Physciaceae	Foliose	Corticolous/ Saxicolous	Eravikulam National Park; Silent Valley Estate, Munnar; Mannavanshola, Marayoor
32	*Heterodermia pellucida* (D.D. Awasthi) D.D. Awasthi	Physciaceae	Foliose	Corticolous	Eravikulam National Park; Pettimudi, Munnar; Kattapara shola; Mannavanshola, Marayoor
33	*Heterodermia podocarpa* (Bél.) D.D. Awasthi	Physciaceae	Foliose	Corticolous	Kattapara shola
34	*Heterodermia pseudospeciosa* (Kurok.) W.L. Culb.	Physciaceae	Foliose	Corticolous/ Saxicolous	Eravikulam National Park; Kattapara shola
35	*Heterodermia speciosa* (Wulfen) Trevis.	Physciaceae	Foliose	Corticolous	Eravikulam National Park; Silent Valley Estate, Munnar
36	*Hyperphyscia aglutinata* (Florke) Mayrn. & Poelt	Physciaceae	Foliose	Corticolous	Mannavanshola, Marayoor

S. No.	Species	Family	Habit	Habitat	Distribution
37	*Hyperphyscia granulata* (Poelt) Moberg	Physciaceae	Foliose	Corticolous	Mannavanshola, Marayoor
38	*Hyperphyscia syncolla* (Tuck. ex Nyl.) Kalb	Physciaceae	Foliose	Corticolous	Silent Valley Estate, Munnar
39	*Hypogymnia pseudobitteriana* (D.D. Awasthi	Parmeliaceae	Foliose	Corticolous	Mannavanshola, Marayoor
40	*Hypogymnia vittata* (Ach.) Parrique	Parmeliaceae	Foliose	Corticolous	Mannavanshola, Marayoor
41	*Hypotrachyna adducta* (Nyl.) Hale	Parmeliaceae	Foliose	Corticolous	Silent Valley Estate, Munnar
42	*Hypotrachyna brevirhiza* (Kurok.) Hale	Parmeliaceae	Foliose	Corticolous	Mannavanshola, Marayoor; Kattapara shola
43	*Hypotrachyna cirrhata* (Fr.) Divakar, A. Crespo, Sipman, Elix & Lumbsch	Parmeliaceae	Foliose	Corticolous	Eravikulam National Park, Munnar; Mannavanshola, Marayoor; Rajamala; Pettimudi; Anaimudi slope, Munnar
44	*Hypotrachyna crenata* (Kurok.) Hale	Parmeliaceae	Foliose	Corticolous/ Saxicolous	Kattapara shola
45	*Hypotrachyna dactylifera* (Vain.) Hale	Parmeliaceae	Foliose	Corticolous	Pettimudi, Munnaar
46	*Hypotrachyna degelii* (Hale) Hale	Parmeliaceae	Foliose	Corticolous	Mannavanshola, Marayoor; Kattapara shola
47	*Hypotrachyna endochlora* (Leight.) Hale	Parmeliaceae	Foliose	Corticolous	Mannavanshola, Marayoor
48	*Hypotrachyna expallida* (Kurok.) Divakar, A. Crespo, Sipman, Elix & Lumbsch	Parmeliaceae	Foliose	Corticolous	Pettimudi, Munnar; Mannavanshola, Marayoor; Kattapara shola
49	*Hypotrachyna exsecta* (Taylor) Hale	Parmeliaceae	Foliose	Corticolous	Pettimudi; Silent Valley Estate, Munnar; Mannavanshola, Marayoor
50	*Hypotrachyna formosana* (Zahlbr.) Hale	Parmeliaceae	Foliose	Corticolous	Mannavanshola, Marayoor; Eravikulam National Park, Munnar
51	*Hypotrachyna infirma* (Kurok.) Hale	Parmeliaceae	Foliose	Corticolous	Kallar Estate, Munnar; Kattapara shola; Uppupara, Periyar Tiger Reserve
52	*Hypotrachyna masonhalei* Pat. & Prabhu	Parmeliaceae	Foliose	Corticolous	Mannavanshola, Marayoor
53	*Hypotrachyna microlobulata* (D.D. Awasthi) Divakar, A. Crespo, Sipman, Elix & Lumbsch	Parmeliaceae	Foliose	Corticolous	Kattapara shola
54	*Hypotrachyna nepalensis* (Taylor) Divakar, A. Crespo, Sipman, Elix & Lumbsch	Parmeliaceae	Foliose	Corticolous/ Terricolous	Eravikulam National Park, Pettimudi, Silent Valley Estate Munnar; Mannavanshola, Marayoor
55	*Hypotrachyna orientalis* (Hale) Hale	Parmeliaceae	Foliose	Corticolous	Mannavanshola, Marayoor
56	*Hypotrachyna revoluta* (Florke) Hale	Parmeliaceae	Foliose	Corticolous	Mannavanshola, Marayoor

S. No.	Species	Family	Habit	Habitat	Distribution
57	*Hypotrachyna vexans* (Zahlbr. ex W.L. Culb. & C.F.) Divakar, A. Crespo, Sipman, Elix & Lumbsch	Parmeliaceae	Foliose	Corticolous/ Saxicolous	Pettimudi, Silent Valley Estate, Munnar; Uppupara,Periyar Tiger Reserve
58	*Lathagrium auriforme* (With.) Otálora, P.M. Jørg. & Wedin	Collemataceae	Foliose	Open moist places	Mannavanshola, Marayoor
59	*Lecanora indica* Zahlbr.	Lecanoraceae	Placodioid	Saxicolous	Chockanad Estate, Munnar
60	*Lepraria pseudoarbuscula* (Asahina) Lendemer & B.P. Hodk.	Leprocaulaceae	-	Terricolous/ Corticolous	Mannavanshola, Marayoor; Eravikulam National Park, Munnar
61	*Leptogium austroamericanum* (Malme) C.W. Dodge	Collemataceae	Foliose	Corticolous	Eravikulam National Park, Munnar
62	*Leptogium azureum* (Sw.) Mont.	Collemataceae	Foliose	Corticolous	Uppupara, Periyar Tiger Reserve
63	*Leptogium brebissonii* Mont.	Collemataceae	Foliose	Corticolous	Silent Valley Estate; Eravikulam National Park, Munnar
64	*Leptogium burgessii* (L.) Mont.	Collemataceae	Foliose	Corticolous	Mannavanshola, Marayoor
65	*Leptogium chloromelum* (Ach.) Nyl.	Collemataceae	Foliose	Corticolous	Eravikulam National Park, Munnar
66	*Leptogium corticola* (Taylor) Tuck.	Collemataceae	Foliose	Corticolous	Uppupara, Periyar Tiger Reserve
67	*Leptogium cyanescens* (Ach.) Körb.	Collemataceae	Foliose	Corticolous	Mannavanshola, Marayoor; Lockart, Munnar
68	*Leptogium marginellum* (Sw.) Gray	Collemataceae	Foliose	Corticolous	Lockart, Munnar
69	*Leptogium moluccanum* (Pers.) Vain.	Collemataceae	Foliose	Corticolous	Uppupara, Periyar Tiger Reserve
70	*Leptogium phyllocarpum var. phyllocarpum* (Pers.) Mont.	Collemataceae	Foliose	Corticolous/ Saxicolous	Uppupara, Periyar Tiger Reserve
71	*Leptogium pichneum* (Ach.) Nyl.	Collemataceae	Foliose	Corticolous	Kattapara shola
72	*Leptogium tenuisissimum* (Discson) Korber.	Collemataceae	Foliose	Corticolous	Rajamala
73	*Leptogium ulvaceum* (Pers.) Vain.	Collemataceae	Foliose	Corticolous	Silent Valley Estate , Munnar
74	*Letrouitia vulpine* (Tuck.) Haf. & Bellem.	Letrouitiaceae	Microlichen	Crustose	Anamalai hills; Thekkady forest
75	*Leucodermia boryi* (Fée) Kalb	Physciaceae	Foliose	Corticolous/ Saxicolous/ Terricolous	Eravikulam National Park, Munnar; Mannavanshola, Marayoor
76	*Leucodermia leucomelos* (L.) Kalb	Physciaceae	Foliose	Corticolous	Eravikulam National Park, Munnar; Mannavanshola, Marayoor

S. No.	Species	Family	Habit	Habitat	Distribution
77	*Lobaria retigera var. retigera* (Bory) Trevis	Lobariaceae	Foliose	Corticolous	Chockanad Estate; Anaimudi, Munnar; Mannavanshola, Marayoor
78	*Lopadium granulosum* Patw. & Makhija	Lopadiaceae	Microlichen	Crustose	Devikulam; Thekkady forest
79	*Megalospora sulphurata* Meyen	Megalosporaceae	Microlichen	Corticolous	Myladumpara, Munnar
80	*Megalospora tuberculosa* (Fée) Sipman	Megalosporaceae	Microlichen	Corticolous	Myladumpara, Munnar
81	*Menegazzia terebrata* (Hoffm.) A. Massal.	Parmeliaceae	Foliose	Corticolous	Mannavanshola, Marayoor
82	*Myriotrema microporum* (Mont.) Hale	Graphidaceae	Microlichen	Corticolous	Devikulam
83	*Ocellularia epitrypa* (Nyl.) Hale	Graphidaceae	Microlichen	Corticolous	Cardamom hills, Kumily
84	*Ocellularia papillata* (Leight.) Zahlbr.	Graphidaceae	Microlichen	Corticolous	Devikulam; Cardamom hills
85	*Pannaria leucosticte* (Tuck. in Darl.) Nyl.	Pannariaceae	Squamulose	Corticolous	Mannavanshola, Marayoor
86	*Pannaria rubiginosa* (Thunb. ex Ach.) Delise	Pannariaceae	Foliose	Corticolous	Uppupara, Periyar Tiger Reserve; Mannavanshola, Marayoor
87	*Parmeliella pannosa* (Sw.) Müll. Arg.	Pannariaceae	Foliose	Corticolous	Kattapara shola
88	*Parmeliella tryptophylla* (Ach.) Mull. Arg.	Pannariaceae	Foliose	Corticolous/ Saxicolous	Mannavanshola, Marayoor; Uppupara,Periyar Tiger Reserve; Silent Valley Estate , Munnar
89	*Parmelina indica* Hale	Parmeliaceae	Foliose	Corticolous	Mannavanshola, Marayoor
90	*Parmelina subaurulenta* (Nyl.) Hale	Parmeliaceae	Foliose	Corticolous	Mannavanshola, Marayoor
91	*Parmelinella simplicior* (Hale) Elix & Hale	Parmeliaceae	Foliose	Corticolous	Mannavanshola, Marayoor; Eravikulam National Park, Munnar
92	*Parmelinella wallichiana* (Taylor) Elix & Hale	Parmeliaceae	Foliose	Corticolous/ Saxicolous	Mannavanshola, Marayoor; Kattapara shola; Uppupara, Periyar Tiger Reserve
93	*Parmelinopsis horrescens* (Taylor) Elix & Hale	Parmeliaceae	Foliose	Corticolous/ Saxicolous	Pettimudi, Munnar; Mannavanshola, Marayoor
94	*Parmotrema abessinicum* (Nyl. ex Kremp.) Hale	Parmeliaceae	Foliose	Corticolous	Pettimudi; Silent Valley Estate, Munnar
95	*Parmotrema arnoldii* (Du Rietz) Hale	Parmeliaceae	Foliose	Corticolous	Mannavanshola, Marayoor; Rajamala, Munnar
96	*Parmotrema crinitum* (Ach.) M. Choisy	Parmeliaceae	Foliose	Corticolous	Pettimudi; Munnar; Uppupara, Periyar Tiger Reserve
97	*Parmotrema dilatatum* (Vain.) Hale	Parmeliaceae	Foliose	Corticolous	Mannavanshola, Marayoor

S. No.	Species	Family	Habit	Habitat	Distribution
98	*Parmotrema grayanum* (Hue) Hale	Parmeliaceae	Foliose	Corticolous/ Saxicolous	Pettimudi, Munnar; Uppupara, Periyar Tiger Reserve
99	*Parmotrema indicum* Hale	Parmeliaceae	Foliose	Corticolous	Uppupara, Periyar Tiger Reserve
100	*Parmotrema kamatii* Patw. & Prabhu	Parmeliaceae	Foliose	Corticolous	Eravikulam National Park, Munnar
101	*Parmotrema mesotropum* (Müll. Arg.) Hale	Parmeliaceae	Foliose	Corticolous	Pettimudi, Munnar
102	*Parmotrema nilgherrense* (Nyl.) Hale	Parmeliaceae	Foliose	Corticolous/ Saxicolous	Chinnamala; Anaimudi, Munnar; Mannavanshola, Marayoor
103	*Parmotrema pseudonilgherrense* (Asahina) Hale	Parmeliaceae	Foliose	Corticolous	Silent Valley Estate, Munnar
104	*Parmotrema reticulatum* (Taylor) M. Choisy	Parmeliaceae	Foliose	Corticolous	Mannavanshola, Marayoor
105	*Parmotrema thomsonii* (Stirt.) A. Crespo, Divakar & Elix	Parmeliaceae	Foliose	Corticolous	Pettimudi; Silent Valley Estate, Munnar; Mannavanshola, Marayoor
106	*Parmotrema tinctorum* (Despr. ex Nyl.) Hale	Parmeliaceae	Foliose	Corticolous	Uppupara, Periyar Tiger Reserve; Silent Valley Estate, Munnar
107	*Parmotremopsis phlyctina* (Hale) Elix & Hale	Parmeliaceae	Foliose	Corticolous	Mannavanshola, Marayoor
108	*Pectenia plumbea* (Lightf.) P.M. Jørg., L. Lindblom, Wedin & S. Ekman	Pannariaceae	Foliose	Corticolous/ Saxicolous	Uppupara, Periyar Tiger Reserve; Eravikulam National Park, Munnar
109	*Phaeographis subtigrina* (Vain.) Zahlbr.	Graphidaceae	Microlichen	Corticolous	Cardamom hills
110	*Phaeophyscia orbicularis* (Neck.) Moberg	Physciaceae	Foliose	Corticolous	Uppupara, Periyar Tiger Reserve
111	*Phaeotrema disciforme* (Leight.) Hale	Graphidaceae	Microlichen	Corticolous	Thekkady forest
112	*Phyllospora coralline* (Eschw.) Mull.	Lecidiaceae	Foliose	Corticolous	Pettimudi, Munnar
113	*Physcia albinea* (Ach.) Nyl.	Physciaceae	Foliose	Saxicolous	Mannavanshola, Marayoor
114	*Physcia dimidiata* (Arnold) Nyl.	Physciaceae	Foliose	Corticolous	Pettimudi, Munnar
115	*Physcia integrata* Nyl.	Physciaceae	Foliose	Corticolous	Mannavanshola, Marayoor
116	*Physciella nepalensis* (Poelt) Essl.	Physciaceae	Foliose	Corticolous	Silent Valley Estate, Munnar
117	*Pilophorus awasthianum* Ras.	Stereocaulaceae	Fruticose	Saxicolous	Anaimudi top, Munnar
118	*Polyblastidium hypocaesium* (Yasuda ex Räsänen) Kalb	Physciaceae	Foliose	Corticolous/ Saxicolous	Rajamala, Munnar; Mannavanshola, Marayoor; Uppupara, Periyar Tiger Reserve
119	*Polyblastidium microphyllum* (Kurok.) Kalb	Physciaceae	Foliose	Corticolous	Anaimudi, Munnar

S. No.	Species	Family	Habit	Habitat	Distribution
120	*Polyblastidium togashii* (Kurok.) Kalb	Physciaceae	Foliose	Corticolous	Eravikulam National Park; Pettimudi; Chinnamala; Anaimudi; Silent Valley Estate, Munnar; Kattapara shola
121	*Pseudocyphellaria argyracea* (Delise) Vain.	Lobariaceae	Foliose	Corticolous	Eravikulam National Park; Kallar Estate; Anaimudi, Munnar; Mannavanshola, Marayoor
122	*Pseudoparmelia crozalziana* (B. de Lesd.) Hale	Parmeliaceae	Foliose	Corticolous	Chinnamala; Anaimudi; Pettimudi, Munnar
123	*Psorella isidiophora* D.D. Awasthi & Kr.P. Singh	Parmeliaceae	Squamulose	Corticolous	Kattapara shola
124	*Pyxine asiatica* Vain.	Caliciaceae	Foliose	Saxicolous	Uppupara, Periyar Tiger Reserve
125	*Pyxine cylindrica* Kashiw.	Caliciaceae	Foliose	Corticolous	Eravikulam National Park; Silent Valley Estate, Munnar
126	*Pyxine meissnerina* Nyl.	Caliciaceae	Foliose	Corticolous	Mannavanshola, Marayoor
127	*Pyxine philippina* Vain.	Caliciaceae	Foliose	Corticolous	Kattapara shola
128	*Pyxine sorediata* (Ach.) Mont.	Caliciaceae	Foliose	Corticolous/ Saxicolous	Mannavanshola, Marayoor
129	*Ramalina australiensis* Nyl.	Ramalinaceae	Fruticose	Corticolous	Mannavanshola, Marayoor
130	*Ramalina inflata subsp. inflata* (Hook. f. & Taylor) Hook. f. & Taylor	Ramalinaceae	Fruticose	Corticolous	Anaimudi slope, Munnar
131	*Ramalina lacera* (With.) J.R. Laundon	Ramalinaceae	Fruticose	Corticolous	Mannavanshola, Marayoor
132	*Ramalina pacifica* Asahina	Ramalinaceae	Fruticose	Corticolous	Mannavanshola, Marayoor
133	*Ramalina roesleri* (Hochst. ex Schaer.) Nyl.	Ramalinaceae	Fruticose	Corticolous	Lockart Gap, Munnar
134	*Ramalina subampliata* (Nyl.) Fink.	Ramalinaceae	Fruticose	Corticolous	Mannavanshola, Marayoor
135	*Ramalina taitensis* Nyl.	Ramalinaceae	Fruticose	Corticolous	Mannavanshola, Marayoor
136	*Heterodermia indica* (H. Magn.) D.D. Awasthi	Physciaceae	Foliose	Corticolous	Silent Valley Estate, Munnar
137	*Reimnitzia santensis* (Tuck.) Kalb	Graphidaceae	Microlichen	Corticolous	Thekkady forest; Cardamom hills
138	*Relicina abstrusa* (Vain.) Hale	Parmeliaceae	Foliose	Corticolous	Cardamom hills
139	*Relicina sydneyensis* (Gyeln.) Hale	Parmeliaceae	Foliose	Corticolous	Cardamom hills
140	*Remototrachyna awasthii* (Hale & Patew.) Divakar & A. Crespo	Parmeliaceae	Foliose	Corticolous	Eravikulam National Park, Pettimudi, Anaimudi, Silent Valley Estate Munnar; Uppupara,Periyar Tiger Reserve

S. No.	Species	Family	Habit	Habitat	Distribution
141	*Remototrachyna dodapetta* (Hale & Patw.) Divakar & A. Crespo	Parmeliaceae	Foliose	Corticolous	Mannavanshola, Marayoor; Pettimudi, Munnar
142	*Remototrachyna flexilis* (Kurok.) Divakar & A. Crespo	Parmeliaceae	Foliose	Corticolous	Kattapara shola
143	*Remototrachyna rigidula* (Kurok.) Divakar & A. Crespo	Parmeliaceae	Foliose	Corticolous	Uppupara, Periyar Tiger Reserve
144	*Remototrachyna thryptica* (Hale) Divakar & A. Crespo	Parmeliaceae	Foliose	Corticolous	Mannavanshola, Marayoor
145	*Rhabdodiscus verrucoisidiatus* (Nagarkar, Sethy & Patw.) S. Joshi, Upreti & Lücking	Graphidaceae	Microlichen	Corticolous	Devikulam; Cardamom hills
146	*Roccella montagnei* Bél.	Roccellaceae	Fruticose	Corticolous	Top station, Munnar
147	*Sarcographa dendroides* (Leight.) Luch & Lücking	Graphidaceae	Microlichen	Corticolous	Cardamom hills
148	*Scytinium gelatinosum* (With.) Otálora, P.M. Jørg. & Wedin	Collemataceae	Foliose	Corticolous	Silent Valley Estate , Munnar
149	*Stegobolus fissus* (Müll. Arg.) Frisch	Graphidaceae	Microlichen	Corticolous	Cardamom hills, Kumily
150	*Stereocaulon austroindicum* I.M. Lamb	Stereocaulaceae	Persistant fruticose	Corticolous/ Saxicolous	Rajamala, Munnar; Uppupara, Periyar Tiger Reserve; Mannavanshola, Marayoor
151	*Sticta cyphellulata* (Mull. Arg.) Hue	Lobariaceae	Foliose	Corticolous	Eravikulam National Park; Anaimudi; Silent Valley Estate, Munnar; Uppupara, Periyar Tiger Reserve
152	*Sticta filix* (Sw.) Nyl.	Lobariaceae	Foliose	Corticolous	Kallar Estate; Silent Valley Estate; Anaimudi, Munnar; Mannavanshola, Marayoor
153	*Sticta henryana* Mull. Arg.	Lobariaceae	Foliose	Corticolous	Pettimudi, Munnar
154	*Sticta limbata* (Sm.) Ach.	Lobariaceae	Foliose	Corticolous	Silent Valley Estate, Munnar; Uppupara, Periyar Tiger Reserve
155	*Sticta neocaledonica* (Mull. Arg.) Hue	Lobariaceae	Foliose	Corticolous	Silent Valley Estate, Munnar
156	*Sticta orbicularis* (A. Braun ex Meyen & Flot.) Hue	Lobariaceae	Foliose	Corticolous	Eravikulam National Park, Munnar; Mannavanshola, Marayoor; Uppupara, Periyar Tiger Reserve
157	*Sticta sylvatica* (Huds.) Ach.	Lobariaceae	Foliose	Corticolous	Anaimudi, Munnar

S. No.	Species	Family	Habit	Habitat	Distribution
158	*Sticta weigelii* Isert	Lobariaceae	Foliose	Corticolous	Kattappara shola; Kallar Estate, Munnar; Uppupara, Periyar Tiger Reserve; Mannavanshola, Marayoor
159	*Teloschistes flavicans* (Sw.) Norman	Teloschistaceae	Fruticose	Corticolous	Mannavanshola, Marayoor; Mattupetti; Top station, Munnar
160	*Thelotrema keralense* Patw. & Kulk.	Graphidaceae	Microlichen	-	Munnar
161	*Usnea austroindica* G. Awasthi	Parmeliaceae	Fruticose	Corticolous	Mannavanshola, Marayoor
162	*Usnea bimolliuscula* Zahlbr.	Parmeliaceae	Fruticose	Corticolous	Mannavanshola, Marayoor
163	*Usnea bornmuelleri* J. Steiner	Parmeliaceae	Fruticose	Corticolous	Mannavanshola, Marayoor; Rajamala; Anaimudi, Munnar
164	*Usnea cineraria* Motyka	Parmeliaceae	Fruticose	Corticolous	Mannavanshola, Marayoor
165	*Usnea complanata* (Müll. Arg.) Motyka	Parmeliaceae	Fruticose	Corticolous	Pettimudi, Munnar
166	*Usnea corallina* Motyka	Parmeliaceae	Fruticose	Corticolous	Mannavanshola, Marayoor; Anamalai hills, Munnar
167	*Usnea dentritica* Stirt.	Parmeliaceae	Fruticose	Corticolous	Eravikulam National Park; Chinnamala; Anaimudi slope, Munnar
168	*Usnea eumitrioides* Motyka	Parmeliaceae	Fruticose	Corticolous	Mannavanshola, Marayoor
169	*Usnea fischeri* G. Awasthi	Parmeliaceae	Fruticose	Corticolous	Mannavanshola, Marayoor; Pettimudi; Mattupetti; Silent Valley Estate, Munnar
170	*Usnea fragilis* Stirt.	Parmeliaceae	Fruticose	Corticolous	Mannavanshola, Marayoor; Anaimudi slope; Mattupetti, Munnar
171	*Usnea gigas* Motyka	Parmeliaceae	Fruticose	Corticolous	Mannavanshola, Marayoor
172	*Usnea himalayana* C. Bab.	Parmeliaceae	Fruticose	Corticolous	Eravikulam National Park; Chinnamala; Anaimudi slope; Silent Valley Estate, Munnar; Mannavanshola, Marayoor
173	*Usnea indica* Motyka	Parmeliaceae	Fruticose	Corticolous	Mannavanshola, Marayoor
174	*Usnea maculata* Stirt.	Parmeliaceae	Fruticose	Corticolous	Mannavanshola, Marayoor
175	*Usnea nepalensis* G. Awasthi	Parmeliaceae	Fruticose	Corticolous	Mannavanshola, Marayoor
176	*Usnea nilgirica* G. Awasthi	Parmeliaceae	Fruticose	Corticolous	Mannavanshola, Marayoor; Silent Valley Estate, Munnar

S. No.	Species	Family	Habit	Habitat	Distribution
177	*Usnea orientalis* Motyka	Parmeliaceae	Fruticose	Corticolous	Eravikulam National Park; Anaimudi slope; Silent Valley Estate, Munnar; Mannavanshola, Marayoor
178	*Usnea pangiana* Stirt.	Parmeliaceae	Fruticose	Corticolous	Mannavanshola, Marayoor
179	*Usnea pectinate* Tayl.	Parmeliaceae	Fruticose	Corticolous	Mannavanshola, Marayoor
180	*Usnea picta* (J. Steiner) Motyka	Parmeliaceae	Fruticose	Corticolous	Anaimudi slope; Pettimudi; Silent Valley Estate, Munnar; Mannavanshola, Marayoor
181	*Usnea pictoides* G. Awasthi	Parmeliaceae	Fruticose	Corticolous	Anaimudi slope, Munnar
182	*Usnea pseudosinensis* Asahina	Parmeliaceae	Fruticose	Corticolous	Mannavanshola, Marayoor
183	*Usnea rigidula* (Stirt.) G. Awasthi	Parmeliaceae	Fruticose	Corticolous	Rajamala; Silent Valley Estate, Munnar; Mannavanshola, Marayoor
184	*Usnea rubicunda* Stirt.	Parmeliaceae	Fruticose	Corticolous	Mannavanshola, Marayoor; Eravikulam National Park, Munnar; Silent Valley Estate, Munnar
185	*Usnea spinosula* Stirt.	Parmeliaceae	Fruticose	Corticolous	Eravikulam National Park, Munnar; Mannavanshola, Marayoor
186	*Usnea splendens* Stirt.	Parmeliaceae	Fruticose	Corticolous	Mannavanshola, Marayoor
187	*Usnea stigmatoides* G. Awasthi	Parmeliaceae	Fruticose	Corticolous	Mannavanshola, Marayoor; Kattappara, Rajamala
188	*Usnea subchalybeae* Zahlbr.	Parmeliaceae	Fruticose	Corticolous	Anaimudi, Munnar; Mannavanshola, Marayoor
189	*Usnea subflorida* (Zahlbr.) Motyka	Parmeliaceae	Fruticose	Corticolous	Eravikulam National Park, Munnar; Mannavanshola, Marayoor
190	*Usnea thomsonii* Stirt.	Parmeliaceae	Fruticose	Corticolous	Silent Valley Estate, Munnar
191	*Usnea undulata* Stirt.	Parmeliaceae	Fruticose	Corticolous	Mannavanshola, Marayoor
192	*Usnea vegae* Motyka	Parmeliaceae	Fruticose	Corticolous	Silent Valley Estate, Munnar
193	*Usnea wasmuthii* Rasanen	Parmeliaceae	Fruticose	Corticolous	Mannavanshola, Marayoor
194	*Vahliella leucophaea* (Vahl) P.M. Jørg.	Pannariaceae	Squamulose-ceustose	Corticolous	Mannavanshola, Marayoor

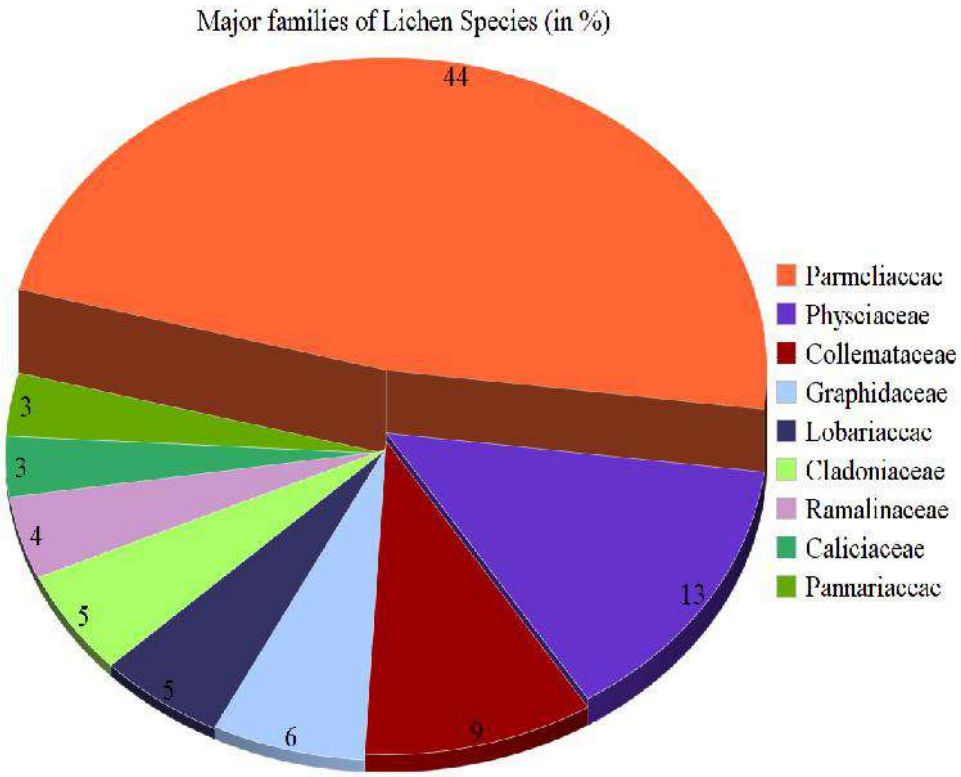

Major families of Lichen Species (in %)
44
13
9
6
5
5
4
3
3
Parmeliaceae
Physciaceae
Collemataceae
Graphidaceae
Lobariaceae
Cladoniaceae
Ramalinaceae
Caliciaceae
Pannariaceae

Table 3. **Bryophytes from the HRML study area, Anjunadu valley, Kerala**

S.No.	Species	Family	Habitat	Locality
1	*Anacolia menziesii* (Turner) Paris	Bartramiaceae	Rocks	Attukadu
2	*Aneura tenuicostata* (Schiffner) Stephani	Aneuraceae		
3	*Anisothecium molliculum* (Mitt.) Broth.	Dicranaceae	Rocks	Attukadu
4	*Anoectangium stracheyanum* Mitt.	Pottiaceae		
5	*Anomobryum auratum* (Mitt.) A. Jaeger	Bryaceae		
6	*Anomobryum brachymenioides* Dixon & P. de la Varde	Bryaceae	Wet rocks	Munnar
7	*Anomobryum cymbifolium* (Lindb.) Broth.	Bryaceae	Wet rocks	Athirapalli
8	*Anomobryum pellucidum* Dixon & Badhw.	Bryaceae	Wet rocks	Attukadu
9	*Anthoceros crispulus* (Mont.) Douin	Anthocerotaceae		
10	*Anthoceros erectus* Stephani	Anthocerotaceae		
11	*Anthoceros gemmulosus* Schiffner & Pande	Anthocerotaceae		
12	*Asterella leptophylla* (Mont.) Grolle	Aytoniaceae		
13	*Asterella wallichiana* (Lehm.) Grolle	Aytoniaceae		
14	*Atrichum longifolium* Cardot & Dixon ex Gangulee	Polytrichaceae	Loose soil	Attukadu
15	*Atrichum obtusulum* (Müll. Hal.) A. Jaeger	Polytrichaceae	Loose soil	Kannimalai
16	*Bartramidula bartramioides* (Griff.) Wijk & Margad.	Bartramiaceae		
17	*Bartramidula roylei* (Hook. f.) Bruch & Schimp.	Bartramiaceae	Wet rocks	Kannimalai
18	*Brachymenium acuminatum* Harv.	Bryaceae	Wet rocks	Munnar
19	*Brachymenium bryoides* Hook. ex Schwägr.	Bryaceae		
20	*Brachymenium exile* (Dozy & Molk.) Bosch & Sande Lac.	Bryaceae		
21	*Brachymenium ptychothecium* (Besch.) Ochi	Bryaceae	Soil	Poyankutti
22	*Brachymenium sikkimense* Renauld & Cardot	Bryaceae	Tree bark	Munnar
23	*Brachymenium walkeri* Broth.	Bryaceae		
24	*Brachythecium kamounense* (Harv.) A. Jaeger	Brachytheciaceae	Rocks	Devikulam
25	*Brachythecium populeum* (Hedw.) Schimp.	Brachytheciaceae	Soil	Attukadu
26	*Brotherella dixonii* Herzog	Sematophyllaceae	Wet rocks	Eravikulam
27	*Bryum argenteum* Hedw.	Bryaceae		

S.No.	Species	Family	Habitat	Locality
28	*Bryum atrovirens* Brid.	Bryaceae	Soil	Thekadi
29	*Bryum auratum* Mitt.	Bryaceae	Wet rocks	Munnar
30	*Bryum badhwarii* Ochi	Bryaceae		
31	*Bryum coronatum* Schwägr.	Bryaceae		
32	*Bryum dichotomum* Hedw.	Bryaceae	Soil	Munnar
33	*Bryum pseudotriquetrum* (Hedw.) P. Gaertn., B. Mey. & Scherb.	Bryaceae		
34	*Bryum uliginosum* (Brid.) Bruch & Schimp.	Bryaceae		
35	*Callicostella papillata* (Mont.) Mitt.	Pilotrichaceae		
36	*Calliergon cordifolium* (Hedw.) Kindb.	Amblystegiaceae	Wet rocks	Munnar
37	*Calycularia crispula* Mitt.	Allisoniaceae		
38	*Calymperes graeffeanum* Müll. Hal.	Calymperaceae		
39	*Campylopodiella tenella* Cardot	Dicranaceae	Rocks	Athirapalli
40	*Campylopus atrovirens* De Not.	Dicranaceae		
41	*Campylopus flexuosus* (Hedw.) Brid.	Dicranaceae	Rocks	Munnar
42	*Campylopus fragilis subsp. goughii* (Mitt.) J.-P. Frahm	Dicranaceae	Rocks	Athirapalli
43	*Campylopus gracilis* (Mitt.) A. Jaeger	Dicranaceae	Rocks	Munnar
44	*Campylopus richardii* Brid.	Dicranaceae	Rocks	Munnar
45	*Campylopus schmidii* (Müll. Hal.) A. Jaeger	Dicranaceae	Rocks	Munnar
46	*Campylopus subfragilis* Renauld & Cardot	Dicranaceae	Rocks	Matupatti
47	*Catharinea aculeata* (Cardot & P. de la Varde) Broth.	Polytrichaceae	Loose soil	Devikulam
48	*Cephaloziella kiaeri* (Austin) S.W. Arnell	Cephaloziellaceae		
49	*Ceratodon purpureus* (Hedw.) Brid.	Ditrichaceae	Soil, rocks and roofs	Kothamangalam
50	*Claopodium pellucinerve* (Mitt.) Best	Thuidiaceae	Rocks	Munnar
51	*Claopodium prionophyllum* (Müll. Hal.) Broth.	Thuidiaceae		
52	*Cyathodium tuberculatum* Udar & D.K. Singh	Targioniaceae		
53	*Diaphanodon blandus* (Harv.) Renauld & Cardot	Trachypodaceae		
54	*Dicladiella cubensis* (Mitt.) W.R. Buck	Meteoriaceae		
55	*Dicranella macrospora* Gangulee	Dicranaceae	Soil	Munnar

S.No.	Species	Family	Habitat	Locality
56	*Dicranella spiralis* (Mitt.) A. Jaeger	Dicranaceae	Moist soil	Munnar
57	*Dicranodontium denudatum* (Brid.) E. Britton	Dicranaceae	Rocks	Athirapalli
58	*Dicranolejeunea yoshinagana* (S. Hatt.) Mizut.	Lejeuneaceae		
59	*Ditrichum darjeelingense* Renauld & Cardot	Dicranaceae		Poyankutti
60	*Ditrichum difficile* (Duby) M. Fleisch.	Ditrichaceae		
61	*Ditrichum heteromallum* (Hedw.) E. Britton	Ditrichaceae	Wet rocks	Thattekad
62	*Ditrichum pusillum* (Hedw.) Hampe	Ditrichaceae	Rocks	Munnar
63	*Ditrichum tortipes* (Mitt.) Kuntze	Ditrichaceae	Dry exposed rocks	Munnar
64	*Ditrichum tortuloides* Grout	Ditrichaceae	Exposed rocks	Thattekad
65	*Dumortiera hirsuta* (Sw.) Nees	Marchantiaceae		
66	*Ectropothecium buitenzorgii* (Bél.) Mitt.	Hypnaceae		
67	*Ectropothecium dealbatum* (Reinw. & Hornsch.) A. Jaeger	Hypnaceae		
68	*Entodon laetus* (Griff.) A. Jaeger	Entodontaceae	Tree bark	Athirapalli
69	*Entodon macropodus* (Hedw.) Müll. Hal.	Entodontaceae		
70	*Entodon plicatus Müll.* Hal.	Entodontaceae		
71	*Entodontopsis nitens* (Mitt.) W.R. Buck & R.R. Ireland	Stereophyllaceae		
72	*Entosthodon nutans* Mitt.	Funariaceae	Rocks	Munnar
73	*Entosthodon wallichii* Mitt.	Funariaceae	Rocks	Eravikulam
74	*Entosthodon wichurae* M. Fleisch.	Funariaceae		
75	*Erythrodontium julaceum* (Hook. ex Schwägr.) Paris	Entodontaceae		
76	*Fabronia pusilla* Raddi	Fabroniaceae	Rocks	Idukki
77	*Fissidens ceylonensis var. acutifolius* Dixon & P. Varde	Fissidentaceae		
78	*Fissidens anomalus* Mont.	Fissidentaceae		
79	*Fissidens ceylonensis* Dozy & Molk.	Fissidentaceae		
80	*Fissidens dubius* P. Beauv.	Fissidentaceae		
81	*Fissidens hollianus* Dozy & Molk.	Fissidentaceae		
82	*Fissidens involutus* Wilson ex Mitt.	Fissidentaceae		
83	*Fissidens polypodioides* Hedw.	Fissidentaceae	Soil	Devikulam

S.No.	Species	Family	Habitat	Locality
84	*Fissidens schmidii* Müll. Hal.	Fissidentaceae		
85	*Fissidens taxifolius* Hedw.	Fissidentaceae	Soil	Munnar
86	*Fissidens zippelianus* Dozy & Molk.	Fissidentaceae		
87	*Folioceros pandei* Udar & Shaheen	Anthocerotaceae		
88	*Fossombronia cristula* Austin	Fossombroniaceae		
89	*Fossombronia himalayensis* Kashyap	Fossombroniaceae		
90	*Fossombronia indica* Stephani	Fossombroniaceae		
91	*Frullania tamarisci* (L.) Dumort.	Jubulaceae		
92	*Funaria hygrometrica* Hedw.	Funariaceae		
93	*Funaria wijkii* R.S. Chopra	Funariaceae	Rocks	Attukadu
94	*Garckea flexuosa* (Griff.) Margad. & Nork.	Ditrichaceae	Shaded rocks	Adimali
95	*Garckea phascoides* (Hook.) Müll. Hal.	Ditrichaceae		
96	*Hageniella assamica* Dixon	Sematophyllaceae	Wet rocks	Eravikulam
97	*Haplocladium schimperi* Thér.	Thuidiaceae	Litter	Matupatti
98	*Heliconema peguense* (Besch.) L.T. Ellis & A. Eddy	Calymperaceae	Wet rocks	Charpa
99	*Herpetineuron toccoae* (Sull. & Lesq.) Cardot	Thuidiaceae	Rocks	Attukadu
100	*Homaliodendron exiguum* (Bosch & Sande Lac.) M. Fleisch.	Neckeraceae		
101	*Homaliodendron flabellatum* (Sm.) M. Fleisch.	Neckeraceae		
102	*Hydrogonium consanguineum* (Thwaites & Mitt.) Hilp.	Pottiaceae		
103	*Hydrogonium pseudoehrenbergii* (M. Fleisch.) P.C. Chen	Pottiaceae	Wet rocks	Kallar
104	*Hymenostylium recurvirostrum* (Hedw.) Dixon	Pottiaceae		
105	*Hyophila involuta* (Hook.) A. Jaeger	Pottiaceae		
106	*Hyophila rosea* R.S. Williams	Pottiaceae	Rocks	Munnar
107	*Hypnum aduncoides* (Brid.) Müll. Hal.	Hypnaceae	Soil	Munnar
108	*Hypnum setschwanicum* (Broth.) Ando	Hypnaceae	Soil	Munnar
109	*Isopterygium lignicola* (Mitt.) A. Jaeger	Hypnaceae		
110	*Isopterygium pohliaecarpum* (Sull. & Lesq.) A. Jaeger	Hypnaceae		
111	*Leptobryum pyriforme* (Hedw.) Wilson	Bryaceae	Rocks	Wariyum

S.No.	Species	Family	Habitat	Locality
112	*Leptopterigynandrum decolor* (Mitt.) M. Fleisch.	Thuidiaceae	Tree base	Attukadu
113	*Lescuraea incurvata* (Hedw.) E. Lawton	Leskeaceae	Munnar	Tree bark
114	*Leucobryum humillimum* Cardot	Dicranaceae		
115	*Leucobryum neilgherrense* Müll. Hal.	Dicranaceae		
116	*Leucoloma amoene-virens* Mitt.	Dicranaceae		
117	*Lopholejeunea subfusca* (Nees) Schiffner	Lejeuneaceae		
118	*Macromitrium vohrai* Rajeevan	Orthotrichaceae		
119	*Macromitrium moorcroftii* (Hook. & Grev.) Schwagr.	Orthotrichaceae		
120	*Macromitrium nepalense* (Hook. & Grev.) Schwagr.	Orthotrichaceae		
121	*Marchantia kashyapii* Udar & Shaheen	Marchantiaceae		
122	*Marchantia palmata* Reinw., Nees & Blume	Marchantiaceae		
123	*Meiothecium jagorii* (Müll. Hal.) Broth.	Sematophyllaceae	Rocks	Athirapalli
124	*Meteoriella soluta* (Mitt.) S. Okamura	Pterobryaceae	Tree branches	Athirapalli
125	*Meteoriopsis reclinata* (Müll. Hal.) M. Fleisch.	Meteoriaceae		
126	*Meteoriopsis squarrosa* (Hook. ex Harv.) M. Fleisch.	Meteoriaceae		
127	*Metzgeria nilgiriensis* S.C. Srivast. & Udar	Metzgeriaceae		
128	*Microcampylopus khasianus* (Griffiths) Giese & J.-P. Frahm	Dicranaceae	Rocks	Rajamalai
129	*Microdus brasiliensis* (Duby) Thér.	Dicranaceae	Wet rocks	Matupatti
130	*Mielichhoferia himalayana* Mitt.	Bryaceae	Soil	Munnar
131	*Mnium thomsonii* Schimp.	Mniaceae	Wet rocks	Matupatti
132	*Molendoa sendtneriana* (Bruch & Schimp.) Limpr.	Pottiaceae		
133	*Myurium borii* (Dixon) Magill	Myuriaceae	Tree bark	Eravikulam
134	*Nanothecium foreaui* Dixon & P. de la Varde	Entodontaceae		
135	*Notothylas dissecta* Steph	Notothyladaceae		
136	*Octoblepharum albidum* Hedw.	Octoblepharaceae		
137	*Orthodontium infractum* Dozy & Molk.	Bryaceae	Tree base	Munnar
138	*Orthomnion bryoides* (Griff.) Nork.	Mniaceae		
139	*Orthotrichum speciosum* Nees	Orthotrichaceae	Tree branches	Matupatti

S.No.	Species	Family	Habitat	Locality
140	*Oxystegus stenophyllus* (Mitt.) Gangulee	Pottiaceae	Soil	Rajamalai
141	*Phaeoceros laevis* (L.) Prosk.	Anthocerotaceae		
142	*Philonotis fontana* (Hedw.) Brid.	Bartramiaceae		
143	*Philonotis hastata* (Duby) Wijk & Margad.	Bartramiaceae		
144	*Philonotis leptocarpa* Mitt.	Bartramiaceae		
145	*Philonotis thwaitesii* Mitt.	Bartramiaceae		
146	*Physcomitrium eurystomum* Sendtn.	Funariaceae		
147	*Physcomitrium japonicum* (Hedw.) Mitt.	Funariaceae	Soil	Kannimalai
148	*Plagiobryum zierii* (Dicks. ex Hedw.) Lindb.	Bryaceae	Wet rocks	Attukadu
149	*Plagiochasma intermedium* Lindenb. & Gottsche	Aytoniaceae		
150	*Plagiomnium rostratum* (Schrad.) T.J. Kop.	Mniaceae		
151	*Plagiothecium cavifolium* (Brid.) Z. Iwats.	Plagiotheciaceae	Tree base	Matupatti
152	*Pleuridium tenue* Mitt.	Ditrichaceae	Wet rocks	Adimali
153	*Pogonatum aloides* (Hedw.) P. Beauv.	Polytrichaceae	Munnar	Munnar
154	*Pogonatum cirratum* (Sw.) Brid.	Polytrichaceae	Soil	Matupatti
155	*Pogonatum microstomum* (R. Br. ex Schwägr.) Brid.	Polytrichaceae	Rocks	Eravikulam
156	*Pogonatum neesii* (Müll. Hal.) Dozy	Polytrichaceae	Soil	Attukadu
157	*Pogonatum perichaetiale* (Mont.) A. Jaeger	Polytrichaceae	Wet rocks	Eravikulam
158	*Pohlia foreaui* Rajeevan	Bryaceae		
159	*Pohlia flexuosa* Harv.	Bryaceae		
160	*Pohlia gedeana* (Bosch & Sande Lac.) Gangulee	Bryaceae		
161	*Pohlia himalayana* (Mitt.) Broth.	Bryaceae	Tree base	Devikulam
162	*Pohlia ludwigii* (Spreng. ex Schwägr.) Broth.	Bryaceae	Soil	Attukadu
163	*Polytrichastrum formosum var. densifolium* (Wilson ex Mitt.) Z. Iwats. & Nog.	Polytrichaceae	Soil	Munnar
164	*Pseudoneura multifida* (L.) Gottsche	Aneuraceae		
165	*Pseudosymblepharis bombayensis* (Müll. Hal.) P. Sollman	Pottiaceae		
166	*Pseudotaxiphyllum elegans* (Brid.) Z. Iwats.	Plagiotheciaceae		
167	*Pterobryopsis keralensis* (Rajeevan) Dix.	Pterobryaceae		

S.No.	Species	Family	Habitat	Locality
168	*Pterobryopsis flexipes* (Mitt.) M. Fleisch.	Pterobryaceae		
169	*Ptychostomum capillare* (Hedw.) D. T. Holyoak & N. Pedersen	Bryaceae	Wet rocks	Attukadu
170	*Pylaisiadelpha drepanioides* Cardot & Dixon	Sematophyllaceae	Wet rocks	Eravikulam
171	*Reboulia hemisphaerica* (L.) Raddi	Aytoniaceae		
172	*Regmatodon declinatus* (Hook.) Brid.	Regmatodontaceae	Rocks	Eravikulam
173	*Rhabdoweisia crenulata* (Mitt.) H. Jameson	Rhabdoweisiaceae	Wet rocks	Kannimalai
174	*Rhaphidostichum glauco-virens* (Mitt.) Broth.	Sematophyllaceae	Rocks	Matupatti
175	*Rhaphidostichum subleptocarpum* (Thér. & P. de la Varde) Broth.	Sematophyllaceae		
176	*Rhodobryum giganteum* (Schwägr.) Paris	Bryaceae		
177	*Rhodobryum laxelimbatum* (Hampe ex Ochi) Z. Iwats. & T.J. Kop.	Bryaceae	Rocks	Attukadu
178	*Riccardia levieri* Schiffner	Aneuraceae		
179	*Riccia billardieri* Mont. & Nees ex Gottsche, Lindenb. & Nees	Ricciaceae		
180	*Riccia crustata* Trab. ex Grolle	Ricciaceae		
181	*Riccia crystallina* L.	Ricciaceae		
182	*Riccia stricta* (Gottsche, Lindenb. & Nees) Perold	Ricciaceae		
183	*Rosulabryum billarderi* (Schwägr.) J.R. Spence	Bryaceae		
184	*Schiffneriolejeunea indica* (Steph.) Udar & Awashti	Lejeuneaceae		
185	*Sematophyllum humile* (Mitt.) Broth.	Sematophyllaceae	Tree bark	Munnar
186	*Sematophyllum subpinnatum* (Brid.) E. Britton	Sematophyllaceae	Tree bark	Athirapalli
187	*Symphysodontella involuta* (Thwaites & Mitt.) M. Fleisch.	Pterobryaceae		
188	*Syrrhopodon albidus* Thwaites & Mitt.	Calymperaceae		
189	*Targionia hypophylla* L.	Targioniaceae		
190	*Targionia indica* Udar & A. Gupta	Targioniaceae		
191	*Thuidium cymbifolium* (Dozy & Molk.) Dozy & Molk.	Thuidiaceae		
192	*Tortula schmidii* (Müll. Hal.) Broth.	Pottiaceae		
193	*Trachypus bicolor* Reinw. & Hornsch.	Trachypodaceae		
194	*Trematodon kurzii* Hampe ex Gangulee	Bruchiaceae	Sandy soil	Athirapalli
195	*Trematodon longicollis* Michx.	Bruchiaceae		

S.No.	Species	Family	Habitat	Locality
196	T*rematodon schmidii* Müll. Hal.	Bruchiaceae	Sandy soil	Adimali
197	*Trematodon subulosus* Griff.	Bruchiaceae	Soil	Kallar
198	*Trichostomum criotum* R.H. Zander	Pottiaceae	Rocks	Munnar
199	*Trichostomum tenuirostre* (Hook. & Taylor) Lindb.	Pottiaceae		

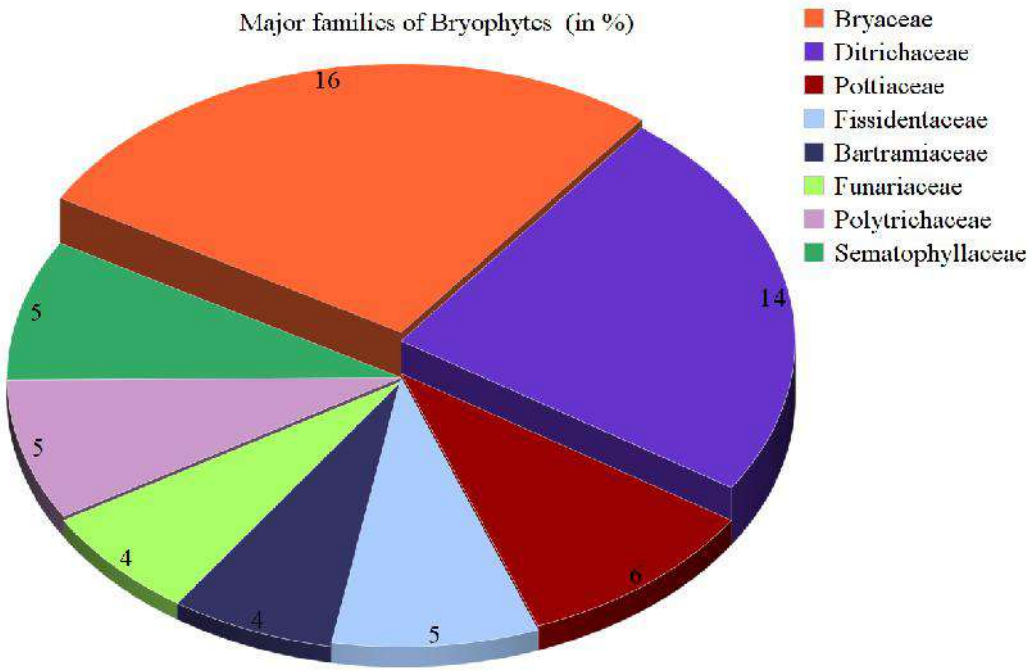


Table 4. **Check list of Medicinal plants in the HRML study area, Anjunadu valley, Kerala**

S. No.	Plant name	Family
1	*Abelmoschus esculentus* (L.) Moench	Malvaceae
2	*Abelmoschus manihot* (L.) Medik.	Malvaceae
3	*Abelmoschus moschatus* Medik.	Malvaceae
4	*Abrus precatorius* L.	Leguminosae
5	*Abrus pulchellus* Thwaites	Leguminosae
6	*Abutilon hirtum* (Lam.) Sweet	Malvaceae
7	*Abutilon indicum* (L.) Sweet	Malvaceae
8	*Abutilon persicum* (Burm.f.) Merr.	Malvaceae
9	*Acacia caesia* (L.) Willd.	Leguminosae
10	*Acacia catechu* (L.f.) Willd.	Leguminosae
11	*Acacia chundra* (Rottler) Willd.	Leguminosae
12	*Acacia dealbata* Link	Leguminosae
13	*Acacia ferruginea* DC.	Leguminosae
14	*Acacia leucophloea* (Roxb.) Willd.	Leguminosae
15	*Acacia melanoxylon* R.Br.	Leguminosae
16	*Acacia nilotica* (L.) Delile	Leguminosae
17	*Acacia pennata* (L.) Willd.	Leguminosae
18	*Acacia planifrons* Wight & Arn.	Leguminosae
19	*Acacia sinuata* (Lour.) Merr.	Leguminosae
20	*Acacia torta* (Roxb.) Craib	Leguminosae
21	*Acalypha ciliata* Forssk.	Euphorbiaceae
22	*Acalypha fruticosa* Forssk.	Euphorbiaceae
23	*Acalypha hispida* Burm.f.	Euphorbiaceae
24	*Acalypha indica* L.	Euphorbiaceae
25	*Acalypha paniculata* Miq.	Euphorbiaceae
26	*Acampe praemorsa* (Roxb.) Blatt. & McCann	Orchidaceae
27	*Acanthospermum hispidum* DC.	Asteraceae
28	*Achyranthes aspera* L.	Amaranthaceae
29	*Achyranthes bidentata* Blume	Amaranthaceae
30	*Acmella paniculata* (Wall. ex DC.) R.K.Jansen	Asteraceae
31	*Acorus calamus* L.	Acoraceae
32	*Acronychia pedunculata* (L.) Miq.	Rutaceae
33	*Acrotrema arnottianum* Wight	Dilleniaceae
34	*Adenia hondala* (Gaertn.) W.J.de Wilde	Passifloraceae
35	*Adenia wightiana* (Wall. ex Wight & Arn.) Engl.	Passifloraceae
36	*Adenostemma lavenia* (L.) Kuntze	Asteraceae
37	*Aeginetia indica* L.	Orobanchaceae
38	*Aegle marmelos* (L.) Corrêa	Rutaceae
39	*Aerva lanata* (L.) Juss.	Amaranthaceae
40	*Aeschynomene aspera* L.	Leguminosae

41	*Aeschynomene indica* L.	Leguminosae
42	*Aganosma cymosa* (Roxb.) G.Don	Apocynaceae
43	*Agave americana* L.	Asparagaceae
44	*Ageratina adenophora* (Spreng.) R.M.King & H.Rob.	Asteraceae
45	*Ageratum conyzoides* (L.) L.	Asteraceae
46	*Ageratum houstonianum* Mill.	Asteraceae
47	*Aglaia elaeagnoidea* (A.Juss.) Benth.	Meliaceae
48	*Aglaia lawii* (Wight) C.J.Saldanha	Meliaceae
49	*Ailanthus excelsa* Roxb.	Simaroubaceae
50	*Ailanthus triphysa* (Dennst.) Alston	Simaroubaceae
51	*Alangium salviifolium* (L.f.) Wangerin	Cornaceae
52	*Albizia amara* (Roxb.) B.Boivin	Leguminosae
53	*Albizia chinensis* (Osbeck) Merr.	Leguminosae
54	*Albizia lebbeck* (L.) Benth.	Leguminosae
55	*Albizia odoratissima* (L.f.) Benth.	Leguminosae
56	*Albizia procera* (Roxb.) Benth.	Leguminosae
57	*Albizia saman* (Jacq.) Merr.	Leguminosae
58	*Allamanda cathartica* L.	Apocynaceae
59	*Allmania nodiflora* (L.) R.Br. ex Wight	Amaranthaceae
60	*Allophylus cobbe* (L.) Raeusch.	Sapindaceae
61	*Allophylus serratus* (Hiern) Kurz	Sapindaceae
62	*Alloteropsis cimicina* (L.) Stapf	Poaceae
63	*Alocasia fornicata* (Roxb.) Schott	Araceae
64	*Aloe vera* (L.) Burm.f.	Xanthorrhoeaceae
65	*Alpinia calcarata* (Haw.) Roscoe	Zingiberaceae
66	*Alpinia galanga* (L.) Willd.	Zingiberaceae
67	*Alpinia malaccensis* (Burm.f.) Roscoe	Zingiberaceae
68	*Alseodaphne semecarpifolia* Nees	Lauraceae
69	*Alstonia scholaris* (L.) R. Br.	Apocynaceae
70	*Alstonia venenata* R.Br.	Apocynaceae
71	*Alternanthera pungens* Kunth	Amaranthaceae
72	*Alternanthera sessilis* (L.) R.Br. ex DC.	Amaranthaceae
73	*Alysicarpus bupleurifolius* (L.) DC.	Leguminosae
74	*Alysicarpus monilifer* (L.) DC.	Leguminosae
75	*Alysicarpus vaginalis* (L.) DC.	Leguminosae
76	*Amaranthus caudatus* L.	Amaranthaceae
77	*Amaranthus spinosus* L.	Amaranthaceae
78	*Amaranthus tricolor* L.	Amaranthaceae
79	*Amaranthus viridis* L.	Amaranthaceae
80	*Ammannia baccifera* L.	Lythraceae
81	*Amorphophallus bulbifer* (Roxb.) Blume	Araceae
82	*Amorphophallus commutatus* (Schott) Engl.	Araceae
83	*Amorphophallus paeoniifolius* (Dennst.) Nicolson	Araceae

84	*Ampelocissus indica* (L.) Planch.	Vitaceae
85	*Ampelocissus tomentosa* (B.Heyne & Roth) Planch.	Vitaceae
86	*Anacardium occidentale* L.	Anacardiaceae
87	*Anacolosa densiflora* Bedd.	Olacaceae
88	*Anamirta cocculus* (L.) Wight & Arn.	Menispermaceae
89	*Ananas comosus* (L.) Merr.	Bromeliaceae
90	*Ancistrocladus heyneanus* Wall. ex J.Graham	Ancistrocladaceae
91	*Andrographis atropurpurea* (Dennst.) Alston	Acanthaceae
92	*Andrographis paniculata* (Burm.f.) Nees	Acanthaceae
93	*Anemone rivularis* Buch.-Ham. ex DC.	Ranunculaceae
94	*Anisochilus carnosus* (L.f.) Wall.	Lamiaceae
95	*Anisomeles indica* (L.) Kuntze	Lamiaceae
96	*Annona muricata* L.	Annonaceae
97	*Annona reticulata* L.	Annonaceae
98	*Annona squamosa* L.	Annonaceae
99	*Anodendron paniculatum* A.DC.	Apocynaceae
100	*Anogeissus latifolia* (Roxb. ex DC.) Wall. ex Guillem. & Perr.	Combretaceae
101	*Antiaris toxicaria* Lesch.	Moraceae
102	*Antidesma acidum* Retz.	Phyllanthaceae
103	*Apluda mutica* L.	Poaceae
104	*Aporosa cardiosperma* (Gaertn.) Merr.	Phyllanthaceae
105	*Archidendron bigeminum* (L.) I.C.Nielsen	Leguminosae
106	*Archidendron clypearia* (Jack) I.C.Nielsen	Leguminosae
107	*Areca catechu* L.	Arecaceae
108	*Arenga wightii* Griff.	Arecaceae
109	*Argyreia cuneata* Ker Gawl.	Convolvulaceae
110	*Argyreia daltonii* C.B.Clarke	Convolvulaceae
111	*Argyreia imbricata* Santapau & V.Patel	Convolvulaceae
112	*Arisaema barnesii* C.E.C.Fisch.	Araceae
113	*Arisaema leschenaultii* Blume	Araceae
114	*Arisaema murrayi* (J.Graham) Hook.	Araceae
115	*Arisaema tortuosum* (Wall.) Schott	Araceae
116	*Aristida adscensionis* L.	Poaceae
117	*Aristida setacea* Retz.	Poaceae
118	*Aristolochia indica* L.	Aristolochiaceae
119	*Aristolochia tagala* Cham.	Aristolochiaceae
120	*Artanema longifolium* (L.) Vatke	Linderniaceae
121	*Artemisia nilagirica* (C.B.Clarke) Pamp.	Asteraceae
122	*Artocarpus gomezianus* Wall. ex Trécul	Moraceae
123	*Artocarpus heterophyllus* Lam.	Moraceae
124	*Artocarpus hirsutus* Lam.	Moraceae
125	*Asclepias curassavica* L.	Apocynaceae
126	*Asystasia dalzelliana* Santapau	Acanthaceae

127	*Asystasia gangetica* (L.) T.Anderson	Acanthaceae
128	*Atalantia monophylla* DC.	Rutaceae
129	*Atalantia racemosa* Wight ex Hook.	Rutaceae
130	*Averrhoa bilimbi* L.	Oxalidaceae
131	*Averrhoa carambola* L.	Oxalidaceae
132	*Azadirachta indica* A.Juss.	Meliaceae
133	*Baccharoides anthelmintica* (L.) Moench	Asteraceae
134	*Bacopa monnieri* (L.) Wettst.	Plantaginaceae
135	*Balanophora fungosa subsp. indica* (Arn.) B.Hansen	Balanophoraceae
136	*Baliospermum solanifolium* (Burm.) Suresh	Euphorbiaceae
137	*Bambusa bambos* (L.) Voss	Poaceae
138	*Barleria acuminata* Wight ex Nees	Acanthaceae
139	*Barleria courtallica* Nees	Acanthaceae
140	*Barleria cristata* L.	Acanthaceae
141	*Barleria involucrata* Nees	Acanthaceae
142	*Barleria mysorensis* B.Heyne ex Roth	Acanthaceae
143	*Barleria prattensis* Santapau	Acanthaceae
144	*Barleria prionitis* L.	Acanthaceae
145	*Bauhinia malabarica* Roxb.	Leguminosae
146	*Bauhinia phoenicea* Wight & Arn.	Leguminosae
147	*Bauhinia racemosa* Lam.	Leguminosae
148	*Bauhinia scandens* L.	Leguminosae
149	*Bauhinia tomentosa* L.	Leguminosae
150	*Bauhinia variegata* L.	Leguminosae
151	*Begonia malabarica* Lam.	Begoniaceae
152	*Benincasa hispida* (Thunb.) Cogn.	Cucurbitaceae
153	*Benkara malabarica* (Lam.) Tirveng.	Rubiaceae
154	*Bentinckia condapanna* Berry ex Roxb.	Arecaceae
155	*Berberis leschenaultii* Wall. ex Wight & Arn.	Berberidaceae
156	*Bidens biternata* (Lour.) Merr. & Sherff	Asteraceae
157	*Bidens pilosa* L.	Asteraceae
158	*Biophytum reinwardtii* (Zucc.) Klotzsch	Oxalidaceae
159	*Biophytum sensitivum* (L.) DC.	Oxalidaceae
160	*Bischofia javanica* Blume	Phyllanthaceae
161	*Blepharis maderaspatensis* (L.) B.Heyne ex Roth	Acanthaceae
162	*Blumea axillaris* (Lam.) DC.	Asteraceae
163	*Blumea eriantha* DC.	Asteraceae
164	*Blumea lacera* (Burm.f.) DC.	Asteraceae
165	*Blumea lanceolaria* (Roxb.) Druce	Asteraceae
166	*Blumea membranacea* DC.	Asteraceae
167	*Blumea oxyodonta* DC.	Asteraceae
168	*Blyxa octandra* (Roxb.) Planch. ex Thwaites	Hydrocharitaceae
169	*Boehmeria macrophylla* Hornem.	Urticaceae

170	*Boerhavia chinensis* (L.) Rottb.	Nyctaginaceae
171	*Boerhavia erecta* L.	Nyctaginaceae
172	*Bombax ceiba* L.	Malvaceae
173	*Borassus flabellifer* L.	Arecaceae
174	*Boswellia serrata* Roxb. ex Colebr.	Burseraceae
175	*Bougainvillea spectabilis* Willd.	Nyctaginaceae
176	*Brachiaria ramosa* (L.) Stapf	Poaceae
177	*Brachiaria reptans* (L.) C.A.Gardner & C.E.Hubb.	Poaceae
178	*Brassica juncea* (L.) Czern.	Brassicaceae
179	*Breynia retusa* (Dennst.) Alston	Phyllanthaceae
180	*Breynia vitis-idaea* (Burm.f.) C.E.C.Fisch.	Phyllanthaceae
181	*Bridelia retusa* (L.) A.Juss.	Phyllanthaceae
182	*Bridelia stipularis* (L.) Blume	Phyllanthaceae
183	*Brugmansia suaveolens* (Humb. & Bonpl. ex Willd.) Bercht. & J.Presl	Solanaceae
184	*Buchanania cochinchinensis* (Lour.) M.R.Almeida	Anacardiaceae
185	*Bulbophyllum sterile* (Lam.) Suresh	Orchidaceae
186	*Bulbostylis barbata* (Rottb.) C.B.Clarke	Cyperaceae
187	*Butea monosperma* (Lam.) Taub.	Leguminosae
188	*Cadaba fruticosa* (L.) Druce	Capparaceae
189	*Caesalpinia bonduc* (L.) Roxb.	Leguminosae
190	*Caesalpinia coriaria* (Jacq.) Willd.	Leguminosae
191	*Caesalpinia cucullata* Roxb.	Leguminosae
192	*Caesalpinia decapetala* (Roth) Alston	Leguminosae
193	*Caesalpinia mimosoides* Lam.	Leguminosae
194	*Caesalpinia pulcherrima* (L.) Sw.	Leguminosae
195	*Cajanus cajan* (L.) Millsp.	Leguminosae
196	*Calamus thwaitesii* Becc.	Arecaceae
197	*Callicarpa tomentosa* (L.) L.	Lamiaceae
198	*Calophyllum calaba* L.	Clusiaceae
199	*Calophyllum inophyllum* L.	Clusiaceae
200	*Calotropis gigantea* (L.) Dryand.	Apocynaceae
201	*Camellia sinensis* (L.) Kuntze	Theaceae
202	*Canarium strictum* Roxb.	Burseraceae
203	*Canna indica* L.	Cannaceae
204	*Canscora diffusa* (Vahl) R.Br. ex Roem. & Schult.	Gentianaceae
205	*Canscora perfoliata* Lam.	Gentianaceae
206	*Canthium angustifolium* Roxb.	Rubiaceae
207	*Canthium coromandelicum* (Burm.f.) Alston	Rubiaceae
208	*Canthium rheedei* DC.	Rubiaceae
209	*Capparis divaricata* Lam.	Capparaceae
210	*Capparis roxburghii* DC.	Capparaceae
211	*Capparis zeylanica* L.	Capparaceae

212	*Capsicum annuum* L.	Solanaceae
213	*Carallia brachiata* (Lour.) Merr.	Rhizophoraceae
214	*Caralluma adscendens* (Roxb.) R.Br.	Apocynaceae
215	*Caralluma indica* (Wight & Arn.) N.E.Br.	Apocynaceae
216	*Caralluma umbellata* Haw.	Apocynaceae
217	*Cardiospermum corindum* L.	Sapindaceae
218	*Cardiospermum halicacabum* L.	Sapindaceae
219	*Careya arborea* Roxb.	Lecythidaceae
220	*Carissa carandas* L.	Apocynaceae
221	*Caryota urens* L.	Arecaceae
222	*Cascabela thevetia* (L.) Lippold	Apocynaceae
223	*Casearia ovata* (Lam.) Willd.	Salicaceae
224	*Casearia tomentosa* Roxb.	Salicaceae
225	*Cassia fistula* L.	Leguminosae
226	*Cassytha filiformis* L.	Lauraceae
227	*Catharanthus pusillus* (Murray) G.Don	Apocynaceae
228	*Catharanthus roseus* (L.) G.Don	Apocynaceae
229	*Cayratia mollissima* (Planch.) Gagnep.	Vitaceae
230	*Cayratia pedata* (Lam.) Gagnep.	Vitaceae
231	*Cayratia trifolia* (L.) Domin	Vitaceae
232	*Ceiba pentandra* (L.) Gaertn.	Malvaceae
233	*Celosia argentea* L.	Amaranthaceae
234	*Celtis philippensis* Blanco	Cannabaceae
235	*Celtis tetrandra* Roxb.	Cannabaceae
236	*Celtis timorensis* Span.	Cannabaceae
237	*Centella asiatica* (L.) Urb.	Apiaceae
238	*Centranthera indica* (L.) Gamble	Orobanchaceae
239	*Centrosema pubescens* Benth.	Leguminosae
240	*Cerastium lanceolatum* (Poir.) Volponi	Caryophyllaceae
241	*Ceropegia beddomei* Hook.f.	Apocynaceae
242	*Ceropegia candelabrum* L.	Apocynaceae
243	*Ceropegia juncea* Roxb.	Apocynaceae
244	*Cestrum nocturnum* L.	Solanaceae
245	*Chamaecrista absus* (L.) H.S.Irwin & Barneby	Leguminosae
246	*Chamaecrista mimosoides* (L.) Greene	Leguminosae
247	*Chassalia curviflora var. ophioxyloides* (Wall.) Deb & B.Krishna	Rubiaceae
248	*Cheilocostus speciosus* (J.Koenig) C.D.Specht	Costaceae
249	*Chionachne gigantea* (J.Koenig) Veldkamp	Poaceae
250	*Chionanthus mala-elengi* (Dennst.) P.S.Green	Oleaceae
215	*Chloris barbata* Sw.	Poaceae
252	*Chlorophytum indicum* (Willd. ex Schult. & Schult.f.) Dress	Asparagaceae
253	*Chonemorpha fragrans* (Moon) Alston	Apocynaceae
254	*Chromolaena odorata* (L.) R.M.King & H.Rob.	Asteraceae

255	*Chrysophyllum cainito* L.	Sapotaceae
256	*Chrysophyllum roxburghii* G.Don	Sapotaceae
257	*Chrysopogon aciculatus* (Retz.) Trin.	Poaceae
258	*Chrysopogon fulvus* (Spreng.) Chiov.	Poaceae
259	*Chukrasia tabularis* A.Juss.	Meliaceae
260	*Cinnamomum camphora* (L.) J.Presl	Lauraceae
261	*Cinnamomum cassia* (L.) J.Presl	Lauraceae
262	*Cinnamomum malabatrum* (Burm.f.) J.Presl	Lauraceae
263	*Cinnamomum sulphuratum* Nees	Lauraceae
264	*Cinnamomum verum* J.Presl	Lauraceae
265	*Cinnamomum wightii* Meisn.	Lauraceae
266	*Circaea alpina* L.	Onagraceae
267	*Cirsium wallichii* DC.	Asteraceae
268	*Cissampelos pareira* L.	Menispermaceae
269	*Cissus javana* DC.	Vitaceae
270	*Cissus latifolia* Lam.	Vitaceae
271	*Cissus quadrangularis* L.	Vitaceae
272	*Cissus repens* Lam.	Vitaceae
273	*Cissus vitiginea* L.	Vitaceae
274	*Citrullus colocynthis* (L.) Schrad.	Cucurbitaceae
275	*Citrullus lanatus* (Thunb.) Matsum. & Nakai	Cucurbitaceae
276	*Citrus limon* (L.) Osbeck	Rutaceae
277	*Citrus medica* L.	Rutaceae
278	*Cleisostoma tenuifolium* (L.) Garay	Orchidaceae
279	*Clematis gouriana* Roxb. ex DC.	Ranunculaceae
280	*Clematis smilacifolia* Wall.	Ranunculaceae
281	*Clematis wightiana* Wall.	Ranunculaceae
282	*Cleome monophylla* L.	Cleomaceae
283	*Cleome rutidosperma var. burmannii* (Wight & Arn.) Siddiqui & S.N.Dixit	Cleomaceae
284	*Cleome viscosa* L.	Cleomaceae
285	*Clerodendrum indicum* (L.) Kuntze	Lamiaceae
286	*Clerodendrum infortunatum* L.	Lamiaceae
287	*Clerodendrum phlomoides* hort. ex DC.	Lamiaceae
288	*Clitoria ternatea* L.	Leguminosae
289	*Coccinia grandis* (L.) Voigt	Cucurbitaceae
290	*Cocculus laurifolius* DC.	Menispermaceae
291	*Cochlospermum religiosum* (L.) Alston	Bixaceae
292	*Cocos nucifera* L.	Arecaceae
293	*Codariocalyx motorius* (Houtt.) H.Ohashi	Leguminosae
294	*Coffea arabica* L.	Rubiaceae
295	*Coix lacryma-jobi* L.	Poaceae
296	*Coldenia procumbens* L.	Boraginaceae

297	*Colebrookea oppositifolia* Sm.	Lamiaceae
298	*Colocasia esculenta* (L.) Schott	Araceae
299	*Combretum indicum* (L.) DeFilipps	Combretaceae
300	*Commelina benghalensis* L.	Commelinaceae
301	*Commelina diffusa* Burm.f.	Commelinaceae
302	*Commiphora berryi* (Arn.) Engl.	Burseraceae
303	*Commiphora caudata* (Wight & Arn.) Engl.	Burseraceae
304	*Connarus monocarpus* L.	Connaraceae
305	*Corallocarpus epigaeus* (Rottler) Hook.f.	Cucurbitaceae
306	*Corchorus aestuans* L.	Malvaceae
307	*Coriandrum sativum* L.	Apiaceae
308	*Corypha umbraculifera* L.	Arecaceae
309	*Coscinium fenestratum* (Goetgh.) Colebr.	Menispermaceae
310	*Cosmostigma cordatum* (Poir.) M.R.Almeida	Apocynaceae
311	*Crassocephalum crepidioides* (Benth.) S.Moore	Asteraceae
312	*Crateva adansonii* DC.	Capparaceae
313	*Crateva religiosa* G.Forst.	Capparaceae
314	*Crinum asiaticum* L.	Amaryllidaceae
315	*Crinum latifolium* L.	Amaryllidaceae
316	*Crossandra infundibuliformis* (L.) Nees	Acanthaceae
317	*Crotalaria albida* Roth	Leguminosae
318	*Crotalaria calycina* Schrank	Leguminosae
319	*Crotalaria juncea* L.	Leguminosae
320	*Crotalaria medicaginea* Lam.	Leguminosae
321	*Crotalaria mysorensis* Roth	Leguminosae
322	*Crotalaria pallida* Aiton	Leguminosae
323	*Crotalaria spectabilis* Roth	Leguminosae
324	*Crotalaria verrucosa* L.	Leguminosae
325	*Croton bonplandianus* Baill.	Euphorbiaceae
326	*Croton caudatus* Geiseler	Euphorbiaceae
327	*Croton malabaricus* Bedd.	Euphorbiaceae
328	*Croton tiglium* L.	Euphorbiaceae
329	*Croton zeylanicus* Müll.Arg.	Euphorbiaceae
330	*Cryptostegia grandiflora* Roxb. ex R.Br.	Apocynaceae
331	*Ctenolepis garcini* (L.) C.B.Clarke	Cucurbitaceae
332	*Cucumis leiospermus* (Wight & Arn.) Ghebret. & Thulin	Cucurbitaceae
333	*Cucumis melo* L.	Cucurbitaceae
334	*Cucumis prophetarum* L.	Cucurbitaceae
335	*Cucumis sativus* L.	Cucurbitaceae
336	*Cucurbita maxima* Duchesne	Cucurbitaceae
337	*Cucurbita pepo* L.	Cucurbitaceae
338	*Cullenia exarillata* A.Robyns	Malvaceae
339	*Curculigo orchioides* Gaertn.	Hypoxidaceae

340	*Curcuma aromatica* Salisb.	Zingiberaceae
341	*Curcuma longa* L.	Zingiberaceae
342	*Curcuma montana* Roxb.	Zingiberaceae
343	*Curcuma zedoaria* (Christm.) Roscoe	Zingiberaceae
344	*Cuscuta chinensis* Lam.	Convolvulaceae
345	*Cuscuta reflexa* Roxb.	Convolvulaceae
346	*Cyanotis axillaris* (L.) D.Don ex Sweet	Commelinaceae
347	*Cyanotis cristata* (L.) D.Don	Commelinaceae
348	*Cyanotis papilionacea* (Burm.f.) Schult. & Schult.f.	Commelinaceae
349	*Cyanthillium albicans* (DC.) H.Rob.	Asteraceae
350	*Cyanthillium cinereum* (L.) H.Rob.	Asteraceae
351	*Cyathula prostrata* (L.) Blume	Amaranthaceae
352	*Cyclea fissicalyx* Dunn	Menispermaceae
353	*Cyclea peltata* (Lam.) Hook.f. & Thomson	Menispermaceae
354	*Cymbidium aloifolium* (L.) Sw.	Orchidaceae
355	*Cymbopogon caesius* (Hook. & Arn.) Stapf	Poaceae
356	*Cymbopogon citratus* (DC.) Stapf	Poaceae
357	*Cymbopogon flexuosus* (Nees ex Steud.) W.Watson	Poaceae
358	*Cynodon dactylon* (L.) Pers.	Poaceae
359	*Cyperus compressus* L.	Cyperaceae
360	*Cyperus diffusus* Vahl	Cyperaceae
361	*Cyperus distans* L.f.	Cyperaceae
362	*Cyperus exaltatus* Retz.	Cyperaceae
363	*Cyperus haspan* L.	Cyperaceae
364	*Cyperus iria* L.	Cyperaceae
365	*Cyperus malaccensis* Lam.	Cyperaceae
366	*Cyperus nutans var. eleusinoides* (Kunth) Haines	Cyperaceae
367	*Cyperus pangorei* Rottb.	Cyperaceae
368	*Cyperus pilosus* Vahl	Cyperaceae
369	*Cyperus rotundus* L.	Cyperaceae
370	*Dalbergia lanceolaria* L.f.	Leguminosae
371	*Dalbergia latifolia* Roxb.	Leguminosae
372	*Dalbergia sissoides* Wight & Arn.	Leguminosae
373	*Dalbergia volubilis* Roxb.	Leguminosae
374	*Daphniphyllum neilgherrense* (Wight) K.Rosenthal	Daphniphyllaceae
375	*Datura metel* L.	Solanaceae
376	*Debregeasia longifolia* (Burm.f.) Wedd.	Urticaceae
377	*Decalepis hamiltonii* Wight & Arn.	Apocynaceae
378	*Delonix regia* (Hook.) Raf.	Leguminosae
379	*Dendrobium nodosum* Dalzell	Orchidaceae
380	*Dendrobium ovatum* (L.) Kraenzl.	Orchidaceae
381	*Dendrocalamus strictus* (Roxb.) Nees	Poaceae
382	*Dendrocnide sinuata* (Blume) Chew	Urticaceae

383	*Dendrolobium triangulare* (Retz.) Schindl.	Leguminosae
384	*Dendrophthoe falcata* (L.f.) Ettingsh.	Loranthaceae
385	*Dentella repens* (L.) J.R.Forst. & G.Forst.	Rubiaceae
386	*Derris scandens* (Roxb.) Benth.	Leguminosae
387	*Desmodium gangeticum* (L.) DC.	Leguminosae
388	*Desmodium heterocarpon var. strigosum* Meeuwen	Leguminosae
389	*Desmodium heterophyllum* (Willd.) DC.	Leguminosae
390	*Desmodium laxiflorum* DC.	Leguminosae
391	*Desmodium microphyllum* (Thunb.) DC.	Leguminosae
392	*Desmodium styracifolium* (Osbeck) Merr.	Leguminosae
393	*Desmodium triflorum* (L.) DC.	Leguminosae
394	*Desmodium velutinum* (Willd.) DC.	Leguminosae
395	*Dichrocephala integrifolia* (L.f.) Kuntze	Asteraceae
396	*Dichrostachys cinerea* (L.) Wight & Arn.	Leguminosae
397	*Dicliptera cuneata* Nees	Acanthaceae
398	*Dicliptera paniculata* (Forssk.) I.Darbysh.	Acanthaceae
399	*Digera muricata* (L.) Mart.	Amaranthaceae
400	*Dillenia pentagyna* Roxb.	Dilleniaceae
401	*Dimocarpus longan* Lour.	Sapindaceae
402	*Diospyros bourdillonii* Brandis	Ebenaceae
403	*Diospyros buxifolia* (Blume) Hiern	Ebenaceae
404	*Diospyros candolleana* Wight	Ebenaceae
405	*Diospyros ebenum* J.Koenig ex Retz.	Ebenaceae
406	*Diospyros malabarica* (Desr.) Kostel.	Ebenaceae
407	*Diospyros melanoxylon* Roxb.	Ebenaceae
408	*Diospyros montana* Roxb.	Ebenaceae
409	*Diospyros paniculata* Dalzell	Ebenaceae
410	*Diospyros sylvatica* Roxb.	Ebenaceae
411	*Diospyros vera* (Lour.) A.Chev.	Ebenaceae
412	*Diploclisia glaucescens* (Blume) Diels	Menispermaceae
413	*Diplocyclos palmatus* (L.) C.Jeffrey	Cucurbitaceae
414	*Dipteracanthus prostratus* (Poir.) Nees	Acanthaceae
415	*Dodonaea viscosa* (L.) Jacq.	Sapindaceae
416	*Dolichandrone arcuata* (Wight) C.B.Clarke	Bignoniaceae
417	*Dolichos trilobus* L.	Leguminosae
418	*Dopatrium junceum* (Roxb.) Buch.-Ham. ex Benth.	Plantaginaceae
419	*Dregea volubilis* (L.f.) Benth. ex Hook.f.	Apocynaceae
420	*Drymaria cordata* (L.) Willd. ex Schult.	Caryophyllaceae
421	*Dysoxylum malabaricum* Bedd. ex C.DC.	Meliaceae
422	*Ecbolium viride* (Forssk.) Alston	Acanthaceae
423	*Echinochloa crus-galli* (L.) P.Beauv.	Poaceae
424	*Echinochloa stagnina* (Retz.) P.Beauv.	Poaceae
425	*Eclipta prostrata* (L.) L.	Asteraceae

426	*Eichhornia crassipes* (Mart.) Solms	Pontederiaceae
427	*Elaeagnus conferta* Roxb.	Elaeagnaceae
428	*Elaeocarpus munroii* Mast.	Elaeocarpaceae
429	*Elaeocarpus serratus* L.	Elaeocarpaceae
430	*Elaeocarpus tuberculatus* Roxb.	Elaeocarpaceae
431	*Elatostema lineolatum* Wight	Urticaceae
432	*Elephantopus scaber* L.	Asteraceae
433	*Elettaria cardamomum* (L.) Maton	Zingiberaceae
434	*Eleusine indica* (L.) Gaertn.	Poaceae
435	*Elytranthe parasitica* (L.) Danser	Loranthaceae
436	*Embelia ribes* Burm.f.	Primulaceae
437	*Emilia sonchifolia* (L.) DC. ex DC.	Asteraceae
438	*Entada rheedii* Spreng.	Leguminosae
439	*Eragrostis gangetica* (Roxb.) Steud.	Poaceae
440	*Eragrostis nutans* (Retz.) Nees ex Steud.	Poaceae
441	*Eragrostis viscosa* (Retz.) Trin.	Poaceae
442	*Erigeron bonariensis* L.	Asteraceae
443	*Erigeron trilobus* (Decne.) Boiss.	Asteraceae
444	*Eriocaulon sexangulare* L.	Eriocaulaceae
445	*Eriolaena hookeriana* Wight & Arn.	Malvaceae
446	*Eriolaena lushingtonii* Dunn	Malvaceae
447	*Eriolaena quinquelocularis* (Wight & Arn.) Wight	Malvaceae
448	*Erycibe paniculata* Roxb.	Convolvulaceae
449	*Erythrina stricta* Roxb.	Leguminosae
450	*Erythrina suberosa* Roxb.	Leguminosae
451	*Erythropalum scandens* Blume	Olacaceae
452	*Eucalyptus camaldulensis* Dehnh.	Myrtaceae
453	*Eucalyptus globulus* Labill.	Myrtaceae
454	*Eucalyptus tereticornis* Sm.	Myrtaceae
455	*Eugenia roxburghii* DC.	Myrtaceae
456	*Eulophia epidendraea* (J.Koenig ex Retz.) C.E.C.Fisch.	Orchidaceae
457	*Eulophia pratensis* Lindl.	Orchidaceae
458	*Eulophia spectabilis* (Dennst.) Suresh	Orchidaceae
459	*Euonymus crenulatus* Wall. ex Wight & Arn.	Celastraceae
460	*Euonymus indicus* B.Heyne ex Wall.	Celastraceae
461	*Euonymus serratifolius* Bedd.	Celastraceae
462	*Euphorbia antiquorum* L.	Euphorbiaceae
463	*Euphorbia hirta* L.	Euphorbiaceae
464	*Euphorbia milii* Des Moul.	Euphorbiaceae
465	*Euphorbia nivulia* Buch.-Ham.	Euphorbiaceae
466	*Euphorbia pulcherrima* Willd. ex Klotzsch	Euphorbiaceae
467	*Euphorbia rosea* Retz.	Euphorbiaceae
468	*Euphorbia rothiana* Spreng.	Euphorbiaceae

469	*Euphorbia thymifolia* L.	Euphorbiaceae
470	*Euphorbia tirucalli* L.	Euphorbiaceae
471	*Euphorbia tortilis* Rottler ex Ainslie	Euphorbiaceae
472	*Eurya nitida* Korth.	Pentaphylacaceae
473	*Evolvulus alsinoides* (L.) L.	Convolvulaceae
474	*Evolvulus nummularius* (L.) L.	Convolvulaceae
475	*Exacum tetragonum* Roxb.	Gentianaceae
476	*Excoecaria agallocha* L.	Euphorbiaceae
477	*Fagraea ceilanica* Thunb.	Gentianaceae
478	*Ficus amplissima* Sm.	Moraceae
479	*Ficus arnottiana* (Miq.) Miq.	Moraceae
480	*Ficus benghalensis* L.	Moraceae
481	*Ficus callosa* Willd.	Moraceae
482	*Ficus dalhousiae* Miq.	Moraceae
483	*Ficus drupacea* Thunb.	Moraceae
484	*Ficus elastica* Roxb. ex Hornem.	Moraceae
485	*Ficus exasperata* Vahl	Moraceae
486	*Ficus hispida* L.f.	Moraceae
487	*Ficus microcarpa* L.f.	Moraceae
488	*Ficus mollis* Vahl	Moraceae
489	*Ficus racemosa* L.	Moraceae
490	*Ficus religiosa* L.	Moraceae
491	*Ficus talbotii* King	Moraceae
492	*Ficus tinctoria* subsp. gibbosa (Blume) Corner	Moraceae
493	*Ficus tsjakela* Burm.f.	Moraceae
494	*Filicium decipiens* (Wight & Arn.) Thwaites	Sapindaceae
495	*Fimbristylis bisumbellata* (Forssk.) Bubani	Cyperaceae
496	*Fimbristylis falcata* (Vahl) Kunth	Cyperaceae
497	*Fimbristylis ovata* (Burm.f.) J.Kern	Cyperaceae
498	*Firmiana colorata* (Roxb.) R.Br.	Malvaceae
499	*Firmiana simplex* (L.) W.Wight	Malvaceae
500	*Flacourtia indica* (Burm.f.) Merr.	Salicaceae
501	*Flemingia grahamiana* Wight & Arn.	Leguminosae
502	*Flemingia macrophylla* (Willd.) Merr.	Leguminosae
503	*Flemingia semialata* Roxb.	Leguminosae
504	*Flemingia strobilifera* (L.) W.T.Aiton	Leguminosae
505	*Flemingia wightiana* Wight & Arn.	Leguminosae
506	*Floscopa scandens* Lour.	Commelinaceae
507	*Galinsoga parviflora* Cav.	Asteraceae
508	*Galium asperifolium* Wall.	Rubiaceae
509	*Garcinia cowa* Roxb. ex Choisy	Clusiaceae
510	*Garcinia gummi-gutta* (L.) Roxb.	Clusiaceae
511	*Garcinia mangostana* L.	Clusiaceae

512	*Garcinia morella* (Gaertn.) Desr.	Clusiaceae
513	*Garcinia spicata* Hook.f.	Clusiaceae
514	*Garcinia wightii* T.Anderson	Clusiaceae
515	*Gardenia gummifera* L.f.	Rubiaceae
516	*Gardenia jasminoides* J.Ellis	Rubiaceae
517	*Gardenia resinifera* Roth	Rubiaceae
518	*Geodorum densiflorum* (Lam.) Schltr.	Orchidaceae
519	*Geophila repens* (L.) I.M.Johnst.	Rubiaceae
520	*Getonia floribunda* Roxb.	Combretaceae
521	*Girardinia diversifolia* (Link) Friis	Urticaceae
522	*Gisekia pharnaceoides* L.	Gisekiaceae
523	*Glinus lotoides* L.	Molluginaceae
524	*Glinus oppositifolius* (L.) Aug.DC.	Molluginaceae
525	*Globba marantina* L.	Zingiberaceae
526	*Gloriosa superba* L.	Colchicaceae
527	*Glycosmis macrocarpa* Wight	Rutaceae
528	*Glycosmis mauritiana* (Lam.) Tanaka	Rutaceae
529	*Glycosmis pentaphylla* (Retz.) DC.	Rutaceae
530	*Gmelina arborea* Roxb.	Lamiaceae
531	*Gmelina asiatica* L.	Lamiaceae
532	*Gomphrena celosioides* Mart.	Amaranthaceae
533	*Gomphrena globosa* L.	Amaranthaceae
534	*Goniothalamus wightii* Hook.f. & Thomson	Annonaceae
535	*Gordonia obtusa* Wall. ex Wight	Theaceae
536	*Gouania microcarpa* DC.	Rhamnaceae
537	*Grangea maderaspatana* (L.) Poir.	Asteraceae
538	*Grevillea robusta* A.Cunn. ex R.Br.	Proteaceae
539	*Grewia laevigata* Vahl	Malvaceae
540	*Grewia villosa* Willd.	Malvaceae
541	*Grewia abutilifolia* Vent. ex Juss.	Malvaceae
542	*Grewia bracteata* Roth	Malvaceae
543	*Grewia heterotricha* Mast.	Malvaceae
544	*Grewia hirsuta* Vahl	Malvaceae
545	*Grewia oppositifolia* Roxb. ex DC.	Malvaceae
546	*Grewia orbiculata* Rottler	Malvaceae
547	*Grewia tiliifolia* Vahl	Malvaceae
548	*Gymnema khandalense* Santapau	Apocynaceae
549	*Gymnema sylvestre* (Retz.) R.Br. ex Sm.	Apocynaceae
550	*Gymnostachyum febrifugum* Benth.	Acanthaceae
551	*Gynura pseudo-china* Benth.	Asteraceae
552	*Habenaria crinifera* Lindl.	Orchidaceae
553	*Habenaria furcifera* Lindl.	Orchidaceae
554	*Habenaria longicorniculata* J.Graham	Orchidaceae

555	*Habenaria plantaginea* Lindl.	Orchidaceae
556	*Habenaria rariflora* A.Rich.	Orchidaceae
557	*Habenaria roxburghii* Nicolson	Orchidaceae
558	*Hackelochloa granularis* (L.) Kuntze	Poaceae
559	*Haldina cordifolia* (Roxb.) Ridsdale	Rubiaceae
560	*Hamelia patens* Jacq.	Rubiaceae
561	*Hardwickia binata* Roxb.	Leguminosae
562	*Harpullia arborea* (Blanco) Radlk.	Sapindaceae
563	*Hedychium coronarium* J.Koenig	Zingiberaceae
564	*Hedyotis articularis* R.Br. ex G.Don	Rubiaceae
565	*Helicteres isora* L.	Malvaceae
566	*Heliotropium indicum* L.	Boraginaceae
567	*Helixanthera wallichiana* Danser	Loranthaceae
568	*Hemidesmus indicus* (L.) R. Br. ex Schult.	Apocynaceae
569	*Heracleum candolleanum* Gamble	Apiaceae
570	*Heracleum rigens* Wall. ex DC.	Apiaceae
571	*Heritiera papilio* Bedd.	Malvaceae
572	*Heteropogon contortus* (L.) P.Beauv. ex Roem. & Schult.	Poaceae
573	*Hewittia malabarica* (L.) Suresh	Convolvulaceae
574	*Heynea trijuga* Roxb. ex Sims	Meliaceae
575	*Hibiscus hispidissimus* Griff.	Malvaceae
576	*Hibiscus lunariifolius* Willd.	Malvaceae
577	*Hibiscus micranthus* L.f.	Malvaceae
578	*Hibiscus mutabilis* L.	Malvaceae
579	*Hibiscus rosa-sinensis* L.	Malvaceae
580	*Hibiscus sabdariffa* L.	Malvaceae
581	*Hibiscus surattensis* L.	Malvaceae
582	*Hiptage benghalensis* (L.) Kurz	Malpighiaceae
583	*Holarrhena pubescens* Wall. ex G.Don	Apocynaceae
584	*Holigarna arnottiana* Hook.f.	Anacardiaceae
585	*Holigarna ferruginea* Marchand	Anacardiaceae
586	*Holigarna grahamii* (Wight) Kurz	Anacardiaceae
587	*Holigarna nigra* Bourd.	Anacardiaceae
588	*Holoptelea integrifolia* Planch.	Ulmaceae
589	*Holostemma ada-kodien* Schult.	Apocynaceae
590	*Hoya wightii* Hook.f.	Apocynaceae
591	*Hoya ovalifolia* Wight & Arn.	Apocynaceae
592	*Humboldtia vahliana* Wight	Leguminosae
593	*Hunteria zeylanica* (Retz.) Gardner ex Thwaites	Apocynaceae
594	*Hybanthus enneaspermus* (L.) F.Muell.	Violaceae
595	*Hydnocarpus alpina* Wight	Achariaceae
596	*Hydnocarpus macrocarpa* Warb.	Achariaceae
597	*Hydnocarpus pentandrus* (Buch.-Ham.) Oken	Achariaceae

598	*Hydrilla verticillata* (L.f.) Royle	Hydrocharitaceae
599	*Hydrocotyle javanica* Thunb.	Araliaceae
600	*Hydrocotyle sibthorpioides* Lam.	Araliaceae
601	*Hydrolea zeylanica* (L.) Vahl	Hydroleaceae
602	*Hygrophila auriculata* (Schumach.) Heine	Acanthaceae
603	*Hygrophila ringens* (L.) R. Br. ex Spreng.	Acanthaceae
604	*Hygrophila ringens var. ringens*	Acanthaceae
605	*Hymenodictyon obovatum* Wall.	Rubiaceae
606	*Hymenodictyon orixense* (Roxb.) Mabb.	Rubiaceae
607	*Hypericum humifusum* L.	Hypericaceae
608	*Hypericum japonicum* Thunb.	Hypericaceae
609	*Hypericum mysurense* Wall. ex Wight & Arn.	Hypericaceae
610	*Hypolytrum nemorum* (Vahl) Spreng.	Cyperaceae
611	*Hypoxis aurea* Lour.	Hypoxidaceae
612	*Hyptis capitata* Jacq.	Lamiaceae
613	*Hyptis suaveolens* (L.) Poit.	Lamiaceae
614	*Ichnocarpus frutescens* (L.) W.T.Aiton	Apocynaceae
615	*Ilex wightiana* Wall. ex Wight	Aquifoliaceae
616	*Ilex denticulata* Wall. ex Wight	Aquifoliaceae
617	*Impatiens balsamina* L.	Balsaminaceae
618	*Indigofera astragalina* DC.	Leguminosae
619	*Indigofera cassioides* DC.	Leguminosae
620	*Indigofera galegoides* DC.	Leguminosae
621	*Indigofera hirsuta* L.	Leguminosae
622	*Indigofera linnaei* Ali	Leguminosae
623	*Indigofera tinctoria* L.	Leguminosae
624	*Ipomoea alba* L.	Convolvulaceae
625	*Ipomoea batatas* (L.) Lam.	Convolvulaceae
626	*Ipomoea cairica* (L.) Sweet	Convolvulaceae
627	*Ipomoea eriocarpa* R. Br.	Convolvulaceae
628	*Ipomoea hederifolia* L.	Convolvulaceae
629	*Ipomoea mauritiana* Jacq.	Convolvulaceae
630	*Ipomoea nil* (L.) Roth	Convolvulaceae
631	*Ipomoea obscura* (L.) Ker Gawl.	Convolvulaceae
632	*Ipomoea pes-tigridis* L.	Convolvulaceae
633	*Ipomoea quamoclit* L.	Convolvulaceae
634	*Ipomoea staphylina* Roem. & Schult.	Convolvulaceae
635	Ipomoea turbinata Lag.	Convolvulaceae
636	*Isachne globosa* (Thunb.) Kuntze	Poaceae
637	*Isodon nilgherricus* (Benth.) H.Hara	Lamiaceae
638	*Ixora coccinea* L.	Rubiaceae
639	*Ixora cuneifolia* Roxb.	Rubiaceae
640	*Ixora nigricans* R.Br. ex Wight & Arn.	Rubiaceae

641	*Ixora notoniana* Wall. ex G.Don	Rubiaceae
642	*Ixora pavetta* Andr.	Rubiaceae
643	*Jasminum angustifolium* (L.) Willd.	Oleaceae
644	*Jasminum auriculatum* Vahl	Oleaceae
645	*Jasminum azoricum* L.	Oleaceae
646	*Jasminum bignoniaceum* Wall. & G.Don	Oleaceae
647	*Jasminum calophyllum* Wall. & G.Don	Oleaceae
648	*Jasminum cuspidatum* Rottl. & Willd.	Oleaceae
649	*Jasminum grandiflorum* L.	Oleaceae
650	*Jasminum multiflorum* (Burm.f.) Andrews	Oleaceae
651	*Jasminum sambac* (L.) Aiton	Oleaceae
652	*Jasminum trichotomum* B.Heyne ex Roth	Oleaceae
653	*Justicia adhatoda* L.	Acanthaceae
654	*Justicia betonica* L.	Acanthaceae
655	*Justicia gendarussa* Burm.f.	Acanthaceae
656	*Justicia procumbens* L.	Acanthaceae
657	*Justicia prostrata* Gamble	Acanthaceae
658	*Justicia tranquebariensis* L.f.	Acanthaceae
659	*Kaempferia galanga* L.	Zingiberaceae
660	*Kamettia caryophyllata* (Roxb.) Nicolson & Suresh	Apocynaceae
661	*Kleinia grandiflora* (wallich ex DC.) N.Rani	Asteraceae
662	*Knoxia sumatrensis* (Retz.) DC.	Rubiaceae
663	*Kopsia fruticosa* (Roxb.) A.DC.	Apocynaceae
664	*Kyllinga squamulata* Vahl	Cyperaceae
665	*Kyllinga brevifolia* Rottb.	Cyperaceae
666	*Kyllinga nemoralis* (J.R.Forst. & G.Forst.) Dandy ex Hutch. & Dalziel	Cyperaceae
667	*Lablab purpureus* (L.) Sweet	Leguminosae
668	*Lagenandra ovata* (L.) Thwaites	Araceae
669	*Lagenandra toxicaria* Dalzell	Araceae
670	*Lagenaria siceraria* (Molina) Standl.	Cucurbitaceae
671	*Lagerstroemia indica* L.	Lythraceae
672	*Lagerstroemia microcarpa* Wight	Lythraceae
673	*Lagerstroemia speciosa* (L.) Pers.	Lythraceae
674	*Laggera crispata* (Vahl) Hepper & J.R.I.Wood	Asteraceae
675	*Lannea coromandelica* (Houtt.) Merr.	Anacardiaceae
676	*Lantana camara* L.	Verbenaceae
677	*Laportea interrupta* (L.) Chew	Urticaceae
678	*Launaea acaulis* (Roxb.) Babc. ex Kerr	Asteraceae
679	*Lawsonia inermis* L.	Lythraceae
680	*Leea guineensis* G. Don	Vitaceae
681	*Leea indica* (Burm. f.) Merr.	Vitaceae
682	*Leea macrophylla* Roxb. ex Hornem.	Vitaceae

683	*Leonotis nepetifolia* (L.) R.Br.	Lamiaceae
684	*Lepidagathis incurva* Buch.-Ham. ex D. Don	Acanthaceae
685	*Lepidagathis scariosa* Nees	Acanthaceae
686	*Lepidium didymum* L.	Brassicaceae
687	*Leptadenia reticulata* (Retz.) Wight & Arn.	Apocynaceae
688	*Leucas decemdentata* (Willd.) Sm.	Lamiaceae
689	*Leucas lavandulaefolia* Rees	Lamiaceae
690	*Leucas martinicensis* (Jacq.) R.Br.	Lamiaceae
691	*Leucas urticifolia* (Vahl) Sm.	Lamiaceae
692	*Leucas zeylanica* (L.) W.T.Aiton	Lamiaceae
693	*Ligustrum perrottetii* A.DC.	Oleaceae
694	*Ligustrum robustum* (Roxb.) Blume	Oleaceae
695	*Limnophila aromatica* (Lam.) Merr.	Plantaginaceae
696	*Limnophila indica* (L.) Druce	Plantaginaceae
697	*Limonia acidissima* Groff	Rutaceae
698	*Lindernia anagallis* (Burm.f.) Pennell	Linderniaceae
699	*Lindernia antipoda* (L.) Alston	Linderniaceae
700	*Lindernia caespitosa* (Blume) Panigrahi	Linderniaceae
701	*Lindernia ciliata* (Colsm.) Pennell	Linderniaceae
702	*Lindernia crustacea* (L.) F.Muell.	Linderniaceae
703	*Lindernia hyssopoides* (L.) Haines	Linderniaceae
704	*Lindernia oppositifolia* (L.) Mukerjee	Linderniaceae
705	*Lindernia rotundifolia* (L.) Alston	Linderniaceae
706	*Lindernia ruellioides* (Colsm.) Pennell	Linderniaceae
707	*Lipocarpha squarrosa* (L.) Goetgh.	Cyperaceae
708	*Lippia javanica* (Burm.f.) Spreng.	Verbenaceae
709	*Litchi chinensis* Sonn.	Sapindaceae
710	*Litsea coriacea* Hook.f.	Lauraceae
711	*Litsea quinqueflora* (Dennst.) Suresh	Lauraceae
712	*Litsea stocksii* Hook.f.	Lauraceae
713	*Lobelia nicotianifolia* Roth ex Schult.	Campanulaceae
714	*Lobelia alsinoides* Lam.	Campanulaceae
715	*Lobelia leschenaultiana* (C.Presl) Skottsb.	Campanulaceae
716	*Loeseneriella obtusifolia* (Roxb.) A.C.Sm.	Celastraceae
717	*Lolium temulentum* L.	Poaceae
718	*Luffa acutangula* (L.) Roxb.	Cucurbitaceae
719	*Luffa cylindrica* (L.) M.Roem.	Cucurbitaceae
720	*Lycianthes laevis* (Dunal) Bitter	Solanaceae
721	*Lycianthes denticulata* (Blume) Bitter	Solanaceae
722	*Lycopersicon esculentum* Mill.	Solanaceae
723	*Madhuca longifolia* (J.Koenig ex L.) J.F.Macbr. i	Sapotaceae
724	*Madhuca neriifolia* (Moon) H.J.Lam	Sapotaceae
725	*Maesa indica* (Roxb.) A. DC.	Primulaceae

726	*Magnolia champaca* (L.) Baill. ex Pierre	Magnoliaceae
727	*Magnolia nilagirica* (Zenker) Figlar	Magnoliaceae
728	*Malvastrum coromandelianum* (L.) Garcke	Malvaceae
729	*Mangifera indica* L.	Anacardiaceae
730	*Manilkara hexandra* (Roxb.) Dubard	Sapotaceae
731	*Manilkara zapota* (L.) P.Royen	Sapotaceae
732	*Marsdenia tirunelvelica* A.N.Henry & Subr.	Apocynaceae
733	*Mastixia arborea* (Wight) C.B.Clarke	Cornaceae
734	*Mazus pumilus* (Burm.f.) Steenis	Phrymaceae
735	*Melastoma malabathricum* L.	Melastomataceae
736	*Melia azedarach* L.	Meliaceae
737	*Meliosma simplicifolia* (Roxb.) Walp.	Sabiaceae
738	*Melochia corchorifolia* L.	Malvaceae
739	*Memecylon angustifolium* Wight	Melastomataceae
740	*Memecylon talbotianum* Brandis	Melastomataceae
741	*Memecylon umbellatum* Burm. f.	Melastomataceae
742	*Merremia hederacea* (Burm. f.) Hallier f.	Convolvulaceae
743	*Merremia tridentata* (L.) Hallier f.	Convolvulaceae
744	*Merremia umbellata* (L.) Hallier f.	Convolvulaceae
745	*Merremia vitifolia* (Burm. f.) Hallier f.	Convolvulaceae
746	*Mesua ferrea* L.	Calophyllaceae
747	*Micromeria biflora* (Buch.-Ham. ex D.Don) Benth.	Lamiaceae
748	*Microstegium ciliatum* (Trin.) A.Camus	Poaceae
749	*Mikania micrantha* Kunth	Asteraceae
750	*Miliusa tomentosa* (Roxb.) J.Sinclair	Annonaceae
751	*Millingtonia hortensis* L.f.	Bignoniaceae
752	*Mimosa pudica var. unijuga* (Duchass. & Walp.) Griseb.	Leguminosae
753	*Mimusops elengi* L.	Sapotaceae
754	*Mirabilis jalapa* L.	Nyctaginaceae
755	*Mitracarpus hirtus* (L.) DC.	Rubiaceae
756	*Mitragyna parvifolia* (Roxb.) Korth.	Rubiaceae
757	*Mollugo nudicaulis* Lam.	Molluginaceae
758	*Mollugo pentaphylla* L.	Molluginaceae
759	*Momordica charantia* L.	Cucurbitaceae
760	*Momordica dioica* Roxb. ex Willd.	Cucurbitaceae
761	*Monochoria vaginalis* (Burm.f.) C.Presl	Pontederiaceae
762	*Morinda pubescens* Sm.	Rubiaceae
763	*Morinda umbellata* L.	Rubiaceae
764	*Moringa pterygosperma* Gaertn.	Moringaceae
765	*Morus alba* L.	Moraceae
766	*Mucuna monosperma* Wight	Leguminosae
767	*Mucuna pruriens* (L.) DC.	Leguminosae
768	*Mukia maderaspatana* (L.) M.Roem.	Cucurbitaceae

769	*Mundulea sericea* (Willd.) A.Chev.	Leguminosae
770	*Munronia pinnata* (Wall.) W.Theob.	Meliaceae
771	*Murdannia japonica* (Thunb.) Faden	Commelinaceae
772	*Murdannia nudiflora* (L.) Brenan	Commelinaceae
773	*Murraya koenigii* (L.) Spreng.	Rutaceae
774	*Murraya paniculata* (L.) Jack	Rutaceae
775	*Musa paradisiaca* L.	Musaceae
776	*Mussaenda frondosa* L.	Rubiaceae
777	*Myristica fragrans* Houtt.	Myristicaceae
778	*Myristica malabarica* Lam.	Myristicaceae
779	*Myxopyrum smilacifolium* (Wall.) Blume	Oleaceae
780	*Naravelia zeylanica* (L.) DC.	Ranunculaceae
781	*Naregamia alata* Wight & Arn.	Meliaceae
782	*Naringi crenulata* (Roxb.) Nicolson	Rutaceae
783	*Neolamarckia cadamba* (Roxb.) Bosser	Rubiaceae
784	*Neolitsea scrobiculata* Gamble	Lauraceae
785	*Nerium oleander* L.	Apocynaceae
786	*Nervilia plicata* (Andrews) Schltr.	Orchidaceae
787	*Nicandra physalodes* (L.) Gaertn.	Solanaceae
788	*Nicotiana tabacum* L.	Solanaceae
789	*Nilgirianthus wightianus* (Nees) Bremek.	Acanthaceae
790	*Nothopegia colebrookiana* (Wight) Blume	Anacardiaceae
791	*Nothosaerva brachiata* (L.) Wight	Amaranthaceae
792	*Nymphoides hydrophylla* (Lour.) Kuntze	Menyanthaceae
793	*Nymphoides indica* (L.) Kuntze	Menyanthaceae
794	*Ocimum americanum* L.	Lamiaceae
795	*Ocimum basilicum* L.	Lamiaceae
796	*Ocimum gratissimum* L.	Lamiaceae
797	*Ocimum tenuiflorum* L.	Lamiaceae
798	*Oldenlandia auricularia* (L.) K.Schum.	Rubiaceae
799	*Oldenlandia brachypoda* DC.	Rubiaceae
800	*Oldenlandia corymbosa* L.	Rubiaceae
801	*Oldenlandia diffusa* (Willd.) Roxb.	Rubiaceae
802	*Oldenlandia herbacea* (L.) Roxb.	Rubiaceae
803	*Oldenlandia umbellata* L.	Rubiaceae
804	*Olea dioica* Roxb.	Oleaceae
805	*Ophiopogon intermedius* D.Don	Asparagaceae
806	*Ophiorrhiza mungos* L.	Rubiaceae
807	*Opuntia elatior* Mill.	Cactaceae
808	*Opuntia ficus-indica* (L.) Mill.	Cactaceae
809	*Opuntia stricta* (Haw.) Haw.	Cactaceae
810	*Oreocnide integrifolia* (Gaudich.) Miq.	Urticaceae
811	*Ormocarpum cochinchinense* (Lour.) Merr.	Leguminosae

812	*Ormosia travancorica* Bedd.	Leguminosae
813	*Oroxylum indicum* (L.) Kurz	Bignoniaceae
814	*Orthosiphon aristatus* (Blume) Miq.	Lamiaceae
815	*Orthosiphon thymiflorus* (Roth) Sleesen	Lamiaceae
816	*Oryza rufipogon* Griff.	Poaceae
817	*Oryza sativa* L.	Poaceae
818	*Osbeckia aspera* Blume	Melastomataceae
819	*Osbeckia zeylanica* Steud. ex Naudin	Melastomataceae
820	*Osyris lanceolata* Hochst. & Steud.	Santalaceae
821	*Oxalis corniculata* L.	Oxalidaceae
822	*Pajanelia longifolia* (Willd.) K.Schum.	Bignoniaceae
823	*Palaquium ellipticum* (Dalzell) Baill.	Sapotaceae
824	*Pancratium triflorum* Roxb.	Amaryllidaceae
825	*Pandanus thwaitesii* Martelli	Pandanaceae
826	*Panicum antidotale* Retz.	Poaceae
827	*Panicum maximum* Jacq.	Poaceae
828	*Panicum repens* L.	Poaceae
829	*Panicum sumatrense* Roth	Poaceae
830	*Paracalyx scariosus* (Roxb.) Ali	Leguminosae
831	*Paramignya monophylla* Wight	Rutaceae
832	*Parkinsonia aculeata* L.	Leguminosae
833	*Parochetus communis* D.Don	Leguminosae
834	*Parthenium hysterophorus* L.	Asteraceae
835	*Paspalum distichum* L.	Poaceae
836	*Paspalum scrobiculatum* L.	Poaceae
837	*Passiflora edulis* Sims	Passifloraceae
838	*Passiflora foetida* L.	Passifloraceae
839	*Pavetta tomentosa* Roxb. ex Sm.	Rubiaceae
840	*Pedalium murex* L.	Pedaliaceae
841	*Peltophorum pterocarpum* (DC.) K.Heyne	Leguminosae
842	*Pentanema indicum* (L.) Ling	Asteraceae
843	*Peperomia pellucida* (L.) Kunth	Piperaceae
844	*Peperomia tetraphylla* (G.Forst.) Hook. & Arn.	Piperaceae
845	*Pergularia daemia* (Forssk.) Chiov.	Apocynaceae
846	*Perotis indica* (L.) Kuntze	Poaceae
847	*Persea macrantha* (Nees) Kosterm.	Lauraceae
848	*Petrea volubilis* L.	Verbenaceae
849	*Phaulopsis imbricata* (Forssk.) Sweet	Acanthaceae
850	*Phoebe wightii* Meisn.	Lauraceae
851	*Phoenix loureiroi* Kunth	Arecaceae
852	*Pholidota imbricat*a Lindl.	Orchidaceae
853	*Phragmites karka* (Retz.) Trin. ex Steud.	Poaceae
854	*Physalis angulata* L.	Solanaceae

855	*Physalis peruviana* L.	Solanaceae
856	*Pilea microphylla* (L.) Liebm.	Urticaceae
857	*Pimpinella heyneana* (DC.) Benth.	Apiaceae
858	*Pimpinella pulneyensis* Gamble	Apiaceae
859	*Piper argyrophyllum* Miq.	Piperaceae
860	*Piper barberi* Gamble	Piperaceae
861	*Piper betle* L.	Piperaceae
862	*Piper longum* L.	Piperaceae
863	*Piper mullesua* Buch.-Ham. ex D. Don	Piperaceae
864	*Piper nigrum* L.	Piperaceae
865	*Piper trichostachyon* (Miq.) C. DC.	Piperaceae
866	*Piper umbellatum* L.	Piperaceae
867	*Pisonia aculeata* L.	Nyctaginaceae
868	*Pistia stratiotes* L.	Araceae
869	*Pittosporum napaulense* (DC.) Rehder & E.H. Wilson	Pittosporaceae
870	*Pittosporum neelgherrense* Wight & Arn.	Pittosporaceae
871	*Pittosporum tetraspermum* Wight & Arn.	Pittosporaceae
872	*Platostoma hispidum* (L.) A.J.Paton	Lamiaceae
873	*Pleiospermium alatum* (Wight & Arn.) Swingle	Rutaceae
874	*Pleurostylia opposita* (Wall.) Alston	Celastraceae
875	*Plumbago indica* L.	Plumbaginaceae
876	*Plumbago zeylanica* L.	Plumbaginaceae
877	*Plumeria alba* L.	Apocynaceae
878	*Plumeria rubra* L.	Apocynaceae
879	*Poeciloneuron indicum* Bedd.	Calophyllaceae
880	*Pogonatherum crinitum* (Thunb.) Kunth	Poaceae
881	*Pogostemon auricularius* (L.) Hassk.	Lamiaceae
882	*Pogostemon benghalensis* (Burm.f.) Kuntze	Lamiaceae
883	*Pogostemon heyneanus* Benth.	Lamiaceae
884	*Pogostemon paniculatus* (Willd.) Benth.	Lamiaceae
885	*Pogostemon pubescens* Benth.	Lamiaceae
886	*Pogostemon purpurascens* Dalzell	Lamiaceae
887	*Polyalthia cerasoides* (Roxb.) Bedd.	Annonaceae
888	*Polyalthia coffeoides* (Thwaites) Hook.f. & Thomson	Annonaceae
889	*Polyalthia fragrans* (Dalzell) Benth. & Hook. f.	Annonaceae
890	*Polyalthia longifolia* (Sonn.) Thwaites	Annonaceae
891	*Polycarpaea corymbosa* (L.) Lam.	Caryophyllaceae
892	*Polycarpon prostratum* (Forssk.) Asch. & Schweinf.	Caryophyllaceae
893	*Polygala arvensis* Willd.	Polygalaceae
894	*Polygala chinensis* L.	Polygalaceae
895	*Polygala elongata* Klein ex Willd.	Polygalaceae
896	*Polygala sphenoptera* Fresen.	Polygalaceae
897	*Polygonum plebeium* R.Br.	Polygalaceae

898	*Pongamia pinnata* (L.) Pierre	Leguminosae
899	*Portulaca grandiflora* Hook.	Portulacaceae
900	*Portulaca oleracea* L.	Portulacaceae
901	*Portulaca pilosa* L.	Portulacaceae
902	*Portulaca quadrifida* L.	Portulacaceae
903	*Pothos scandens* L.	Araceae
904	*Pouzolzia bennettiana* Wight	Urticaceae
905	*Pouzolzia zeylanica* (L.) Benn.	Urticaceae
906	*Premna coriacea* C.B.Clarke	Lamiaceae
907	*Premna herbacea* Roxb.	Lamiaceae
908	*Premna mollissima* Roth	Lamiaceae
909	*Premna serratifolia* L.	Lamiaceae
910	*Premna tomentosa* Willd.	Lamiaceae
911	*Priva cordifolia* (L.f.) Druce	Verbenaceae
912	*Prunus ceylanica* (Wight) Miq.	Rosaceae
913	*Prunus persica* (L.) Batsch	Rosaceae
914	*Pseudarthria viscida* (L.) Wight & Arn.	Leguminosae
915	*Psidium guajava* L.	Myrtaceae
916	*Psychotria glandulosa* (Dennst.) Suresh	Rubiaceae
917	*Pterocarpus marsupium* Roxb.	Leguminosae
918	*Pterolobium hexapetalum* (Roth) Santapau & Wagh	Leguminosae
919	*Pterospermum diversifolium* Blume	Malvaceae
920	*Pterospermum rubiginosum* B.Heyne ex Wall.	Malvaceae
921	*Pueraria phaseoloides* (Roxb.) Benth.	Leguminosae
922	*Pueraria tuberosa* (Willd.) DC.	Leguminosae
923	*Punica granatum* L.	Lythraceae
924	*Pupalia lappacea* (L.) Juss.	Amaranthaceae
925	*Putranjiva roxburghii* Wall.	Putranjivaceae
926	*Pycnospora lutescens* (Poir.) Schindl.	Leguminosae
927	*Radermachera xylocarpa* (Roxb.) Roxb. ex K.Schum.	Bignoniaceae
928	*Rauvolfia micrantha* Hook.f.	Apocynaceae
929	*Rauvolfia serpentina* (L.) Benth. ex Kurz	Apocynaceae
930	*Rauvolfia tetraphylla* L.	Apocynaceae
931	*Reissantia indica* (Willd.) N.Hallé	Celastraceae
932	*Remusatia vivipara* (Roxb.) Schott	Araceae
933	*Rhaphidophora pertusa* (Roxb.) Schott	Araceae
934	*Rhinacanthus nasutus* (L.) Kurz	Acanthaceae
935	*Rhododendron arboreum* Sm.	Ericaceae
936	*Rhodomyrtus tomentosa* (Aiton) Hassk.	Myrtaceae
937	*Rhynchostylis retusa* (L.) Blume	Orchidaceae
938	*Richardia scabra* L.	Rubiaceae
939	*Rivea ornata* Choisy	Convolvulaceae
940	*Rotala indica* (Willd.) Koehne	Lythraceae

941	*Rotheca serrata* (L.) Steane & Mabb.	Lamiaceae
942	*Rothia indica* (L.) Druce	Leguminosae
943	*Rotula aquatica* Lour.	Boraginaceae
944	*Rourea minor* (Gaertn.) Alston	Connaraceae
945	*Rubia cordifolia* L.	Rubiaceae
946	*Rubus ellipticus* Sm.	Rubiaceae
947	*Rubus niveus* Thunb.	Rosaceae
948	*Rubus rugosus* Sm.	Rosaceae
949	*Ruellia patula* Jacq.	Acanthaceae
950	*Rumex nepalensis* Spreng.	Polygonaceae
951	*Rungia pectinata* (L.) Nees	Acanthaceae
952	*Saccharum officinarum* L.	Poaceae
953	*Saccharum spontaneum* L.	Poaceae
954	*Sacciolepis indica* (L.) Chase	Poaceae
955	*Sacciolepis interrupta* (Willd.) Stapf	Poaceae
956	*Sagina saginoides* (L.) H.Karst.	Caryophyllaceae
957	*Salacia fruticosa* Wall.	Celastraceae
958	*Salacia macrosperma* Wight	Celastraceae
959	*Salacia oblonga* Wall.	Celastraceae
960	*Salvia officinalis* L.	Lamiaceae
961	*Santalum album* L.	Santalaceae
962	*Sapindus emarginatus* Vahl	Sapindaceae
963	*Sapindus trifoliatus* L.	Sapindaceae
964	*Saraca asoca* (Roxb.) Willd.	Leguminosae
965	*Sarcostemma acidum* (Roxb.) Voigt	Apocynaceae
966	*Sarcostemma viminale subsp. brunonianum* (Wight & Arn.) P.I. Forst.	Apocynaceae
967	*Satyrium nepalense* D.Don	Orchidaceae
968	*Schefflera stellata* (Gaertn.) Baill.	Araliaceae
969	*Schefflera venulosa* (Wight & Arn.) Harms	Araliaceae
970	*Schleichera oleosa* (Lour.) Merr.	Sapindaceae
971	*Scleria levis* Retz.	Cyperaceae
972	*Scleria lithosperma* (L.) Sw.	Cyperaceae
973	*Scleria terrestris* (L.) Fassett	Cyperaceae
974	*Scleropyrum pentandrum* (Dennst.) Mabb.	Santalaceae
975	*Scolopia crenata* Clos	Salicaceae
976	*Scoparia dulcis* L.	Plantaginaceae
977	*Scurrula parasitica* L.	Loranthaceae
978	Secamone emetica (Retz.) R. Br. ex Schult.	Apocynaceae
979	*Semecarpus travancorica* Bedd.	Anacardiaceae
980	*Senna hirsuta* (L.) H.S.Irwin & Barneby	Leguminosae
981	*Senna occidentalis* (L.) Link	Leguminosae
982	*Senna siamea* (Lam.) H.S.Irwin & Barneby	Leguminosae

983	*Senna tora* (L.) Roxb.	Leguminosae
984	*Sesamum indicum* L.	Pedaliaceae
985	*Sesbania grandiflora* (L.) Pers.	Leguminosae
986	*Setaria verticillata* (L.) P.Beauv.	Poaceae
987	*Sigesbeckia orientalis* L.	Asteraceae
988	*Smilax aspera* L.	Smilacaceae
989	*Smilax perfoliata* Lour.	Smilacaceae
990	*Smilax wightii* A.DC.	Smilacaceae
991	*Smilax zeylanica* L.	Smilacaceae
992	*Solanum americanum* Mill.	Solanaceae
993	*Solanum capsicoides* All.	Solanaceae
994	*Solanum erianthum* D. Don	Solanaceae
995	*Solanum giganteum* Jacq.	Solanaceae
996	*Solanum lasiocarpum* Dunal	Solanaceae
997	*Solanum melongena* L.	Solanaceae
998	*Solanum pubescens* Willd.	Solanaceae
999	*Solanum seaforthianum* Andrews	Solanaceae
1000	*Solanum sisymbriifolium* Lam.	Solanaceae
1001	*Solanum torvum* Sw.	Solanaceae
1002	*Solanum trilobatum* L.	Solanaceae
1003	*Solanum violaceum* Ortega	Solanaceae
1004	*Solena amplexicaulis* (Lam.) Gandhi	Cucurbitaceae
1005	*Sonchus oleraceus* (L.) L.	Asteraceae
1006	*Sonchus wightianus* DC.	Asteraceae
1007	*Sonerila rheedei* Wall.	Melastomataceae
1008	*Sopubia delphinifolia* G.Don	Orobanchaceae
1009	*Sorghum bicolor* (L.) Moench	Poaceae
1010	*Sorghum halepense* (L.) Pers.	Poaceae
1011	*Spatholobus parviflorus* (DC.) Kuntze	Leguminosae
1012	*Spergula arvensis* L.	Caryophyllaceae
1013	*Spermacoce articularis* L.f.	Rubiaceae
1014	*Sphaeranthus indicus* L.	Asteraceae
1015	*Sphagneticola calendulacea* (L.) Prusk	Asteraceae
1016	*Sphenoclea zeylanica* Gaertn.	Sphenocleaceae
1017	*Spondias pinnata* (L. f.) Kurz	Anacardiaceae
1018	*Stachytarpheta jamaicensis* (L.) Vahl	Verbenaceae
1019	*Stachytarpheta urticifolia* (Salisb.) Sims	Verbenaceae
1020	*Stellaria media* (L.) Vill.	Caryophyllaceae
1021	*Stephania japonica* (Thunb.) Miers	Menispermaceae
1022	*Stephania wightii* Dunn	Menispermaceae
1023	*Sterculia foetida* L.	Malvaceae
1024	*Sterculia guttata* Roxb. ex G.Don	Malvaceae
1025	*Sterculia villosa* Roxb.	Malvaceae

1026	*Stictocardia tiliifolia* (Desr.) Hallier f.	Convolvulaceae
1027	*Striga asiatica* (L.) Kuntze	Orobanchaceae
1028	*Striga gesnerioides* (Willd.) Vatke	Orobanchaceae
1029	*Strobilanthes ciliata* Nees	Acanthaceae
1030	*Strobilanthes consanguineus* Clarke	Acanthaceae
1031	*Strobilanthes heyneanus* Nees	Acanthaceae
1032	*Strychnos potatorum* L.f.	Loganiaceae
1033	*Stylosanthes fruticosa* (Retz.) Alston	Leguminosae
1034	*Swertia corymbosa* Wight ex Griseb.	Gentianaceae
1035	*Swertia minor* Knobl.	Gentianaceae
1036	*Swietenia macrophylla* King	Meliaceae
1037	*Swietenia mahogani* L.	Meliaceae
1038	*Symplocos cochinchinensis var. laurina* (Retz.) Noot.	Symplocaceae
1039	*Symplocos monantha* Wight	Symplocaceae
1040	*Symplocos racemosa* Roxb.	Symplocaceae
1041	*Synedrella nodiflora* (L.) Gaertn.	Asteraceae
1042	*Syzygium aromaticum* (L.) Merr. & L.M.Perry	Myrtaceae
1043	*Syzygium caryophyllatum* (L.) Alston	Myrtaceae
1044	*Syzygium cumini* (L.) Skeels	Myrtaceae
1045	*Syzygium hemisphericum* (Wight) Alston	Myrtaceae
1046	*Syzygium jambos* (L.) Alston	Myrtaceae
1047	*Syzygium salicifolium* (Wight) J.Graham	Myrtaceae
1048	*Tabernaemontana alternifolia* L.	Apocynaceae
1049	*Tabernaemontana divaricata* (L.) R.Br. ex Roem. & Schult.	Apocynaceae
1050	*Tadehagi triquetrum* (L.) H.Ohashi	Leguminosae
1051	*Tamarindus indica* L.	Leguminosae
1052	*Tarenna asiatica* (L.) Kuntze ex K.Schum.	Rubiaceae
1053	*Taxillus tomentosus* Tiegh.	Loranthaceae
1054	*Tecoma stans* (L.) Juss. ex Kunth	Bignoniaceae
1055	*Tectona grandis* L.f.	Lamiaceae
1056	*Tephrosia candida* (Roxb.) DC.	Leguminosae
1057	*Tephrosia purpurea* (L.) Pers.	Leguminosae
1058	*Tephrosia tinctoria* Pers.	Leguminosae
1059	*Tephrosia villosa* (L.) Pers.	Leguminosae
1060	*Teramnus labialis* (L.f.) Spreng.	Leguminosae
1061	*Terminalia paniculata* Roth	Combretaceae
1062	*Terminalia travancorensis* Wight & Arn.	Combretaceae
1063	*Terminalia bellirica* (Gaertn.) Roxb.	Combretaceae
1064	*Terminalia catappa* L.	Combretaceae
1065	*Terminalia chebula* Retz.	Combretaceae
1066	*Tetracera akara* Merr.	Dilleniaceae
1067	*Tetrameles nudiflora* R. Br.	Tetramelaceae
1068	*Tetrastigma leucostaphylum* (Dennst.) Alston	Vitaceae

1069	*Themeda triandra* Forssk.	Poaceae
1070	*Theriophonum infaustum* N.E.Br.	Araceae
1071	*Thottea siliquosa* (Lam.) Ding Hou	Aristolochiaceae
1072	*Thunbergia alata* Bojer ex Sims	Acanthaceae
1073	*Thunbergia fragrans* Roxb.	Acanthaceae
1074	*Thunbergia grandiflora* (Roxb. ex Rottl.) Roxb.	Acanthaceae
1075	*Tiliacora racemosa* Colebr.	Menispermaceae
1076	*Tinospora sinensis* (Lour.) Merr.	Menispermaceae
1077	*Tithonia diversifolia* (Hemsl.) A.Gray	Asteraceae
1078	*Toddalia asiatica* (L.) Lam.	Rutaceae
1079	*Toona ciliata* M.Roem.	Meliaceae
1080	*Torenia bicolor* Dalzell	Linderniaceae
1081	*Torenia travancorica* Gamble	Linderniaceae
1082	*Trema orientalis* (L.) Blume	Cannabaceae
1083	*Trichodesma indicum* (L.) Lehm.	Boraginaceae
1084	*Trichodesma zeylanicum* (Burm.f.) R.Br.	Boraginaceae
1085	*Trichopodium zeylanicum* (Gaertn.) Thwaites	Leguminosae
1086	*Trichosanthes anaimalaiensis* Bedd.	Cucurbitaceae
1087	*Trichosanthes cucumerina* L.	Cucurbitaceae
1088	*Trichosanthes lobata* Roxb.	Cucurbitaceae
1089	*Trichosanthes nervifolia* L.	Cucurbitaceae
1090	*Trichosanthes tricuspidata* Lour.	Cucurbitaceae
1091	*Tridax procumbens* (L.) L.	Asteraceae
1092	*Triumfetta annua* L.	Malvaceae
1093	*Triumfetta rhomboidea* Jacq.	Malvaceae
1094	*Turpinia cochinchinensis* (Lour.) Merr.	Staphyleaceae
1095	*Turraea pubescens* Hell.	Meliaceae
1096	*Tylophora fasciculata* Buch.-Ham. ex Wight	Apocynaceae
1097	*Tylophora flexuosa* R. Br.	Apocynaceae
1098	*Tylophora indica* (Burm. f.) Merr.	Apocynaceae
1099	*Typha domingensis* Pers.	Typhaceae
1100	*Uraria rufescens* (DC.) Schindl.	Leguminosae
1101	*Utricularia reticulata* Sm.	Lentibulariaceae
1102	*Uvaria hookeri* King	Annonaceae
1103	*Uvaria narum* (Dunal) Blume	Annonaceae
1104	*Vanda tessellata* (Roxb.) Hook. ex G.Don	Orchidaceae
1105	*Vanda testacea* (Lindl.) Rchb.f.	Orchidaceae
1106	*Ventilago maderaspatana* Gaertn.	Rhamnaceae
1107	*Vepris bilocularis* Engl.	Rutaceae
1108	*Vernonia arborea* Buch.-Ham.	Asteraceae
1109	*Vigna grahamiana* (Wight & Arn.) Verdc.	Leguminosae
1110	*Vigna mungo* (L.) Hepper	Leguminosae
1111	*Vigna radiata* (L.) R.Wilczek	Leguminosae

1112	*Vigna trilobata* (L.) Verdc.	Leguminosae
1113	*Vigna umbellata* (Thunb.) Ohwi & H.Ohashi	Leguminosae
1114	*Vigna unguiculata* (L.) Walp.	Leguminosae
1115	*Vigna vexillata* (L.) A.Rich.	Leguminosae
1116	*Viscum articulatum* Burm. f.	Santalaceae
1117	*Viscum cruciatum* Sieber ex Boiss.	Santalaceae
1118	*Viscum monoicum* Roxb. ex DC.	Santalaceae
1119	*Vitex altissima* L.f.	Lamiaceae
1120	*Vitex leucoxylon* L.f.	Lamiaceae
1121	*Vitex negundo* L.	Lamiaceae
1122	*Vitis vinifera* L.	Vitaceae
1123	*Volkameria inermis* L.	Lamiaceae
1124	*Wahlenbergia marginata* (Thunb.) A.DC.	Campanulaceae
1125	*Walsura trifoliolata* (A.Juss.) Harms	Meliaceae
1126	*Waltheria indica* L.	Malvaceae
1127	*Wrightia arborea* (Dennst.) Mabb.	Apocynaceae
1128	*Wrightia tinctoria* R.Br.	Apocynaceae
1129	*Xanthium strumarium* L.	Asteraceae
1130	*Xantolis tomentosa* (Roxb.) Raf.	Sapotaceae
1131	*Xylia xylocarpa* (Roxb.) Taub.	Leguminosae
1132	*Xyris pauciflora* Willd.	Xyridaceae
1133	*Youngia japonica* (L.) DC.	Asteraceae
1134	Zanonia indica L.	Cucurbitaceae
1135	*Zanthoxylum ovalifolium* Tutcher	Rutaceae
1136	*Zanthoxylum rhetsa* DC.	Rutaceae
1137	*Zanthoxylum tetraspermum* Wight & Arn.	Rutaceae
1138	*Zehneria maysorensis* Arn.	Cucurbitaceae
1139	*Zehneria scabra* Sond.	Cucurbitaceae
1140	*Zehneria thwaitesii* (Schweinf.) C.Jeffrey	Cucurbitaceae
1141	*Zeuxine longilabris* (Lindl.) Trimen	Orchidaceae
1142	*Zingiber cernuum* Dalzell	Zingiberaceae
1143	*Zingiber officinale* Roscoe	Zingiberaceae
1144	*Zingiber zerumbet* (L.) Roscoe ex Sm.	Zingiberaceae
1145	*Ziziphus jujuba* Mill.	Rhamnaceae
1146	*Ziziphus oenopolia* (L.) Mill.	Rhamnaceae
1147	*Ziziphus xylopyrus* (Retz.) Willd.	Rhamnaceae
1148	*Zornia gibbosa* Span.	Leguminosae

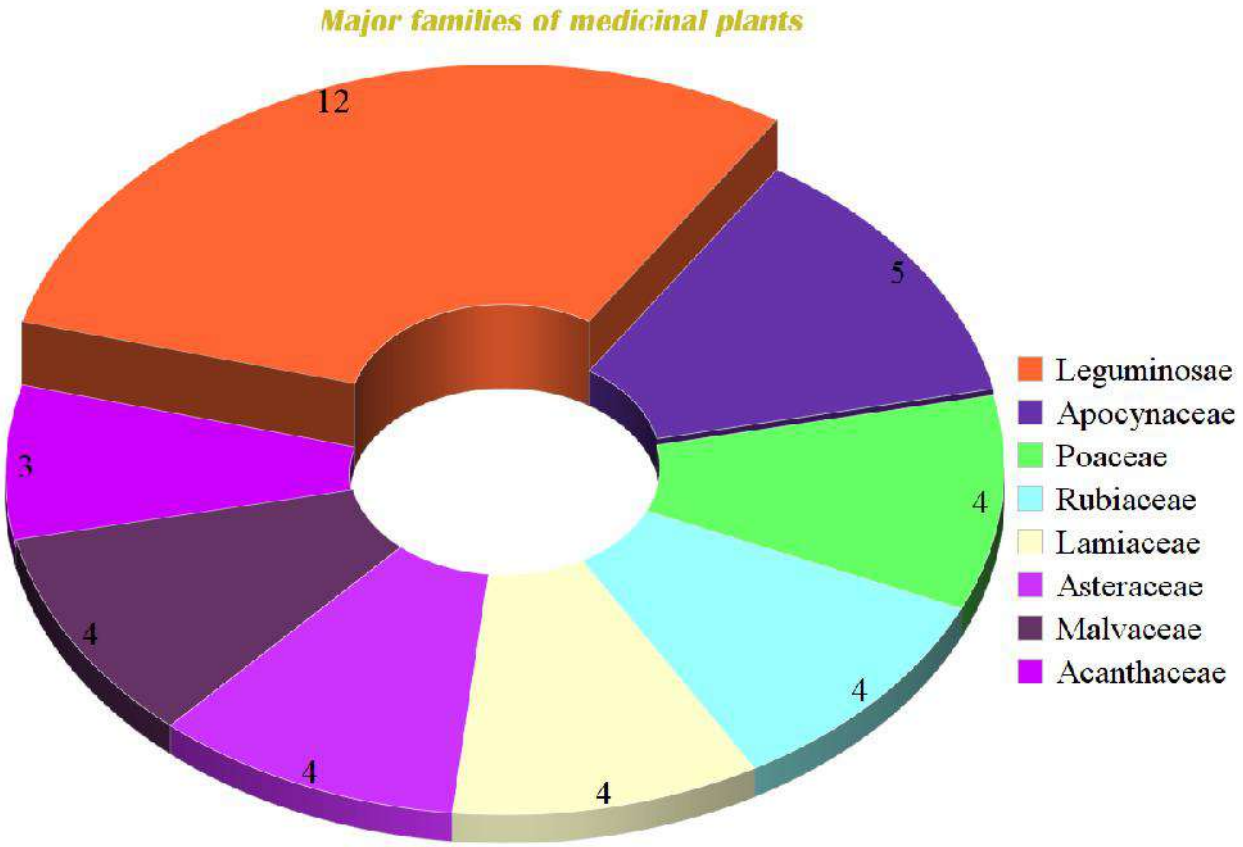

Major families of medicinal plants
12
5
4
4
4
4
4
3
Leguminosae
Apocynaceae
Poaceae
Rubiaceae
Lamiaceae
Asteraceae
Malvaceae
Acanthaceae

Table 5. List of wild edible fruits found in the HRML study area

S. No.	Species name	Family	Local name	Location
1	*Acronychia pedunculata* (L.) Miq.	Rutaceae	Kattuorange, Kambili	Munnar
2	*Aerva lanata* (L.) Juss.	Amaranthaceae	Cherula	Chullippetty
3	*Alangium salviifolium* (L.f.) Wangerin	Cornaceae	Kilikuthippazham, Ottangudi	Kolanikavu (Thodupuzha)
4	*Antidesma montanum* Blume	Phyllanthaceae	Nilamvetti, Kattupulinchi	Adimali
5	*Artocarpus lacucha* Buch.-Ham.	Moraceae	Kurangu pilavu	Bhoothathankettu
6	*Asparagus racemosus* Willd.	Asparagaceae	Shathavari	Kanthalloor, Marayur
7	*Atalantia monophylla* DC.	Rutaceae	Kuruthan	Marayur, Chinnar
8	*Azadirachta indica* A.Juss.	Meliaceae	Veppu	Chinnar
9	*Baccaurea courtallensis* (Wight) Müll.Arg.	Phyllanthaceae	Mootti, Mootippuli	Adimali, Neriyamangalam
10	*Bridelia stipularis* (L.) Blume	Phyllanthaceae	Thondan valli	Adimali, Irumbupalam
11	*Capparis sepiaria* L.	Capparaceae	-	Marayur, Chinnar
12	*Capparis zeylanica* L.	Capparaceae	Athanda	Churulipetty, Chinnar
13	*Caralluma umbellata* Haw.	Apocynaceae	Kathal, Ekidi	Chullippetty, Chinnar
14	*Carissa carandas* L.	Apocynaceae	Kela, Kelavu, Mulli, Karimulli,	Chullippetty, Chinnar
15	*Celastrus paniculatus* Willd.	Celastraceae	Valuluva	Chinnar
16	*Cereus pterogonus* Lem.	Cactaceae	Chathurakolli	Chinnar
17	*Cipadessa baccifera* (Roth) Miq.	Meliaceae	Mainappazham, Thalethirukka	Munnar, Adimali
18	*Cissus quadrangularis* L.	Vitaceae	Changalamparanda	Chambakkad
19	*Cleome gynandra* L.	Cleomaceae	Kattukaduku	Peermade
20	*Coccinia grandis* (L.) Voigt	Cucurbitaceae	Koval,	Chinnar
21	*Crotalaria grahamiana* Wight & Arn.	Leguminosae	Chalanga	Chinnar
22	*Croton malabaricus* Bedd.	Euphorbiaceae	Thavittu pulavu	Adimali
23	*Debregeasia longifolia* (Burm.f.) Wedd.	Urticaceae	Neerinch	Munnar, Marayur
24	*Diospyros montana* Roxb.	Ebenaceae	Vakkana	Chinnar, Marayur
25	*Diplocyclos palmatus* (L.) C.Jeffrey	Cucurbitaceae	-	Marayur, Kuthukal
26	*Elaeagnus conferta* Roxb.	Elaeagnaceae	Kurangupazham, Kattumunthiri, Bhasmadhooli	Munnar, Devikulam, Vagamaurai, Kanthalloor

S. No.	Species name	Family	Local name	Location
27	*Elaeagnus indica* Servett.	Elaeagnaceae	Kurangu rudraksham	Kanthalloor, Marayur
28	*Elaeocarpus hygrophilus* Kurz	Elaeocarpaceae	Kaippan kara, kelakotta	Adimali, Munnar, Marayur, Brindaran estate
29	*Elaeocarpus munroii* Mast.	Elaeocarpaceae	Kattukara	Devikulam, Munnar
30	*Elaeocarpus serratus* L.	Elaeocarpaceae	Kara	Adimali, Neriyamangalam, 6th stone, Munnar
31	*Elaeocarpus tuberculatus* Roxb.	Elaeocarpaceae	Rudraksham	Marayur, Kanthallor
32	*Eleusine coracana* (L.) Gaertn.	Poaceae	Keppa, Kuravu	Kuthukal
33	*Embelia ribes* Burm.f.	Primulaceae	Vizhal	Marayur
34	*Entada rheedii* Spreng.	Leguminosae	Paranda, Kakkumkalli, Thellikkodi	Adimali
35	*Euonymus angulatus* Wight	Celastraceae	-	Anamudi Motta
36	*Ficus racemosa* L.	Moraceae	Athi	Kanthalloor, Marayur
37	*Firmiana simplex* (L.) W.Wight	Malvaceae	Thondi	Chinnar, Marayur
38	*Garcinia gummi-gutta* (L.) Roxb.	Clusiaceae	-	Rajamala
39	*Gardenia resinifera* Roth	Rubiaceae	Kattupera, Kambimaram	Marayur, Chinnar
40	*Gaultheria fragrantissima* Wall.	Ericaceae	Colgate chedi	Munnar, Devikulam
41	*Givotia moluccana* (L.) Sreem.	Euphorbiaceae	-	Marayur, Chinnar
42	*Glycosmis pentaphylla* (Retz.) DC.	Rutaceae	Panal, panchi	Thodupuzha
43	*Gmelina arborea* Roxb.	Lamiaceae	Kumbil, Kumizhu	Marayur, Kanthlloor
44	*Gmelina asiatica* L.	Lamiaceae	Cherukumbil	Chinnar
45	*Grewia damine* Gaertn.	Malvaceae	Chathura kalla	Marayur, Chinnar
46	*Grewia gamblei* J.R.Drumm.	Malvaceae	Malankalla, Vivakukettum valli	Marayur, Chinnar
47	*Grewia rothii* DC.	Malvaceae	Kalla	Chinnar
48	*Grewia serrulata* DC.	Malvaceae	-	Adimali
49	*Grewia villosa* Willd.	Malvaceae	Tholkalla	Munnar, Chinnar
50	*Gymnema sylvestre* (Retz.) R.Br. ex Sm.	Apocynaceae	Chakkarakolli	Chinnar, Chambakkad
51	*Heracleum candolleanum* Gamble	Apiaceae	Chittelam, Vathamkolli	Devikulam
52	*Herissantia crispa* (L.) Brizicky	Malvaceae	Urikka	Chambakkaad

S. No.	Species name	Family	Local name	Location
53	*Lantana camara* L.	Verbenaceae	Chulli	Munnar
54	*Maesa indica* (Roxb.) A. DC.	Primulaceae	Kirithi	Rajamala, Munnar, Marayur
55	*Mallotus philippensis* (Lam.) Müll.Arg.	Euphorbiaceae	Thavittu	Marayur
56	*Manilkara roxburghiana* (Wight) Dubard	Sapotaceae	-	Chinnar
57	*Mimusops elengi* L.	Sapotaceae	Erinjil, Elanji	Marayur
58	*Murraya paniculata* (L.) Jack	Rutaceae	Kattukariveppu	Marayur, Chinnar, Mannavanshola
59	*Nicandra physalodes* (L.) Gaertn.	Solanaceae	-	Vattayar
60	*Nothopegia beddomei* Gamble	Anacardiaceae	-	Kolanikavu (Thodupuzha)
61	*Olea dioica* Roxb.	Oleaceae	Edana	Marayur
62	*Opuntia elatior* Mill.	Cactaceae	Pattanathumkalli	Chinnar
63	*Opuntia stricta* (Haw.) Haw.	Cactaceae	Kalli, Chuvannakalli, Pathikalli	Chambakkad, Chinnar
64	*Oxalis corniculata* L.	Oxalidaceae	Puliyarila	Mattupetty
65	*Phyllanthus emblica* L.	Phyllanthaceae	Nelli	Munnar, Adimali, Kanthalloor
66	*Physalis angulata* L.	Solanaceae	Njotta-njodi, potti	Chinnar, Munnar
67	*Piper schmidtii* Hook.f.	Piperaceae	Kattukurumulaku	Anamudi, Munnar
68	*Piper wightii* Miq.	Piperaceae	Kattukurumulaku	Munnar
69	*Pithecellobium dulce* (Roxb.) Benth.	Leguminosae	Korukkapuli, Kodukkapuli	Chambakkaad
70	*Rhodomyrtus tomentosa* (Aiton) Hassk.	Myrtaceae	Kattukoyyapazham	Anamudi
71	*Ricinus communis* L.	Euphorbiaceae	Avanakku	Munnar, Adimali
72	*Rivea hypocrateriformis* Choisy	Convolvulaceae	-	Alampetty, chinnar
73	*Rotheca serrata* (L.) Steane & Mabb.	Lamiaceae	Cheruthekku	Mattupetty
74	*Rubia cordifolia* L.	Rubiaceae	Manjishta	Vandiperiyar
75	*Rubus ellipticus* Sm.	Rosaceae	Mulli, Manjamulli	Munnar, Devikulam, Anamudi, Rajamala
76	*Rubus micropetalus* Gardner	Rosaceae	Chuvannamulli	Anamudi, Rajamala
77	*Rubus niveus* Thunb.	Rosaceae	Mulli	Munnar
78	*Rubus racemosus* Roxb.	Rosaceae	Chambamulli	Munnar, Anamudi, Rajamala
79	*Santalum album* L.	Santalaceae	Chandanam	Marayur, Chinnar

S. No.	Species name	Family	Local name	Location
80	*Sapindus emarginatus* Vahl	Sapindaceae	Soppumkaya	Chinnar
81	*Schleichera oleosa* (Lour.) Merr.	Sapindaceae	Puvanam, Puvan, Puvanna	Chinnar, Marayur
82	*Smilax perfoliata* Lour.	Smilacaceae	Chural	Chinnar
83	*Solanum americanum* Mill.	Solanaceae	Manithakkali, Cherra, Chunda	Kanthalloor
84	*Solanum pubescens* Willd.	Solanaceae	Chunda, Cheriyachunda	Chambakkad
85	*Solanum surattense* Burm. f.	Solanaceae	Kazhuthachunda	Vattayar
86	*Spondias pinnata* (L. f.) Kurz i	Anacardiaceae	Ambazham	Adimali, Munnar
87	*Strychnos potatorum* L.f.	Loganiaceae	Chillachillam, Thettamparal	Chinnar
88	*Symplocos cochinchinensis* (Lour.) S. Moore	Symplocaceae	Pachotti, Choolamani, Thulasimaram	Munnar, Devikulam
89	*Syzygium cumini* (L.) Skeels	Myrtaceae	Njaval	Devikulam, chinnar
90	*Syzygium densiflorum* Wall. ex Wight & Arn.	Myrtaceae	Navrappazham	Anamudi
91	*Toddalia asiatica* (L.) Lam.	Rutaceae	Melakarana, Mullichedi, Kadichikarantakam	Marayur, Chinnar, Kanthalloor, Mannavanshola
92	*Vaccinium leschenaultii* Wight	Ericaceae	Glass pazham	Munnar, Adimali
93	*Wrightia tinctoria* R.Br.	Apocynaceae	Attukombu, kathippala, Koppela	Chambakkad, Munnar, Chinnar, Marayur, Peermade
94	*Ziziphus glabrata* B.Heyne ex Roth	Rhamnaceae	Karukotta	Chinnar, Chullippetty
95	*Ziziphus oenopolia* (L.) Mill.	Rhamnaceae	Thodali, Churi	Chinnar
96	*Ziziphus xylopyrus* (Retz.) Willd.	Rhamnaceae	Kattukotta, Kadamankotta	Chinnar

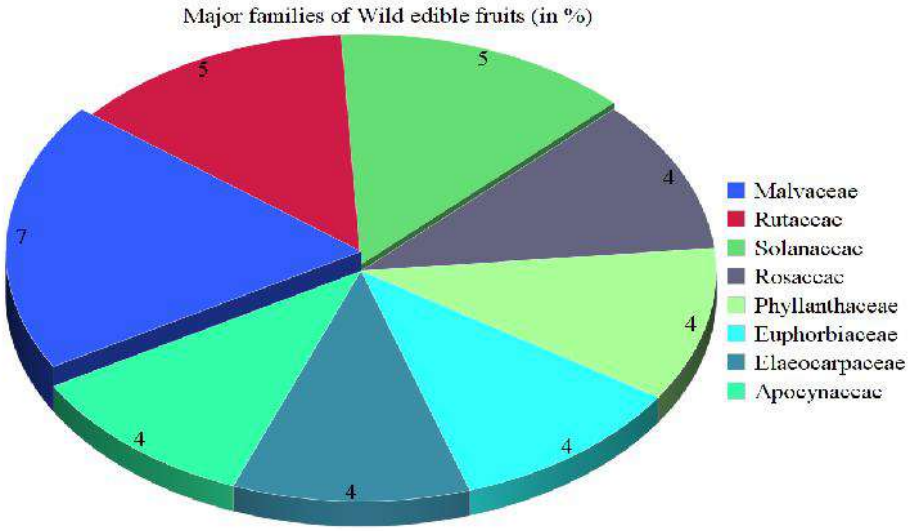

Major families of Wild edible fruits (in %)
5
5
4
7
4
4
4
4
Malvaceae
Rutaceae
Solanaceae
Rosaceae
Phyllanthaceae
Euphorbiaceae
Elaeocarpaceae
Apocynaceae

Table 6. List of selected tradable bio-resources in the HRML study area

S. No.	NTFP	2013-14		2014-15		2015-16		2016-17		2017-18		2018-19		Threat Status*
		Kg	Rs.	Kg	Rs.	Kg	Rs.	Kg	Rs.	Kg	Rs.	Kg	Rs.	
1	Karikurinji *Nilgirianthus ciliatus* (Nees) Bremek. Acanthaceae	2778	31518	1325	19825	4197	51539	5449	76986	9856	147840	9990	160830	VU
		Rs. 11/kg		Rs. 15/kg		Rs. 12/kg		Rs. 14/kg		Rs. 15/kg		Rs. 16/kg		
2	Pinari *Nothapodytes nimmoniana* (J.Graham) Mabb. Icacinaceae	2040	55280	80	2800	4664	145998	1450	50750	1350	47250	2367	101750	NE
		Rs. 27/kg		Rs. 35/kg		Rs. 31/kg		Rs. 35/kg		Rs. 35/kg		Rs. 43/kg		
3	Marotti *Hydnocarpus pentandrus* (Buch.-Ham.) Oken Achariaceae	9500	552	8	480	30	1980	100	6000	100	7000	902	144320	VU
		-		Rs. 60/kg		Rs. 66/kg		Rs. 60/kg		Rs. 70/kg		Rs. 160/kg		
4	Pachottitholi *Symplocos cochinchinensis* (Lour.) S. Moore Symplocaceae	547	16454	180	645	319	11165	-	-	17	765	2732	157952	NE
		Rs. 30/kg		Rs. 4/kg		Rs. 35/kg		-		Rs. 45/kg		Rs. 58/kg		
5	Pattinja *Acacia intsia* (L.) Willd. Leguminosae	-	-	370	18338	-	-	886	44325	904	50852	775	45711	NE
		-		Rs. 50/kg		-		Rs. 50/kg		Rs. 56/kg		Rs. 59/kg		
6	Kurumthoti *Sida rhombifolia* L. Malvaceae	-	-	-	-	-	-	-	-	30	1350	405	21350	NE
		-		-		-		-		Rs. 45/kg		Rs. 53/kg		
7	kurumulaku *Piper nigrum* L. Piperaceae	928	19761	-	-	413	12380	324	11357	2429	88261	2563	130112	NE
		Rs. 21/kg		-		Rs. 30/kg		Rs. 35/kg		Rs. 36/kg		Rs. 51/kg		
8	Thanikka *Terminalia bellirica* (Gaertn.) Roxb. Combretaceae	-	-	800	8000	-	-	-	-	-	-	-	-	NE
		-		Rs. 10/kg		-		-		-		-		
9	Kasthurimanjal *Curcuma aromatica* Salisb. Zingiberaceae	1184	83915	1747	129394	829	52962	1330	79386	953	71925	-	-	NE
		Rs. 71/kg		Rs. 74/kg		Rs. 64/kg		Rs. 60/kg		Rs. 75/kg		-		
10	Chittaratha *Alpinia calcarata* (Haw.) Roscoe Zingiberaceae	-	-	-	-	-	-	60	4200	41	3280	-	-	NE
		-		-		-		Rs. 70/kg		Rs. 80/kg		-		

S. No.	NTFP	2013-14		2014-15		2015-16		2016-17		2017-18		2018-19		Threat Status*
		Kg	Rs.	Kg	Rs.	Kg	Rs.	Kg	Rs.	Kg	Rs.	Kg	Rs.	
11	Kattupadavalam *Trichosanthes cucumerina* L. Cucurbitaceae	140	14000	182	31624	-	-	235	23500	212	30750	-	-	NE
		Rs. 100/kg		Rs. 174/kg		-		Rs. 100/kg		Rs. 145/kg		-		
12	Cheevakai *Acacia sinuata* (Lour.) Merr. Leguminosae	614	18280	2420	84990	390	9750	176	6490	70	3500	-	-	NE
		Rs. 30/kg		Rs. 35/kg		Rs. 25/kg		Rs. 174/kg		Rs. 174/kg		-		
13	Chunda *Solanum torvum* Sw. Solanaceae	97	1940	401	8020	1700	19800	570	17100	1135	34050	22	660	NE
		Rs. 20/kg		Rs. 20/kg		Rs. 12/kg		Rs. 30/kg		Rs. 30/kg		Rs. 30/kg		
14	Thelli *Canarium strictum* Roxb. Burseraceae	-	-	15	2375	-	-	-	-	-	-	25	3250	NE
		-		Rs. 158/kg		-		-		Rs. 130/kg		Rs. 58/kg		
15	Makkumkaya *Entada gigas* (L.) Fawc. & Rendle Leguminosae	-	-	-	-	16	320	38	870	750	24000	895	29025	NE
		-		Rs. 20/kg		Rs. 23/kg		Rs. 32/kg		Rs. 32/kg		Rs. 59/kg		
16	Honey (Small Honey)	-	-	-	-	-	-	-	-	375	30350	61	51851	-
		-		-		-		-		Rs. 81/kg		Rs. 850/kg		
17	Honey (Large Honey)	-	-	-	-	-	-	-	-	45	13500	623	244200	-
		-		-		-		-		Rs. 300/kg		Rs. 392/kg		

*As per IUCN status 2014; VU = Vulnerable; NE = Not Evaluated

Table 7. Summary of progress report

S. No.	Activities	Progress of study	Key insights regarding the studies	Details of report submitted so far	Challenges faced/ concerns	Deliverables
1	Collection and compilation of Secondary data (Group/taxa/subject wise).	Collection of Secondary data from Universities and research centers in Progress.	X	X	X	-
2	Primary data collection (Group/taxa/subject wise). Transect/Pollard walk or multiple quadrat/plot method or Point count censes or focal-animal sampling with the participation of subject experts.	Field visits were conducted in Adimali, Munnar, Devikulam, Kanthalloor and Marayoor Grama panchayaths. Focal Discussions with knowledge providers and data pooling are in progress.	X	X	X	Data of flora and fauna of project areas based on gaps in PBR
3	The documentation of Commercially exploitable bio-resources with the support of representatives of stakeholders via focus group discussions/ survey.	Documentation is on progress with the help of BMCs/ Girijan service co- operative societies/Tribal welfare societies.	Overexploiting of medicinal plants	X	Illegal trading	Data of tradable bio-resources
4	Assigning threat status of species based on primary and secondary data and study impact of natural disasters on Biodiversity.	X	X	X	Will be done after the completion of documentation	-
5	Document critical gap areas in the PBR: based on consultation with BMCs/previous PBR registers/panchayath committees/local communities etc.	PBR updation with the inclusion of economic values in the tradable bio-resources is on progress.	X	X	BMCs are ineffective. Several gaps identified in PBRs	X

S. No.	Activities	Progress of study	Key insights regarding the studies	Details of report submitted so far	Challenges faced/ concerns	Deliverables
6	Check the present status of bio-resources (assign rank based on the % of loss/ gain with respect to the secondary data. Also, the Group/taxa/subject wise updation of PBR and its digitization (e-PBR).	The PBR software designing is completed, its trial Data updation is on progress.	X	X	X	Updated ePBR
7	Studying the ongoing changes and forces driving changes in Bio-resources/ landscapes and its impact in the livelihoods of native people.	X	X	X	X	Development of management strategy.
8	Compilation of primary and secondary data especially in the economically important bio-resources (Group/taxa/ subject wise) via Rural Rapid Appraisal (RRA) and Participatory Rural Appraisal (PRA) methods.	X	X	X	X	-
9	Assigning an index/Rank (category wise) of biological resources involved in Indigenous use/trading purpose/illegal overexploitation for ABS linking.	The secondary and primary data pooling is on progressing with the help of trade analyst.	X	X	Lack of awareness in ABS	-
10	Implementation of Sustainable best practices of ABS via. analysing the long-term availability/IUCN status /trade channels/marketing networks/financial transactions thereby improving native people's life.	The meetings/discussions/ workshops were conducted with the TK holders/Subject experts/Environmental economists. Further discussions are on progress.	X	X	X	Data of flora and fauna of project areas

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6. PROJECT 2

REVIEW OF ECOLOGICAL AND DEVELOPMENT HISTORY OF VARIOUS SECTORS AND CHANGES IN SELECTED ECOLOGICAL UNITS IN GEF- MUNNAR LANDSCAPE PROJECT AREA

6.1 AIM

To identify the ecological changes that has occurred in High Range Munnar landscape and to identify its cause and causer. Year after year, environment and ecology throughout the world endures tremendous changes. The involvement of human beings in this phenomenon is a matter of past doubt. This study is intended at identifying ecological changes that had happened during the last several years. The study mainly focuses on 9 Panchayath in Idukki district, 1 Panchayath in Ernakulum and one in Trissur district.

6.2 OBJECTIVES

The major objectives of the study

1. Identification and documentation the ecological past, drivers and process of modification of various ecological elements in the landscape and their consequent impacts.
2. Documenting various development activities, projects, drivers of change, agencies, and agents of development, institutions and their impacts in the indigenous and migrant settler communities in the HRML.
3. Reviewing development trajectories of various communities and social institutions that have consequences to implementation of HRML programme activities.

The consultants during the expert committee meeting conducted in Kerala state Biodiversity Board suggested focusing in the following aspects:

- Documentation of the changes in the spatiotemparal extent and qualitative changes in selected ecological units such as riparian areas, sholas, valleys, forest, and grasslands.
- Documenting development activities in different sectors (plantations & horticulture, animal husbandry, tourism, transportation, Hydel, quarries, man and animal interactions.) drivers of change, historical and cultural process that induced change on Munnar landscape
- Reviewing impacts of development trajectories on the indigenous and migrant settler communities in the HRML.

6.3 Methodology

Rapid Rural Appraisal (RRA) and Participatory Rural Appraisal (PRA) methods will be employed to document ecological changes and development history in production sectors. Representatives of stakeholders including government departments as agriculture, fisheries, industry, commerce, planning, customs and exercise; the private sector; and local communities and non-governmental organizations (NGOs) and academia, will be involved through focus group discussions. Secondary information available with various departments and from peer reviewed journal will be made use of.

a) Documentation of Ecological Changes

1. Review of bio- climatologically and vegetation changes and affinities in the selected landscape on long duration.
2. Review formation of present- day land –use categories and patterns including human modified, forested and protected areas.
3. A general documentation of changes in the vegetation communities and flora and fauna components and drivers of these changes.
4. Documentation of changes in the spatial extent and qualitative changes in selected ecological units (riparian areas, vayals, sholas, valleys, forests, and grasslands) of the landscape and nature of changes these underwent.
5. To identify, characterize and critically evaluate major agents and drivers of change in the landscape and provide possible implications of these for the future management of biological diversity in the landscape.

b) Documentation of development history in production sectors

6. Review of historical and cultural process and agents that induced/inducing change on larger land cover categories over the past two centuries.
7. Review of major developmental sectors and developmental interventions with cascading ecological effects induced by these interventions (development of plantation- land cover changes, road communication network, river valley project, labour and settler population built up etc.
8. Identify and critically evaluate agencies (institutions and subjects) and drivers of change in the landscape.
9. Evolution of government, quasi government, voluntary and Nongovernment organizational network in HRML; analysis of their integration, cross linkages, inter- institutional communications and compatibility for HRML programme

6.4 .Detailed Progress Report

- During the first half year of the project, Research personnel (one Research Associate and one project assistant) were appointed.
- Consultants were identified in various sectors and expert consultative meetings were held. First consultative meeting was held on March 12, 2019 in the Head Quarters of Kerala State Biodiversity Board, Thiruvananthapuram (**Annexure I**). Second consultative meeting was held on June 26, 2019 (**Annexure II**). Third consultative meeting was held on November 21 and 22, 2019
- Quarterly progress report was presented to the Technical Agencies for the GoIUNDP-GEF India High Range Mountain Landscape Project meeting, held at Hotel Hycinth, Thiruvananthapuram on June 18, 2019 (**Annexure III**).
- Secondary data regarding Demography, Historical and Cultural process that induced change was compiled form various sources
- Secondary data regarding major developmental process in Production sectors such as Tourism, Quarrying, Plantations, Hydel projects that led to land use change was compiled from various sources .
- For field level data collection, 10 BMC meetings were conducted in 10 Grama Panchayath, except Edamalakudy which could not be done due to bad climate condition and inadequate transport facility.

Local perceptions regarding major drivers of change in the landscape were collected

- Procurement of base maps completed and preparation of GIS maps to analyze the land use change is ongoing.
- Questionnaire format was developed for conducting PRA and RRA for local perceptions regarding land use change

6.4.1. Review of historical and cultural process and agents that induced change on the landscape

Demographic details

Details of census done during the year of 2001 and 2011conducted in Idukki district are shown below the table.

Table: 1

SL	Description	2011	2001
1	Population	11.09 Lakhs	11.29 Lakhs

2	Actual Population	1,108,974	1,129,221
3	Male	552,808	566,682
4	Female	556,166	562,539
5	Population Growth	-1.79%	7.03%
6	Area Sq. Km	4,356	4,356
7	Density/km2	255	259
8	Proportion to Kerala Population	3.32%	3.55%
9	Sex Ratio (Per 1000)	1006	993
10	Child Sex Ratio (0-6 Age)	964	969
11	Average Literacy	91.99	88.69
12	Male Literacy	94.56	92.33
13	Female Literacy	89.45	85.02
14	Total Child Population (0-6 Age)	105,641	134,177
15	Male Population (0-6 Age)	53,785	68,155
16	Female Population (0-6 Age)	51,856	66,022
17	Literates	923,010	882,458
18	Male Literates	471,881	460,310
19	Female Literates	451,129	422,148
20	Child Proportion (0-6 Age)	9.53%	11.88%
21	Boys Proportion (0-6 Age)	9.73%	12.03%
22	Girls Proportion (0-6 Age)	9.32%	11.74%

Source :(https://www.census2011.co.in/census/district/279-idukki.html)

Table No1 shows that there is a change of -1.79 percentage in the population compared to population as per 2001. The population of the district between 1971-81 showed an increase of about 27 percent as against an increase of 19 percent for the state as a whole. Since most part of the district is covered with dense forests and plantations there is lesser area for

habitation. There is also large scale conversion of forest areas into arable lands for past two decades. This has resulted in the increase in population in the hilly taluks of the district, especially in Udumbanchola and eastern parts of Thodupuzha taluk. From 1991 to 2001 census in Idukki district shows a increase of 7.03 percentage in total population growth. The decadal growth rate of Kerala's population is estimated at 4.9 per cent, the lowest among Indian states. (Economic review 2016, State Planning Board).

Migration to western Ghats-Idukki –Major land marks

- 1700s-Tamilians known as the Muthuvans migrated to Munnar.
- 1877 Advent of European Planters. In 1877 Kerala Varma, the Raja of Poonjar, sold 227 sq. miles of Kannan Devan Hills to John Daniel Munroe, a British planter.
- 1890-1920 migration of plantation workers
- 1920-50- Mass migration of farmers to different parts of Idukki- Aftermath of II World War
- 1950 Colonies were established for Ex-servicemen

The settlement areas in Udumbanchola that occupied hardly 0.73% in 1910 were increased to 30.57% in 1990 by transferring forest lands, grasslands and cardamom plantations. The total area under plantation in this area had increased from 98, 123 acres in 1921 to 136,802 acres in 1931, an increase of more than39%. (Census of Travancore 1931). During the1951-1961 periods this area witnessed the phenomenal population increase of 675.75%.

In order to withstand the severe shortage of food crops during the 2 nd world war period, the government encouraged massive migration to the vast forested and fertile areas of the high lands, for the production of staple food crops, mainly paddy. However, massive enchroachments were reported only from the early fifties, and the process of enchroachment continued during the sixties and the seventies 18 . A major change notices in the expansion of settlement areas, which acted as catalyst for furthur changes in the form of infrastructure development with far reaching impact on the land use pattern and ecological balance of this region 19. In 1910, there was hardly 0.73% of the area under settlement that has increased to 30.57 with the combination of mixed crops. The narrow valley bottoms and marshy areas were transformed as paddy fields mainly because of the strategy adopted in the early days of migration for the producing staple food crops.

Tribal population data state and district level

Table No: 2

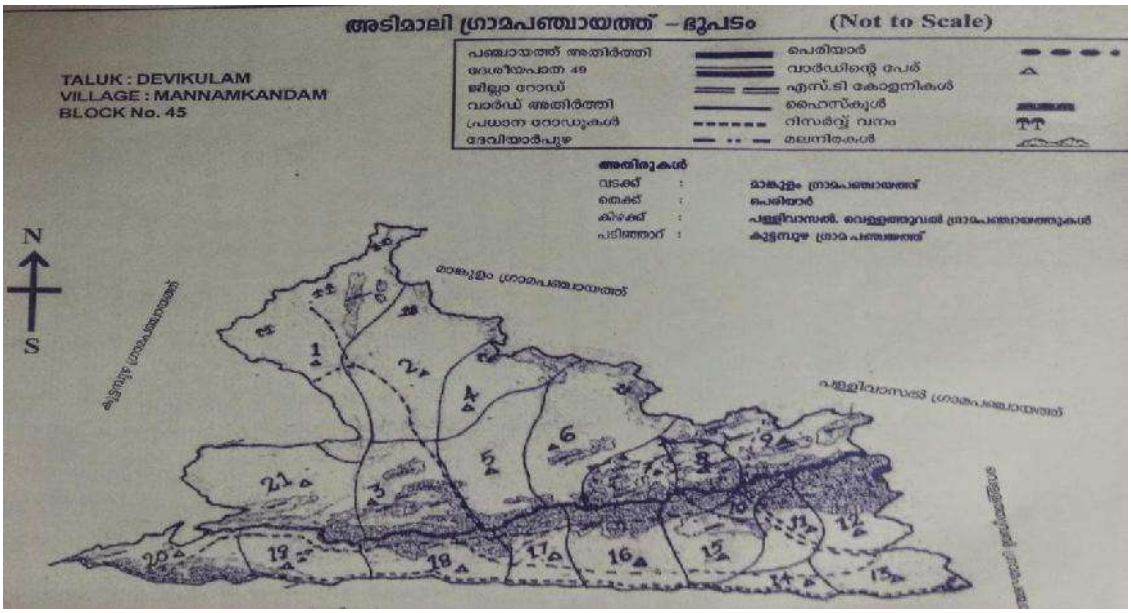
		Kerala state		Idukki district	
Scheduled Tribes in idukki district	Number		percentage	Number	percentage
	Persons	484,839	1.45	55,815	5.03
	Males	238,203	1.49	27,995	5.06
	Females	246,636	1.42	27,820	5.00

Source: (Census of India 2011)

Wayanad has the highest number of Tribals (136062) Idukki has the second highest number of Tribals living area. The third position is Palakkad. TableNo2 shows a 6 percentage change in both male and female sex ratio in Idukki district.

Meeting with Kodakalkudy tribal people, Adimalypanchayath

a.Adimali Panchayath



Adimaly is a town in the Idukki district of Kerala, 27 kilometres to Munnar. The National Highway 185 (NH 185) running from Adimaly to Kumily through Kattappana ends in Adoor in Kerala. Adimaly is located on the National Highway 49, now NH85, known as Kochi -Dhanushkodi National Highway (India) connecting Kochi and Madurai, India. The waterfalls Cheeyappara, Adimaly waterfalls and Valara are located nearby. Pepper cultivation is the main agricultural activity of this place. The Ponmudi Dam (294 meter length) was constructed in 1963 across the Panniar River, nearly 15 km southeast of Adimali, on the way to Rajakkad. Adimali is known for its proximity to Munnar and natural environment. Adimaly have almost all the basic facilities like roads, educational institutions and hospital.

More than 20 years before, 80% of the cultivated land was paddy but now the condition is totally changed. The Kurangatimala tribal settlement is only cultivating paddy. Most of the paddy cultivated areas are changed to cash crops and constructed buildings. Before 2017, more than 20 hectors of land was under paddy cultivation. But the condition has changed in 2017 -2018. The paddy cultivation decreased from 20 to 13.5 hectors. The PadasekaraSamithy and an NGO named Care India, worked together and 35 acres of fallow land were used now for paddy cultivation. More than 50 hectors of land is used for tapioca cultivation in AdimalyPanchayat. The Kudumbrasree mission in Adimaly also promotes Adukkalathottam for every household. They provide the seeds of vegetables to the households with the support of agriculture department. The households are cultivating organic vegetables for their own purpose.

The total residential building in this area are 12498 and the nonresidential building under Adimaly Panchayath is 5235. The total number of residential and nonresidential building under AdimalyPanchayat is 17733. Eastern and agro industry are the 2 major company in this area. There are 28 tribal settlements under the TEO Adimaly. They are Muthuvan, Mannan, Ulladan, Ooralan, and Malayarayan. Most of the tribal people are doing different works. Some of them are collecting NTFP and others are doing cultivation in their own land. Some people are collecting bamboos from the forest and sell them. Several people are doing MNREGA and kooli works from outside the community. Some people are collecting medicinal plants and honey from the forest and they sell them to Girijan society. In Adimaly some of them are selling honey directly to public or other markets in Adimaly.

b.Munnar

Munnar is bounded by Pallivasal in the south, Marayoor Village in the north, Mankulam Village in the west and Vattavada and Chinnakanal village in the east. It extends from 10º1’36” North to 10º19’45” North latitude and 76º53’23” East to 77º15’34” East longitude. It covers an area of 478 sq.km and has total population of 55753 as per Census 2011. The Munnar grama panchayath have 21 wards. The total number of households in Munnar panchayat is 7968. Total population in this area is 32029.The male proportion in under Munnar panchayat is 16069 and the female proportion is 15968. The total number of scheduled caste people in this area is 17657. Scheduled tribe population is 2176. A hill station and former resort for the British Raj elite, it's surrounded by rolling hills dotted with tea plantations established in the late 19th century. Eravikulam National Park, a habitat for

the endangered mountain goat Nilgiritahr, is home to the Lakkam Waterfalls, hiking trails and 2,695m-tall Anamudi Peak.

From 2010 onwards Grama Panchayat has restricted permit for the construction of high rise buildings. Up to 97 percent of areas in Munnar belongs to KDH Company. Livelihood of local people depends on the company, and it provides all their requirements. KDH permit some plots of land for local people for the purpose of agriculture (non-commercial purpose).

Munnar panchayat office

The soil texture in Munnar forest division, in the midland area is yellowish red colored with clayey loamy gravel present in surface. In the mid upland area the texture type is reddish brown to yellowish red with clayey loamy in texture The upland area texture is black to yellowish red with loamy to clayey.

The highland 1 elevation MSL level 600 to 900 is covered with reddish brown to red in colour with clayey loamy. The highland 2 the elevation MSL level 900 to 1200 is covered with dark yellowish brown to red with clayey loamy. The highland 3 the MSL level is 900 to 1200 is covered by the texture of dark reddish brown to yellowish red with silty clay. The mountainous region is the elevation MSL level of above 1200 is covered with the texture of dark reddish brown to reddish yellow with silty, loamy, and clayey in nature (Work plan Munnar forest division 2010-11 to 2019-20).

The climate is more or less temperate in high altitude areas. The temperature varies from 6 to 26°c. Minimum temperature during the last ten years was 6.4°c recorded in February, 1997 and maximum was 25.9°c as recorded in March 2004.

The highly elevated undulating terrain which receives heavy rains from south west and north east monsoons results in the formation of network of rivers and streams and hence there is no scarcity of water in the western slope of tract for the area is well drained.

Another attraction in this area is mainly the tourism. Munnar is a very large and popular tourist destination. The tourists are increasing day by day in this area. The data shows that the number of foreign visitors in Munnar in 2012 was 29326. In 2018, the number of foreign visitors in Munnar is decreased to 24293. But at the same time the domestic tourist in Munnar is increased. In 2012, the number of domestic tourist visitors in Munnar is 307595. In 2018, it is surprisingly increased to 782681. This increased number of tourist in this area is creating lots of hazardous problems in this area like air pollution, waste disposals; increased number of vehicles, noise pollution, and soil erosion. The vast area was being utilized just to construct hotels and restaurants.

A study conducted in Munnar about the marketing of macro small and medium enterprises providing tourist accommodation in Idukki district. It is reported that 78% of accommodation unit in Munnar belongs to category of resorts, 19% home stay category 3% service villa. More than 238 commercial buildings are here.

Landslide Munnar

Tea plantation KDH Munnar

In Munnar Panchayath most of the land (57359 acres of land) is under the control of KDH Company. .With this area under tea crops is 23239.06 acres of land. Area under fuel trees are 16898.91 acres. The area under grazing is 1220.77 acres. The area under buildings, sites, roads, workers garden etc is 2617.69 acres. Area under streams and swamps is 2465.20 acres. The area under uncultivable land is 6393.59 acres. The area under interspersed in estates and in between estates is 4523.92 acres. (Working plan Munnar forest division). Large forest area was demolished for the plantation of tea. The KDH Company mainly cultivated tea plantation, eucalyptus plantation, jasmine plantation, rose plantation, e.t.c. The company have lots of factories in Munnar region. For the purpose of processing tea they needs lots of fire woods therefore the company introduced eucalypts plantation in the Munnar area for their own purpose. The eucalypts plantations raised and managed by cooperate tea companies are exclusively for the fuel requirements of the tea factories and labour lanes. The studies show that the transformation from vegetable farming to eucalypt plantations leads to water shortages in the areas.

The private eucalyptus plantations in the high-altitude but low rainfall areas of Vattavada and Kanthalloor are reportedly causing acute water shortage in the valley bottoms. There is also a recent tendency to convert the vegetable farms to eucalyptus plantations which lead to disruption of local livelihood, cultural drift, impoverishment of local communities as well as

ecosystem malfunctioning (Land use management plan for production landscape in Munnar 2015).

Eucalyptus plantation Kanthalloor

In 1986, there was paddy cultivation in Munnar. Day after day the paddy cultivation area got vanished instead the settlement got increased due to deposition of erosion in that area. The settlement area increased to 5% to 10% because of the increase in population (www.ijrsg.com volume 4, issue 3, May 2015). Animal husbandry is the major activity of the people in here. Panchayath wise reports in 2007 shows that, 140 male and 2565 female exotic and cross breed cattle's are here.

Land use changes in western gats over the last century caused agricultural expansion, conversion to plantations and infrastructural projects. This resulted in loss of forest and grass land (Kumar1993, Jha et al 200, Khan et al., 1997). These changes are also a driving force to land slide problems. The flood in the last year also affected the Munnar region which affected the area adversely. Roads and buildings are destroyed. Many lands under cultivation were badly affected by the land slide.

The main vegetable cultivated in this area are cabbage, carrot, potato, beans, garlic and the other cash crops in this area are cardamom, pepper etc. The potato is the other largest vegetable cultivated in this area, 90 hector of land is used for cultivation and the production is 1080 tonne.

c. Devikulam

Devikulam is a small hill station about 5 kilometres (3.1 mi) from Munnar in the Idukki District of the southern state of Kerala, India. It lies 1,800 metres (5,900 ft) above sea level. The total area of Devikulam panchayath is 215km²(83 sq mi). There are 18 wards in Devikulam Grama Panchayath. The total population in this area is 29734 and the male population is 15101 and the female population is 14633. (Censes 2011) The Devikulam panchayath was officially declared in 2005 October 2. The literacy rate is 75% in this panchayath. There are 10 tribal communities in Idukki district viz. Malayarayan, Muthuvan, Mannan, Urali, hill Pulaya, Ulladan, Paliyan, Malayan, Malavedan and MalamPandaram. In the district, the highest percentage of ST. Population Were Reported in Devikulam Taluk (91%). The total population in Devikulam Taluk in 1875 is 2488. In2001 it reached to 185103. The present population in Devikulam Taluk is 177621 (Census of India 2011).

The area has winter crops cultivation (vegetables). Main crops are Kale, Cabbage, Cauliflower, Green Peas, Carrot, Fenugreek, Beet Root, Potato, Garlic, Rose, Jasmine, Strawberry, Passion Fruit and Tomato. The data from agricultural department shows that 80% of land was under the KDHP Company and Harrison Malayalam private limited company. In this panchayath the Santhozh colony is the only area where land is used for agricultural purpose and 150 families are settled here. In the 500 acres of land, 250 acre is eucalyptus plantation and the remaining land is used for agricultural use and as a residential area.

Panchayath office Devikulam

The tourism in this area is also increasing day by day. The main attractive places in Devikulam area are Mattuppetty Lake, Eravikulam national park, Sita Devi Lake, Keezharkuthu falls, Blossom International Park, Kundala Lake, and Thoovanam falls. Nearly more than 1500 resorts are located in Munnar and Devikulam area. The agricultural cultivation is decreasing day by day due to converting of land from agricultural crops to cash crop and plantation. Some places are facing the problem of wild animal attacks and due to that their agricultural products are destroyed by wild animals, therefore the people are not interested to cultivate crops. In this area about 400 ha is used for winter crops (vegetable), strawberry cultivation etc. Other major crops in this area Cabbage, Cauliflower, Carrot, Beetroot, Passion Fruit, Strawberry, Potato, Rose, Jasmine, Green Peas, Coriander, And Garlic And Tomato.

Tea Plantation, Devikulam

Devikulam

In Devikulam Panchayath, the major land is occupied by KDH Company. In Devikulam panchayath the KDH Company have jasmine and rose plantation. They are using large area of land for this cultivation. The jasmine flowers are exported for processing the jasmine flower and taking the oil from the flower. It's a big profitable business in foreign countries and there is a big demand for this. The major land use in 1997 was the forest area which occupies about 41 % (472.01 km²) and is distributed mainly over the western and northern parts of the region. Area under scrub vegetation forms the next major land use and covers an area of 257.04km² which is about 22.54% of the total area.

In 2004 the condition of the land use changed, the majority of area is covered by forest, scrub, tea and mixed crops. The dominant land use type of the area is forest and it covers about 38.9% (4433.95km²) of the total area. Its main concentration is along the northern and western margins, i.e. along the northern portion of Kannan Devan hills, portions of Mankulam, Mannankandam and Anaviraty villages.

Scrub vegetation is the next largest land use type followed by tea plantations which cover 13.60% (155.09 km² of the total area is occupied by tea estates, mixed crops form another major land use category in the region. (Land use and land cover changes detection using multi temporal satellite data Devikulam Taluk, Idukki district, Kerala).They are mainly distributed over the KDH Marayoor, Mankulam and Mannankandam villages of Taluk.

Jasmine plantation and Rose plantation in Devikulam.

In Devikulam, there are 26 tribal settlements in which most of the people do farming in their own lands, MGNREGA works and other jobs outside the community. Most of the tribal settlement people are facing different problems. Most of the settlement is located in the hill top or inside the thick forest area. In Devikulam panchayath our team visited Kundalam Kudi tribal settlement. The most important problem faced in the settlement is water scarcity in summer season. There is only a spring inside the forest from where they have to collect the water. It is. The water is collected through a pipe which is connected to the water tank inside the settlement. But most of the time the animals like elephant and other wild animals destroy the water pipe. Therefore, in summer season they face the problem of water scarcity. Other problem faced by the people in this settlement is road and transportation. Most of the settlement is located in hill side or inside the thick forest. So transportation is very challenging. Another problem is lack of the availability of hospital facilities near the settlement. Recently, the Devikulam panchayath took an initiative to set up the electricity connection in that area.

Kundalamkudi (Devikulam)

d.Marayoor

Marayoor in Idukki district is located 42 kilometres north of Munnar. In 1953, the Marayoor panchayath was officially declared. The sandal wood forest is the main highlight of this area. Ancient rock paintings and dolmens in Marayoor date back to the Stone Age.

Archaeological evidence indicates human presence in Devikulam high ranges even from 8000 years ago (gurukkal 1999), ancient dolmens (muniyara) and different kinds of rock paintings in Marayoor, Kanthalloore and Chinnar regions are strongly related to a Stone Age culture. The total area of the panchayath is 108.7 sq km of which 70% are covered by forest. The total population under this panchayath is 9590. Male and female sex ratio in the panchayath is 1001. The total literacy rate is 62%. The total wards under the panchayath are 13. The total number of buildings in Marayoor from 2013 to 10-05-19 is 4978 and 758 new buildings were constructed this year.

The climate in Marayoor is characterized by mild wet winters and hot dry summers. Marayoor area is a rain shadow region so the rain fall is very less in this area. The water availability in this area depends upon the rain fall in the high land region of Munnar area. The major rivers in this area are Pambar, Melaady and Karimutty.

Marayoor panchayath office and agricultural office.

10 years before most of the areas were under paddy cultivation. A major change was noticed in the utilization of paddy fields. In Marayoor region, paddy was a major crop cultivated since 18th century. At present some tribal settlement only cultivate paddy. Most of the paddy cultivation is converted to sugarcane cultivation. The main reason for this as explained by the local community is that because of the less availability of water, the amount of money that is spend for paddy cultivation is much more than sugarcane cultivation, further if once they plant sugarcane in an area they can take harvest three times per crop. In 1980 most of the tribal house was built by bamboo and clay hut but now most of the building in the tribal settlement are converted to concrete buildings. The tribal people are cultivating different types of agricultural plants and cash crops. Mainly there are 13 tribal settlements. Hill pulayans and Muthuvans are present in Marayoor Gramapanchayat. A tribal welfare society is present in Marayoor town area. They mainly collect NTFPs as Lemon grass, sugarcane, large honey, small honey, Kodampuli, Ragi, Gooseberry, Kadukka, Padavalakodi. The tribal welfare society directly collects this item from Tribal's. The people in some tribal settlement are cultivating paddy and vegetables in their settlement.

ACFC tribal welfare society Marayoor

When people started cultivating on steep side slopes, without proper soil conservation measures, the eroded soil got deposited in the paddy fields and the cultivation became difficult and less profitable. (Land use and land cover changes detection using multi temporal satellite data Devikulam taluk, Idukki district, Kerala Mani. K, International Journal of Geometrics and Geosciences Volume 3 Issue 1, 2012) .

In Marayoor panchayath more than 345 ha of sugarcane cultivation is present .Within this only three acres of sugarcane cultivation are done by the tribal people. Other cultivations are 50 ha beans (butter beans and muringa), two tribal settlements are cultivating coconut. Potato cultivation is also done by the tribal people. 150 ha is under areca nut cultivation in Marayoor panchayath. Lease cultivation is the main cultivation practice in this area. People take land for lease for a fixed period of time and cultivate crops and give rent for the land to the land owners. Recently the agricultural department took an initiative for the promotion of paddy cultivation in the upland area but it is not much effective. Now there is only 3 acre upland paddy cultivation in Puravel region.

Recently the changes in cultivation that is the paddy to sugarcane introduced some sugarcane manufacturing industries in this area. Mainly there are 3 industries and they are sugarcane manufacturing society, MAPCO and MAHARD.

Marayoor is the only place in Kerala which has natural sandal forest. The processing jobs are done by the selected tribal people. One VSS is working in Marayoor. During the field work, the team interacted with the Secretary of Marayoor VSS, and discussed about their organisation “Chilla”, tribes getting opportunity to sell the Non timber forest produce through auction. They can directly sell their products to other states (Tamil Nadu) such as Butterbeans, Kaattupadavalam (177 per Kg) and honey.

The people from outside and vegetable sellers are directly participating this auction. One of the important thing is that most of the products here are organic, so most of the people in this area and people from outside panchayath are also participating in this auction. Every Thursday they conduct the auction with the help of VSS. So the tribal people are getting reasonable rate of amount for their product.

Rajeev Gandhi nature park Marayoor

There are 11 tribal settlements within the sanctuary and the residents are dependent on the sanctuary for firewood and other minor forest produces. The residents of the tribal settlement lying on the periphery of the sanctuary also depend on the sanctuary for the same. The tribes mainly collect items such as honey, gooseberry, lemon grass and poles for construction of houses. The NWFP collection is without any regulatory mechanism and the rights to NWFP under the Forest Rights Act is yet to be settled. The quantity of materials collected by the tribes has not been studied.

e.Kanthalloor

Image from kanthalloor

Kanthalloor panchayath is under the Block division of Devikulam. The total area of the panchayat is 116.29 sq km. There are 13 wards and the total population is 10265 (census 2011). Total number of males is 5272 and females are 4993. Male female ratio is 947. The climate in this area is very cool. The soil here is gravel, black soil, red soil, loam soil. The average rainfall of the area is 60.00 m.m. Total literacy rate is 71%.

Kanthalloor panchayath was awarded for the most rice cultivated panchayath in 2010.But recently the paddy cultivation declined and the remaining paddy fields exist only in one ward (Keezhanthalloor). Recently, paddy fields were transformed into sugarcane.

Wheat was cultivated about 15 years ago. The main vegetable cultivations are carrot, beetroot, cabbage, green peace, garlic; beans are the main winter season vegetable cultivation. Eucalyptus plantation exists in most of the areas. Sugarcane cultivation is reported only from one tribal ward. Ragi is cultivated in some tribal settlements. Other major plantation crops are tea, cardamom, coffee in this area. Most of the areas are under the control of plantation comparatives which include Tata tea limited Harrison Malayalam, Thalayar estate etc. are the main tea plantations in this area.

The main water sources are streams in this area. In some hilly areas and tribal settlements face water scarcity.

Eucalyptus plantation Kanthalloore

Most areas are covered with eucalyptus plantation. In summer season, some areas catch forest fire. Therefore large area is destroyed by forest fire every year. In the lower side of the Kanthalloor area, people are cultivating Coconut and Arecanut.

Animal husbandry is the important source of income. Most of the family is doing animal husbandry in small scale and large scale.

Tribes in Idukki

A tribe is a social group, who lives in a definite area. They have a common culture, traditions and their own customs.The uniqueness and beliefs of tribes are closely connected with natural resources and the environment in which they live.

Population of tribes in Idukki

The total population of tribes in Kerala is 484,839 and with this 238,203 represents the male population and the female population of tribes in Kerala is 246,636. In Idukki district the total population of tribes is 55,815 and with this the male population is 27,995 and females are 27,820. The main group of tribes in Idukki are Mannan, Muthuvan, Malayarayan and Ulladan,

Livelihood

Most of the tribal people do farm works. Men go for jobs outside the community. Women go for MNREGA works. Some people do agricultural works in their own lands. But most of the tribes do not have land because tribal people lost their lands as land was kept as a mortgage for money at times of need. They seasonally go to the deep forest areas for collecting forest resources like thelli, honey, pathri, medicinal plants, kattumanjal, kattukoova, Nooron,,incha and food resources like tubers etc.

People say that the availability of honey and other products from the forest is also decreased. They meet their livelihood from their own cultivations and from "eettavettu" (reed work)for HNL company and bamboo corporation also collects reed and bamboo. This is the main income generating works in most of the settlement. According to them there is no profit from agriculture. 90% of people live by wild resources. Now eetta is the only wild resource, collected and taken to home to make "paaya" and "kutta" and "murram" which is sold for around Rs 100 in market or public.

Eeta

Most of the settlements are more than 40 years old and they live there and cultivate different crops in their settlement. More than 20 years back, most of the settlements were cultivating rice and ragi but at present the paddy cultivation is completely vanished from most of the settlement in Idukki. Earlier they used to migrate after one year of agriculture and practice shifting cultivation. But now they are settled in a permanent land and have permission for cultivating only in this land.

More than 20 years back most of the settlement were completely covered by "Theruvappullu". So the people extract oil from this and sell them to the market and this was the main livelihood of tribes. Recently this lemon grass has been replaced by rubber. Earlier most of the settlement were cultivating food items for their own need so they cultivated raggi, keppa rice, tubers like tapioca, Yam, Colocasia etc. But the transformation from this food crops cultivation to non-food crops is a major change in land use pattern. Previously the people cultivated traditional varieties of rice such as Peruvazha(Rice), silon (tapioca), Njalipoovan, Palenkodan, Chundilaakannan (Banana). In Komaly Kudi in bison valley most of the tribes were Muthuvan community and they previously cultivated 2 varieties of rice called "Manjapperuva and vellapperuva". According to them, this varieties is now not available in their settlement. In their words, their main staple food was raggi which gives healthy disease free body but these food items are completely vanished from the settlement. In Kurathy kudi under Adimali tribal office still a traditional variety of rice called peruvaya is cultivated by 2 to 3 families.

According to Kaani from Komalikudy; Raggi scarcity has affected their community a lot. Recently the tribal people are buying all items from the market. They get free ration and other items which they buy from the market. This gives a grim picture of food habit transition of tribal people. According to them, due to this transition, the life expectancy of Muthuvan and other tribes in Kerala reduced from 110-120 years to 60-75. Most of the tribes agreed that the food habit changes affected their life expectancy and health. Most of the people use mobile phones, TV etc and this things are now an essential part of their life.

Crisis faced by the tribes

a) Wild animal attack

Most of the settlements are in thick forest area. So most of the colony face the attack of wild animals like elephant, wild pig etc. Recently most of the settlement face crisis of crop damage due to wild animals. Most reported cases are elephant attacks in all the settlement and general people who live near the side of the forest area are reporting that their crops are

destroyed by wild animal mainly by elephants. The elephants are getting attracted with some crops like banana and pineapple. Recently the people reported, the rubber plantations are also destroyed by elephants because the sweetness of rubber milk is attracting the elephants and they feed on the outer skin of rubber tree leading to serious health issues for the elephant in future. Other wild animals like wild pig, wild porcupine, monkey and squirrels also damage main crops. Don't have enough food in the forest, so they come to the human settlement.

b) Poor transportation facilities

Most of the settlements are located in the thick forests and are facing the problems of transportation. Most of the hospitals were located in town areas therefore their travel is time consuming. In some emergency medical situations the people die on the way to hospital. Most of the roads are mud road where only 4x4 jeep can survive there. During the rainy season, the road will completely get damaged and they get isolated.

Destroyed roads

Most of the settlement has more than 2 to 3 jeeps. But due to the maintenance cost people rarely use these vehicles

c) Water scarcity

Water scarcity is the most important problem faced by most of the settlements most of the water project from Panchayath and irrigation department failed due to wild animal attack

damaging the water pipe connection. During the rainy season they faced land slide, because most of the settlement are located in the slopy areas. Due to heavy rain fall and water flow lots of tribal settlement area is facing landslides in rainy season.

Woman carrying drinking water

d) Cultural/Language erosion

Most of the settlements accepted that their new generations were on the way of transformation from their traditional culture to modern culture. They says that education and interaction with other community changed their styles, personality and culture. The best example of their change can be identified from their dressing, hair cutting and talk. At the same time some tribes is till following their culture in a strict manner. The best example is the tribes of Edamalakudy. Excluding this the settlement is under the path of changes. Most of the children go to school till 10th grade after that they stop their education. But some students go for higher studies. Earlier the Tribals marry within the cast but at present they marry from other groups especially the tribes marrying general people. The new generation do not much like to participate in their old traditions, so they keep a distance during the time of ceremonies. Previously they celebrated 4 to 5 festivals in a year and now it is decreased to 1 to 2 festivals in a year. Most of the educated tribal people beautifully speaks Malayalam,

English and some other languages, but at the same time they also can speak their language fluently.

Young tribal men during ceremonies

Previously the death ceremonies of the tribes were very complicated. They bury a person's body in a thick forest along with a Knife and Shovel. Using rifle they fire two times to the sky. They keep these tools like knife and shovel with buried person due to a belief that the dead person will reach a new place, and for meeting the liveli hood in the new area he needs these items. At present, the concept changed and they bury the dead body in their own land.

e) Loss of traditional knowledge

Tribes and other general people visit the traditional vydhyas for different type of diseases. The vydyas go to the thick forest and collect the medicinal plants and prepare medicine. Earlier they got medicine from nearby places of the settlement but now the availability of medicinal plants decreased. And the new generation did not have any idea nor any interest to learn.

Medicinal herbserbs from forest

f) Exploitation from others

A study conducted in Kanthaloor showed that People get very less price for their produced vegetables. The BMC members of a tribal community say that they are cultivating kaatupadavalam and passion fruit in their land. They sell this to the market but they do not get enough money for their hard work. The shop owners will say that price is less because of rain. Profit is gained by intermediate agents. Previously the people cultivated cardamom organically but the demand of organic cardamom has decreased and the merchants advise to use pesticides and give good cardamom. Most of the houses are now converted from hut to concrete building but the quality of all building is very poor in every rainy season. Most of the buildings have leakage problem due to poor quality.

6.4.2. Documentation of Developmental history in Production sector

The secondary information was collected from various departments and peer reviewed journals. A brief summary of the Impact of various sectors, as Plantations & Horticulture, Animal Husbandry, Tourism, Transportation, Hydels and Quarries are presented below

Land use changes in Idukki

K. Raju et al conducted a study "Land use changes in Udumpumchola Taluk, Idukki district—Kerala: An analysis with the application of remote sensing data. This comparative study shows that the settlement areas that occupied hardly 0.73 % in 1910 increased to 30.57 % in 1997 by transferring forest lands, grassland and cardamom plantations. The depletion of natural vegetation and grassland system by the establishment of houses, cash crops and infrastructure facilities, combined with the absence of sufficient land management measures in the side slopes resulted in severe land degradation and the present status of degraded lands is about 14.12 % of the total geographical area. It is also observed that the prevailing agro-climatic conditions favourable for the sustenance of sensitive crops like cardamom has undergone changes mainly due to the impact of large-scale land use modifications.

a) Impact of tourism growth in Idukki district

The hill stations, dams, mountains, spices, plantations, elephant rides, wild life sanctuaries etc. adds to the beauty of Idukki and these factors attract people to Idukki district of Kerala which is the third largest tourist destination of the state. The modern tourism era emerged and developed in 2000. Since then there is a vast change in the development of tourism sector.

The 21st century has witnessed a tremendous change in tea industry, development in educational sector, increase in the literacy rate, infrastructure facilities and so on. This helps in the economic development in local and state level.

Rough mountains and forest shield about 97% of the total area of the district. The protected area includes Thattekad birds sanctuary in the west Kurinjimala sanctuary to the east, Eravikulam national park and Chinnar wildlife sanctuary to the north east, Anamudi shola national park to the north, Pampadum shola national park to the south and Periyar tiger reserve in the south.

The major tourist destinations in the study area are:

1). Munnar- munnar-mattupetty dam

- Pothamedu view point
- Rajamala
- Devikulam

2).Munnar - Pothamedu

- Blossom International park
- Chithirapuram
- Pallivasal
- Attukad waterfalls
- Cheeyappara waterfalls

3). Munnar- rajamala- marayoor, chinar

- Tea museum
- Nyayamakad waterfalls
- Eravikulam national park
- Lakkam waterfalls
- Vagavari
- Marayoor
- Muniyara the caves of the ancient tribes
- Chinnar wildlife sanctuary

4). Munnar –Devikulam range

- Devikulam lake
- Lock heart gap

- Power house waterfalls
- Anayirankal dam

Sajan N Thomas conducted a study in Munnar about the marketing of macro small and medium enterprises providing tourist accommodation in Idukki district. Accordingly 78% of accommodation unit belongs to the category of resorts, 19% homestay category and 3% service villa

Number of commercial buildings in 6 panchayath in Idukki district

Table: 3-Number of Commercial Building

S.L	Name of the panchayath	No of commercial buildings
1	Adimaly	481
2	Munnar	238
3	Marayoor	44
4	Kanthalloore	28
5	Devikulam	42
6	Chinnakkanal	25

(Source: District Industries Centre, Cheruthoni)

Table No: 3 shows that the number of commercial building in different panchayath in most of the commercial buildings is located in Adimalypanchayath and the second top commercial building is located in Munnar. And the day by day the number of buildings is increasing this area. In Munnar area the panchayath officials says that they are not providing permission to constructing building in this area but the illegal constructions are rampant in Munnar area.

Road is the only means of transportation to this beautiful place. Day by day there is a tremendous increase in the number of foreign and domestic tourists visiting the place. Tourism has brought ecological and geographical changes to the area. The accommodation facilities in Munnar area are very large in number. Most of them are resorts, residencies, hotels and service villas. More than 115 licensed residencies and resorts are available in Munnar, Adimaly and Devikulam area. At the same time there are lots of unauthorised small and big hotels and cottages present there. Most of them are located in Munnar and Devikulam area. Most of the hotels and resorts were asking different rate of amount from the customer depending on season. More than 30 food production units, lots of bakery and street foods (Thattukada) are available in Adimaly and Munnar area.

Table No: 4

Eco tourism data

Tourist visitor's data Munnar

year	Munnar		Athirappally		Chalakkudy	
	Foreign	Domestic	Foreign	Domestic	Foreign	Domestic
2012	29326	307595	3260	365397	786	44838
2013	32733	308816	4984	395975	449	47421
2014	35393	349881	5177	361725	436	35349
2015	39303	364493	3746	153267	NA	NA
2016	27576	407881	2225	168547	22	12670
2017	24003	628427	1978	181941	29	13296
2018	24293	782681	2119	187812	116	14846

Source :(Research, Kerala tourism department)

Table No 4 shows that there is a rapid increase of foreign tourists till 2012 to 2015 and then a decrease happened in the flow of visitors till 2018 but the domestic tourist visits were increasing day by day. In Athirappally, the foreign tourist arrival was in an increased rate till 2015 after that a small decrease happed in the foreign visits. But the table shows that the domestic tourist arrival is increasing every year. This is shown below in the graph No 1.

Graph No: 1

Number of tourist visits in Munnar from 2012 to 2018.

The unstructured development of tourism has brought out adverse impacts on the natural environment which is the foundation for the tourism industry in Munnar. Over construction on the rolling grass land ecosystem, lack of waste management techniques, deforestation, maximum utilization of resources, the profit motive, absence of holistic approach of tourism infrastructure development and land use pattern, lack of awareness among the tourism promoters, lack of visitor management technique, exceeding carrying capacity and disappearance of species diversity etc. adversely affect the biodiversity of the area

b) Impact of Plantation

Idukki is characterized by large area under Plantations. Land use changes in Western Ghats over the last century caused by agriculture expansion, conversion to plantations and infrastructural projects have resulted in loss of forest and grassland (Kumar 1993, Jha et al 2000, Khan et al., 1997). Considerable areas of forest have been converted to plantations in the Western Ghats, particularly of tea, coffee, and Eucalyptus and different species of Acaia. The area under plantations is large and growing. Tea plantations in the south Indian states increased by 17.7% in the period 1987-1998 from 74,765 ha to 87,993 ha (Tea Board 2002). Large areas of Eucalyptus and Acacia plantations also occur with tea as it is used as fuelwood for tea-curing in the factories. Extensive eucalyptus plantations have also been established by large tea companies and private farmers. Although tea gardens (14,000 ha) occupy one of the major cash crops in the project landscape it retain several interspersed forest fragments (largely shola) in varying size that act as corridor or sheltered habitat for many floral as well as faunal components of the biological diversity

In 1877, Kerala Varma, the Raja of Poonjar, sold 227 sq.miles of Kannan Devan Hills to John Daniel Munroe,a British planter. This has led to the birth of Kennan Devan Hill Produce Company. KannanThevan is an adivasi who showed the hills to Planters and today Kannan Devan Hills is internationally known. In 1878, the Maharaja of Travancore confirmed the sale. J.D Munroe formed the North Travancore Land Planting and Agricultural Society. The members of the society developed their own estates in various parts of High Ranges. Tea was first planted by A.H.Sharp at Parvathi by clearing 50 acres on a dense forest. Later it was purchased by James Finlay and Company Limited. The Kannan Devan Hills Produce Company Limited and the Anglo-American Direct Tea trading Company Ltd owned 28 estates in these areas. The remaining 7 estates were owned by other British and Indian Companies. The present condition of the Munnar landscape most of the area is covered by tea plantation. The ownership of this plantation is mainly under the control of KDH company and Tata

company. Some of the small and large plantation are also owned by some other individuals most of the owners are from Tamil background. annually. The tea plantation area of the Idukki district is spread over Peermade, Udumbanchola and Devikulam Taluks. There are 36 tea estates, owned by 16 companies, in Peermade Taluk. Out of these, 30 estates run by 12 companies. These estates are spread over Peermedu, Vandiperiyar, Elappara and Upputhara panchayats.

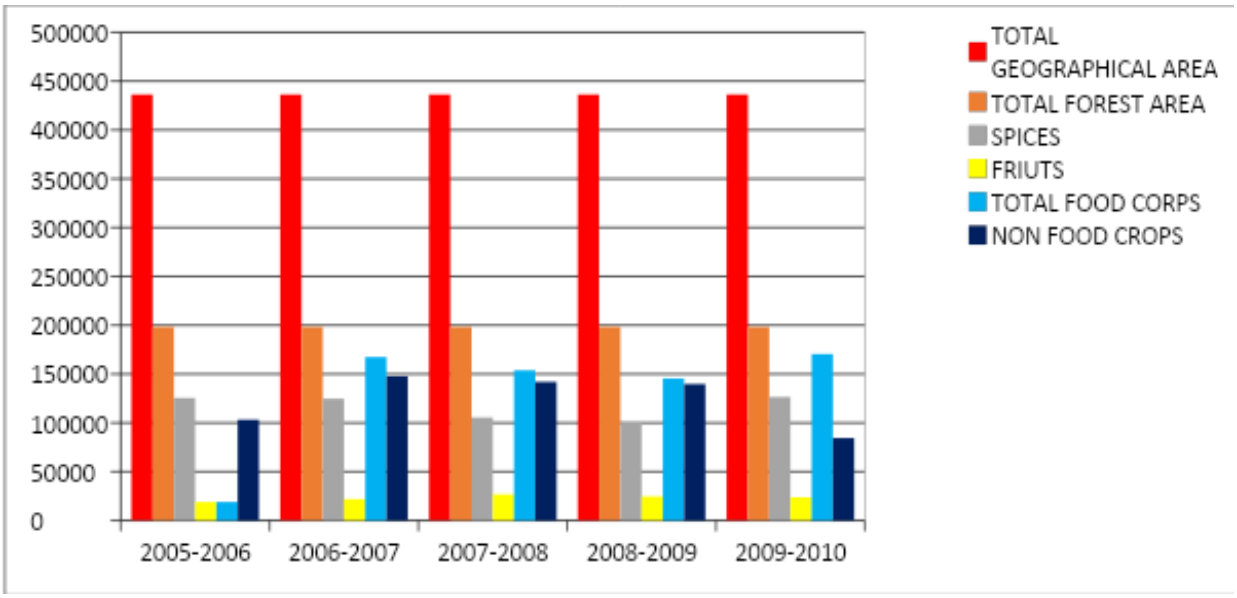
c) Impact of agriculture

Most of the areas showed changed agricultural cultivation methods and most people are cultivating cash crops rather than food products. Most of the paddy cultivations in each panchayath in Idukki changed to different cash crops. Most of the areas in Idukki district are facing drought in summer season, at the same time in rainy season the people are facing flood land slide etc. due to the climate change, most of the paddy cultivation in Marayoor changed to sugarcane. The colder and higher areas of the landscape lying towards the east (Vattavada and Kanthalloor) have vegetable farming.

Comparing with 20 years back most of the area is under the process of changes. In Marayoor region, paddy was a major crop cultivated since the 18th century. But now the majority of the paddy lands were converted into sugarcane plantations.In Munnar most of the land is owned by KDH Company. They use this land for various purposes, like plantation, constructions, mining etc. every year they converting their own forest land to plantation, during the time of field work the team identified the conversion of forest land to jasmine plantation and rose plantation etc.

People mainly cultivate cash crops like Rubber, Catbarry Coffee, Tea, Coconut,Nutmeg, Arecanut etc. In Idukki district the main cultivations are spices. It includes pepper, cardamom, nutmeg, catbarry etc. This type of spices cultivations are increasing day by day. Cardamom Hills is predominantly moist evergreen forests and endured small-scale extraction of wild cardamom from long time ago. However, following the state monopolization of the cardamom trade in the early 19th century, major cardamom growing areas were notified as Cardamom Hill Reserve (CHR). In 2003, a portion of CHR was also gazetted as a National Park (Mathikettan). Cardamom cultivation requires both clearance of the understory growth and opening up of the canopy to enhance light penetration but such manipulation of the evergreen plant community results in the disintegration of the evergreen forest in a relatively short time.

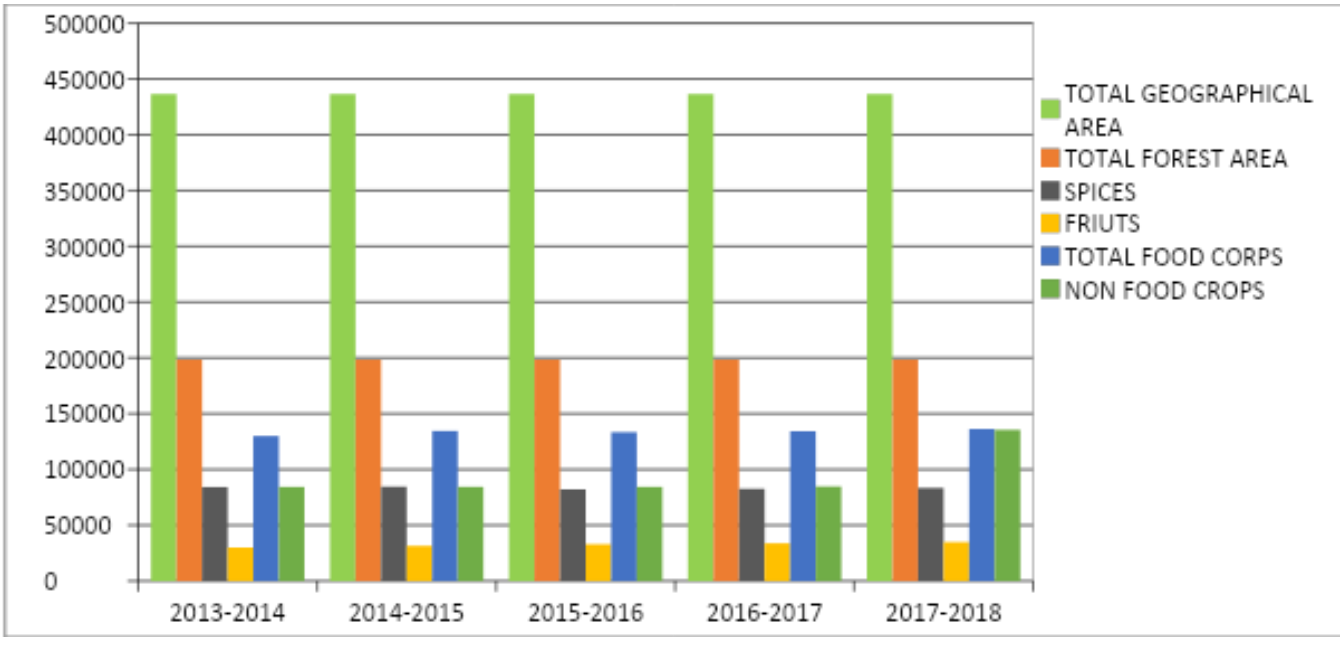
Graph No 2 - Agricultural and non-agricultural productions in Idukki



The graph No: 2 represented the agricultural and non-agricultural productions in Idukki district

Graph No: 2 shows that from 2005 to 2010 a major increase occurred in the field of total food crop cultivation, during this time the non-food crop production decreased. During this time the spices cultivation always maintain the same amount every year

Graph No: 3 - Cultivation in various sectors in Idukki



Graph No: 3 shows that cultivation in various sectors in Idukki district from 2013 to 20018.Comparing with graph no 2 and 3 shows that from 2013-2018 the production was

totally changed. A rapid change occurred in the field of non-food crops area. The spices cultivation and fruit production in this time maintained the same. This increase in non food crops will affect the food security of the local community.

CARDAMOM HILLS

Cardamom Hills are located in south east Kerala and south west Tamil Nadu. They are named so because the major elevation of the hills is perfect to grow cardamom in large quantities, apart from pepper and coffee. The Cardamom Hills cover around 2800 sq. km. area with deep valleys including the drainages of west flowing rivers such as Mullayar, Periyar and Pamba. The hills join the Aryankavu pass in the north, Agasthyamalai Hills to the south, Palni Hills to the north east, and Anaimalai Hills to the north west. The crest of the Cardamom Hills forms the boundary between Tamil Nadu and Kerala. The cardamom Hills which form a salient bio-geographical area in the Western Ghats have played a significant role in the history of the world and human culture on earth..It is the original home of over 1720 species of flowering plants, 16 species of mammals, 91 species of reptiles and 84 species of amphibians. The forests of these areas are considered to be store house of many economically important plants. A number of medicinal plants, wood fuel plants, and Non- wood forest Products have evolved in this area. The wild varieties of many different crops like rice, sugarcane, black pepper, ginger, turmeric, etc., are also found in these jungles. There are also numerous orchids and balsams endemic to this area. The selection of shade trees and its regulation is considered as a vital process in cardamom cultivation. The shade trees like Karana, vayana, murikku, kanikonna, vaka, veetti, anjili etc. perform as a breeding site for bees which are the major pollinators of cardamom crop. Also, the leaf mulches of the shade trees protect the top soil as well as enrich the soil nutrients. Expert committee appointed by the Government of Kerala headed by V. Gopinathan, and by N. Chandrasekharan Nair had earlier warned the adverse ecological impact of clearing of undergrowth and shade regulation in CHR area. Extensive cultivation of eucalyptus and acacia trees in and around the cardamom growing tracts were started under the Social Forestry scheme to meet the increasing firewood and timber demand for the drying the cardamom. The timber was also used to feed the pulpwood factories. Large eucalyptus trees were planted in both private as well as forest lands especially at Kottakkambur, Vattavada, Nedumkandam Cheruthoni, Idukki and Kattappana areas. resulting in significant water shortage in these areas.

Cardamom

d) Impact of quarrying activities

Table No 5 shows the Details of quarries in Idukkidistrict

Table No: 5

S.L	Code	Mineral	Rock type	Village
1	287	Granite(Building Stone)	Granite	KDH
2	288	Granite(Building Stone)	Migmatite	KDH
3	289	Granite(Building Stone)	Granite	KDH
4	290	Granite(Building Stone)	Granite	KDH
5	291	Granite(Building Stone)	Granite	KDH
6	292	Granite(Building Stone)	Granite	KDH
7	293	Granite(Building Stone)	Granite	KDH

8	295	Granite(Building Stone)	Granite Gneiss	Keezhathoor
9	296	Granite(Building Stone)	Granite Gneiss	Keezhathoor
10	297	Granite(Building Stone)	Granite Gneiss	Keezhathoor
11	298	Dimension Stone	Pink Granite	Kanthalloor
12	299	Dimension Stone	Granite Gneiss	Kanthalloor
13	300	Dimension Stone	Pink Granite	Kanthalloor
14	301	Granite(Building Stone)	Migmatite	Kanthalloor
15	302	Granite(Building Stone)	Biotite Gneiss	Kanthalloor
16	303	Granite(Building Stone)	Migmatite	Anaviratty
17	304	Granite(Building Stone)	Migmatite	Mannamkandom
18	305	Granite(Building Stone)	Migmatite	Mannamkandom
19	306	Granite(Building Stone)	Migmatite	Mannamkandom
20	307	Granite(Building Stone)	Migmatite	Mannamkandom
21	308	Granite(Building Stone)	Migmatite	Mannamkandom

Table No: 6 shows most of the Quarries are located at Mannankandam village under Devikulam taluk in Adimaly panchayath

	Code	**Mineral**	**Rock type**	**Village**
1	309	Granite(Building Stone)	Biotite Gneiss	Mannamkandom
2	310	Granite(Building Stone)	Biotite Gneiss	Mannamkandom
3	311	Granite(Building Stone)	Migmatite	Mannamkandom
4	312	Granite(Building Stone)	Migmatite	Mannamkandom

5	313	Granite(Building Stone)	Migmatite	Mannamkandom
6	314	Granite(Building Stone)	Migmatite	Mannamkandom
7	317	Granite(BuildingStone)	Migmatite	Mannamkandom
8	318	Granite(Building Stone)	Migmatite	Mannamkandom
9	321	Granite(Building Stone)	Biotite Gneiss	Mannamkandom
10	322	Granite(Building Stone)	Migmatite	Mannamkandom

The study Impact assessment of flood/ landslides on biodiversity and ecosystem of Idukki district conducted by Kerala State Bio Diversity Board shows that Udumbanchola, Mariyapuram, Vazhathoppe, Adimali, Kanjikuzhy, And Kamakshi panchayath areas faced severe damage in private sector and the main plantations affected are Cardamom, Rubber, Pepper, Coffee, Cocoa, and Tea. The restoration of these sectors will take a long time. This data shows that Adimalypanchayath is one severely affected areas so there is need to investigate whether at there is any connection with the impact of quarrying and landslide. The impact of quarrying activities leads to lots of complications to the environment. it will lead to biodiversity loss, air pollution, water pollution, noise pollution, contamination of ground water and surface water, soil erosion,

The leakage of chemicals from qualifying sites can also have detrimental effects on the health of the population living around the site. The landslides were severe in hilly districts like Idukki, Wayanad etc. During the monsoon season due to the blasting of rock soil erosion may happen and it also leads to landslides, land degradation, etc. During the time of blasting it will create noise pollution and air pollution. The quarrying activities also affect the bio diversity because it will destroy the habitat of different species of flora and fauna. It also leads to loss of fertile topsoil.

c) IMPACTS OF HYDEL PROJECT

Small and giant Hydel projects dams in Idukki district are constructed in large number. The main focus of constructing dams is maintaining the electricity supply for different purpose.

Most of the dams can store a huge amount of and is also used for hydal tourism like boating, fishing and the stored water also provide habitat for flora and fauna. The water is also used by people who live near side the dams for their daily needs. Dams raise the natural level of rivers, so flooding lands previously settled, farmed or periodically grazed. Dam construction results in the loss of productive land beneath the reservoir.

The main micro and macro dams in idukki district are listed below.

IDUKKI DAM

The IDUKKI dam is one of the biggest arch dams in Asia, at a height of 555 feet between two mountains – Kuravanmala and Kurathimala

ANAYIRANGAL DAM

The Aanayirangal dam is one of the biggest earth dams in Asia, situated 22 kms away from Munnar (closer to Chinnakkanal). Only rock and sand used for the construction of this dam. At season the water will fill around 34km perimeter. It is surrounded by Tata Tea plantations, coffee, tea and cardamom plantations in the evergreen forests. Hanging bridge connects tea plantations on opposite sides.

CHERUTHONI DAM

Cheruthony Dam is a 138m tall concrete gravity dam. This dam was constructed as part of the Idukki Hydroelectric Project along with two other dams at Idukki and Kulamavu.It is built across the Cheruthoni River, which is one of the major tributaries of the Periyar River.

The water impounded by these three dams of Idukki, Cheruthony and Kulamavu has formed a single reservoir spread over 60km on a height of 2300 ft above Mean Seal Level and the water stored, is used for production of electricity at the Moolamattom Power house.

The spill way of the Idukki Reservoir is in the Cheruthony dam. Cheruthony is the largest and highest gravity dam in Kerala. (http://idukki-district.com/dams-in-idukki/)

KALLARKUTTY DAM

The Kallarkutty Dam was constructed in 1961 as the part of Neriamangalamhydro electric project across the Muthirappuzha River. It is a gravity masonry dam, with a reservoir spread about 0.648 sqkm and has 6.88 million cubic meter capacity. (http://idukki-district.com/dams-in-idukki/)

KOCHU PAMBA DAM

Kochu Pampa is in the boarder of Idukki- Pathanamthitta District**.**

KULAMAVU DAM

Kulamavu Dam, one of the three dams of Idukki Reservoir Project, is situated at Kulamavu a famous hill station in Idukki District. The Dam is constructed in 1961. Kulamavu Dam was constructed to prevent the water escape through a rivulet called Kallivally, 30 km west to Idukki Arch DamKulamavu extends between rocky hills to form the 33 sq km reservoir.

KUNDALA DAM

Situated at 1700 Mtr above sea level, Kundala Lake is located at 25 Km away from Munnar on the way to Top Station, located amidst a dense forest. The construction of Sethuparvathy Dam at Kundala was completed in the year 1946, as a part of Pallivasal Hydro Electric Project, when it was found that the reservoir at Munnar was not getting adequate water. Kundala Arch Dam is Asia's first Arch Dam.

LOWER PERIYAR DAM

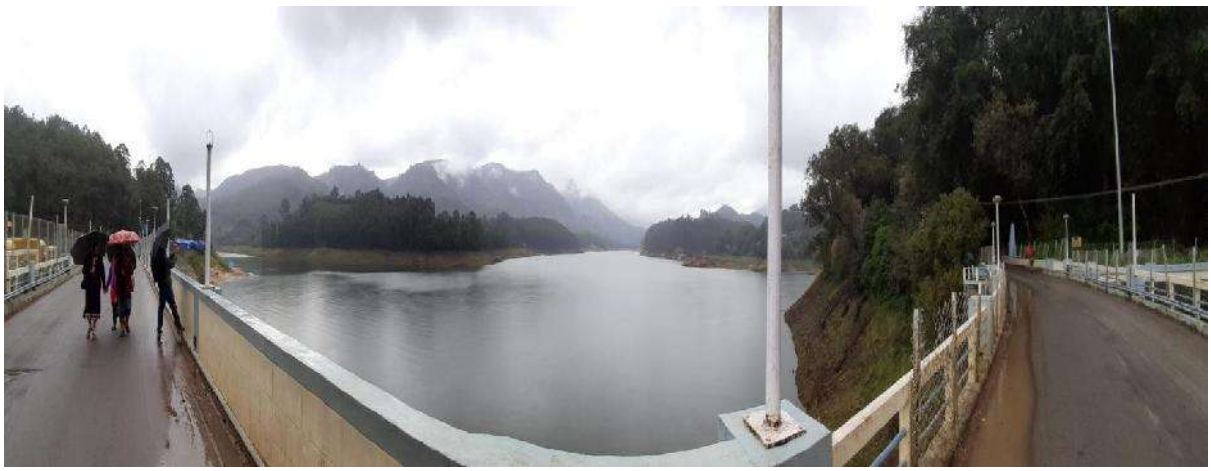
Lower Periyar Dam is the part of Lover PeriyarHydroelectric project.

MALANKARA RESERVOIR

Malankara Reservoir is located at a distance of about 6 Km from Thodupuzha,

MATTUPETTY DAM

The dam of Mattupetty is a storage concrete gravity dam. The surface area of the dam is 323 hectares.



Mattuppetty dam panorama view

MULLAPPERIYAR DAM

The Mullaperiyar Dam is a masonry gravity dam built on the Periyar River in Kerala. The dam is located 2889 feet above mean sea level on the Cardamom Hills of the Western Ghats in Thekkadi, Idukki District. The Periyar National Park in Thekkady is located around the dam's reservoir. The dam is located in Kerala on the river Periyar, but is operated and maintained by Tamil Nadu state. Although the Periyar River has a total catchment area of 5398 km2 with 114 km2 in Tamil Nadu, the catchment area of the Mullaperiyar Dam itself lies entirely in Kerala.

MUNNAR HEAD WORKS DAM

RamaswamyIyer headworks dam is one kilometre away from Munnar town

PONMUDY DAM

Ponmudi Dam in the Idukki District is constructed across the Panniar River, a tributary of the Periyar. The dam is about 15 km from Adimali, on the way to Rajakkad.

Now a day's one of the issues found due to boating as part of hydal tourism is that most of the water are contaminated due to the oil leakage so some animals like elephant and other animals hesitate to drink this water and boating here also make noise problems and pollution in this area. During the field trip the team identified that due to tourism in hydals area the tourist also throw plastic waste and other waste products in the water and the near side the area. As part of that the Forest gazette published by Devikulam range in the Aanayirangal dam area boating in the dam has been restricted.

Boating in Aanayirangal dam area

Aanayirangal dam area.

Area of forest submerged due to each dam and people relocated

Kerala has sixty river valley project sites, half of which are hydel and the other half were irrigation dams. The hydel dams have all come up in the forested hill areas in Western Ghats and the irrigation dams are located amidst the foot hills, both submerging large tracts of forests and fertile valleys. After the construction of large dams in many forested areas in Kerala, the adjacent catchment forests have been declared Wildlife Sanctuaries. The Periyar Tiger Reserve, Neyyar, Peppara, Chenduruny, Parambikulam, Peechi – Vazhani, Chimoni and Idukki Wildlife Sanctuaries are all protected areas in the catchments of river valley projects.

Most of the tribes meet their livelihood from the forest areas. Due to the reallocation and construction of dams they lost the freedom of fishing, hunting, and gathering in the previous settlement. The available data about the forest submerged and people relocated due to the construction of Idukki dam and the pooyamkutty hydal project is as folows.

Among the 1394 families affected by the Idukki dam, many were tribals and three villages namely Ayyappankoil, Kanjiyar, and Vairamony were completely submerged by the dam.

Protected Areas in the Catchments of Dams in Kerala

Protected Area	Area (Sq. Km.)	Year
• Idukki	70	1976
• Thattekad	25	1983

Source: Prakash (2002)

Number of Families / Persons Displaced by Water Resource Projects

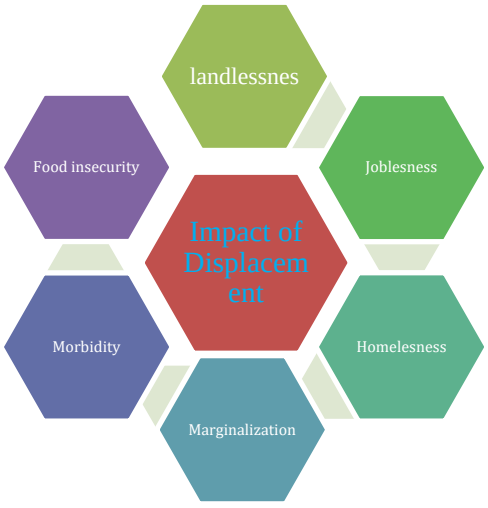
Tabile 7

Name of the Project	Type	Families	Persons	Source
Idukki Hydroelectric Project	Hydel	1394	7388	Idukki Hydroelectric Project
Pooyamkutty Hydroelectric Project	Hydel	184	773	KFRI, Peechi.

Source: Source: Murickan et.al. (2003)

Impact of displacement due to development project

Figure: 2



Aanayirangal dam

The oldest inhabitants of the poyamkutty river catchment area the Muthuvans, whose 50 scattered hamlets are in the submergible area

6.5. Conclusion

The initial study conducted showed that the development of the production sector has played an important role in the ecological changes that occurred in the Munnar landscape area. Year by year, the number of tourists in the area are on the hike, especially the number of domestic tourists. This has brought many changes in the ecology. Even though the Government gets a huge income from this sector, tourism has affected the nature adversely and caused problems too. Changes were happening in the agricultural area. The major plantations in the different panchayath of the Devikulam Taluk includes; Tea plantation, Eucalyptus plantation, Rose plantation and Jasmine plantation. The paddy cultivation is vulnerable in most of the panchayath. There is a shift in the cultivation especially from paddy to cash crops. Day by day, there are changes occurring in landscapes such as renovations and developments. More than 15 tribal settlements were visited during the fieldwork and the major issues facing the tribal population were listed.

Major findings

Population growth in Idukki :- The population growth in Idukki district decreased 1.7 % from 2001 to 2011 although from 1991 to 2011 census in Idukki district showed that a record increase of 7.03 percentage in total population growth.

Tourism: - Data shows that there is a rapid increase of foreign tourists from 2012 to 2015 and then a decrease in the flow of visitors till 2018 but the domestic tourist visits were

increasing day by day. In Athirapally, the foreign tourist arrival was in an increased rate till 2015 after that a small decrease happened in the foreign visitors.

Quarries:- During the survey in 9 Panchayats it was observed reported that Panchayats in the study area is not giving license to quarries, but crushers are still working in most of the Panchayats especially in Adimali, Kanthalloor, etc. The owners of these quarries collect stone from other district and use this stone for crushing.

Number of dams: - There are more than 12 dams in Idukki. The available data regarding diversion of productive land for dams is from Pooyamkutty dam and Idukki dam. The Pooyamkutty dam site will submerge one of the most dense forests which includes 3000 hectors of lush vegetation including trees, vines, shrubs and creepers of every variety. During the construction of Idukki dam three villages namely Ayyappan Koil, Kanjiyar, and Vairamony were completely submerged.

Non food crops cultivation:- During 2005 to 2018 the cultivation of non food crops increased from 103,222 Ha to 135,519 Ha an increase of 31. 3%

Source of data

- Survey of India →Topo sheet Of Idukki District
- Directorate Mining and Geology department →List of licensed quarries and crashers in Idukki district
- Directorate of Tourism department → list of domestic and foreign tourist visitors in study area from 2002 -2018
- District industries Centre Cheruthoni→ List of all industries in the study area
- Forest headquarters → working plan, forest gazettes etc.
- Soil survey department → soil mapping data (progressing)
- Peera made development society
- Land use board→ 11 panchayath (study area boundary shape file, progressing)

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UNDP- India High Range Landscape Project (Munnar)

Expert Consultant Meeting – Minutes

Date: 12/03/2019

Time: 11:00 am to 3.30 PM

Participants:

Dr. S.C. Joshi IFS (Retd.), Chairman, KSBB
Prof. E. Kunhikrishnan,, Associate Professor (Retd.), Department of Zoology, University of Kerala, Thiruvananthapuram
Dr. Jomy Augustine ,Associate Professor and H.O.D, Dept. of Botany, St. Thomas College, Palai, Kottayam
Dr. V. Balakrishnan, Member Secretary, KSBB
Dr. Preetha N, Technical Associate, KSBB
Dr. Pradeep C.G, Technical Associate, KSBB
Divin Murukesh, Research Associate
Bindya A, Project Assistant

The meeting was chaired by Dr. S.C. Joshi IFS (Retd.), Chairman, KSBB . Chairman gave a brief overview of the project and the objectives were discussed in details. A tentative work plan including draft questionnaire for conducting FDGs were circulated. It was explained that the main objective was to develop a methodology for PBR preparation and incorporation of the major gaps identified in the PBR (Annexure). It was also noted that the documentation of process of creating standard PBR is also necessary. It was suggested that the PBR formats may be modified to incorporate all the necessary information. Meaning thereby that these modified formats should be finally fitted in recently prepared ePBR by NIC, Thiruvananthapuram. Therefore it must that UNDP team may interact closely as many times as required with NIC officials, particularly Dr. Kasthuri so that the modifications suggested by UNDP experts are made within the boundaries on suggestions limitations suggested by Dr. Kasthuri inorder to ensure that suggestions after field visit by UNDP consultants get adjusted in the e-PBR made by NIC. This is highly essential as KSBB has already developed an e-PBR after working with NIC for more than one year and utilizing about 9.9 lakhs of rupees on the finalization of ePBR format to make it user friendly and more useful by rationalising existing formats, simplifying some of them and adding certain new fields. Therefore, it is essential that UNDP expert team must discuss with NIC along with Dr. Preetha to understand how the new ePBR being suggested under the project (after standardising the methodology) could fit in the ePBR now being filled up by LSGs in coming months. This is essential to avoid any incompatibility issue with ePBR already made by NIC.

Member Secretary, suggested on focussing on supply chain and value chain of the tradable bio resource of the concerned panchayat. He pointed out that prioritising the areas is necessary otherwise huge volumes of data will be generated which will be difficult to handle. Accordingly it was suggested that key areas shall be bioresources having commercial potential and IPR for medicinal, food and nutraceuticals, biocultural practises. It was agreed that since the methodology will be implemented across the state while updating PBR certain thumb rules has to be developed for collection of information, identification of knowledge providers, for conducting FDGs, PRAs etc.

Dr Kunhikrishnan pointed out several cases studies relating to the traditional knowledge practises relating to soil, resource use etc. It was suggested that a handbook will be brought out regarding incorporating the methodology and thumb rules. The work done during the 1st phase of the project was explained and it was decided to incorporate the data also in the present work and avoid duplication of work

Dr. S.C. Joshi concluded with opinion that as part of this project at least one model PBR will be developed and that data collection for PBR updation is a continuous process and suggested the experts to continue the discussion with the newly appointed team for field execution. The expert team suggested mapping of study area using GIS technique. It was also decided to conduct monthly meetings at Head office regarding the progress of the project.

As per the discussions the objectives were reworked as:

Objectives

1. Systematic Group wise and Taxa wise documentation and compilation of available information.
2. Documentation of the economically important plants, animals, microbes, insects etc., and supply chain, value chain of tradable bioresources .
3. Identification of the research and management priorities and recommend policy and plan initiatives for long term conservation of Munnar landscape.

Initial Action Plan

- In the first phase of discussion Prof. E. Kunhikrishnan suggested to collect secondary data of Birds, Butterflies, Reptiles, Odonate, fishes and Amphibians from scientific journals to find their type locality, endemism, IUCN category, scheduled category, and comments on its population status.
- As a by product of this categorisation, he pointed out the possibilities of upgrading the species if data deficient and the possibilities of incorporating it as notified species under Section 38 of BD Act
- Collection of existing data of flora and fauna using various resources such as E bird, forest department reports, surveys, ZSI, newspaper cuttings and photographs etc.
- Sampling sites are to be finalised with an objective of all representative locations of the study area. Altitude may also be considered while selecting the study location
- Dr. Jomy Augustine provided various sources and references on flora of the study area.
- It was suggested to get required permissions for the KSBB team from Forest department.
- The team planned for incorporating external resource persons in the respective fields for the upcoming field study.
- The team planned for a preliminary field visit on 29th March to 31st March 2019 (tentative).

Expected outcome: Development of standard methodology of it for preparation and upgradation of ePBR and development of at least one PBR as model PBR and its seamless incorporation in the ePBR created by NIC which is now going to be filled up by LSGs.

- The meeting concluded at 3:30PM

Kerala State Biodiversity Board

Dr. S.C. Joshi IFS (Retd.)

Annxure 2

MINUTES OF THE FIRST TECHNICAL AGENCIES MEETING FOR THE GOI-UNDP-GEF INDIA HIGH RANGE MOUNTAIN LANDSCAPE PROJECT

1. The meeting with the Technical Agencies for the GoI-UNDP-GEF India High Range Mountain Landscape Project was held at Hotel Hycinth, Thiruvananthapuram on June 18, 2019 at 10.30 a.m. under the chairmanship of Dr. S.K. Khanduri, Senior Technical advisor, UNDP and Smt Padma Mahanti IFS, State Nodal Officer, as Co-Chair. The list of participants is attached as Annexure 1. At the onset, Shri Jerin Thomas Abraham, Project Officer from the Project Management Unit (PMU) welcomed all the participants and facilitated a round of introduction. Thereafter, the context was set by Anusha Sharma, Project Officer, NPMU. She gave an overview of the project and its deliverables.

2. The chairman apprised the committee of the immediate need to kick-start the various programmes and called for a coordinated effort between the various Technical Agencies and the PMU to ensure successful realization of the project outcomes. He then invited the agencies to present their work updates and concerns, if any.

3. The first presentation was made by Co-Investigator Dr. P. Balasubramanian, Senior Principal Scientist, Salim Ali Centre for Ornithology and Natural History (SACON), Coimbatore. He presented the updates on "Ecosystem requirements of Hornbills and assess the status and distribution of select mammals in Anchunad and adjoining landscape".

   - Dr. Balasubramanian reported that the Indian Grey Hornbill was not figured during the observation visits to Munnar landscape; other species figured include Great Hornbill, Malabar Grey Hornbill and Malabar Pied Hornbill; the species figured were categorized based on the forest types, protected areas and tree species; ideal location for nesting is Evergreen forest areas; *Macaranga peltata* was observed to be the favoured food plant of Malabar Grey Hornbill; Vazhachal and Thattekkad areas are in the first and second positions, respectively regarding the number of species located and that the hornbill breeding season is from January-April. He also explained a format of literature survey sample sheet. Further, he explained that

similar studies have already been conducted in Nilgiri and Anamalai, however in the Munnar landscape, studies have been conducted only in Vazhachal area. Hence the study is relevant to the project and the distribution map presented is relevant to the study since no such data is readily available. A list of mammals occurring in Anchunad landscape was also presented.

- In response to the presentation by SACON, the State Nodal Officer, Smt. Padma Mahanti, IFS, indicated that additional data on shifting of nests and changes in nest patterns will be helpful to have more insightful findings. She stressed on the need to understand the changes in breeding seasons, if any, in the post flood scenario. She also highlighted the need for detailed literature review and clarified that the field data should substantiate the purpose of the study. She also requested SACON to compare the change in hornbill population size, nesting pattern and nesting location with available literature.

- Shri Baiju Krishnan, Assistant Conservator of Forests, Department of Forest and Wildlife, suggested to analyse the regenerative status of associated species. He also suggested to undertake local migration analysis using invasive molecular tools, to which SACON replied that molecular aspect is not built in the project and may not be possible.

- The Chairman commented that there is a need for preparing a large mammals distribution map and specific data about the landscape. He further suggested SACON to focus on 1 or 2 species of mammals.

- The PMU clarified that the Project Results Framework mandates report on Nilgiri Tahr and Malabar Grizzled Squirrel. The PMU also requested SACON to map the threats intensity and device plans for threats and conservation management and effective monitoring of the protected areas.

- In response to the concern raised by SACON regarding clarity on project area, the State Nodal Officer clarified that more prominence is to be given to the landscape units rather than the administrative divisions.

- The constraints raised by SACON include the non-availability of adequate population data, limited literature review available for certain species and

ambiguity regarding the Terms of Reference. They also committed that the distribution map would be prepared once the entire landscape is covered.

4. The second presentation was made by Dr. Udaya S. Mishra, Professor, Centre for Development Studies and Consultant with the Kerala Institute of Local Administration (KILA) on the "Creation of benchmark for socio-economic database".

   - The data presented was primarily descriptive in nature based on the previous studies. Creation of benchmark for socio-economic database for concurrent evaluation and understanding the effectiveness of sustainable resource governance in the landscape is the major focus of the study. A comparison of 11 Grama Panchayats in terms of work participation rate, gender composition in Agri and Non-Agriculture Livelihoods and SC/ST demographics was presented. Other important aspects discussed include migration and climate change in Munnar landscape based on the rainfall changes over a period of 6 years. Dr. Mishra added that the comparison of a period of 15-20 years of rainfall data is required to depict the significant changes.

   - The Chairman stated that there could be variations in the Munnar landscape from Idukki district in general. Hence, there needs to be more focus on the economic activities in natural resource sector, livelihoods pattern and financial inclusion in the Munnar landscape specifically. Regarding access to markets, he suggested to include subsistence-based livelihood analysis.

   - The State Nodal Officer suggested KILA to undertake impact study and alteration reasons for drift in female to male work participation. She also requested KILA to include temporal profile change of population characteristics and economic characteristics and record whether the profile change is in response to natural changes; prepare database on subsistence-based and commercial activities; document the history of landscape with respect to landuses, landscape and migration and record livelihood patterns of new generation, which is not dependent on tea industry. She indicated that gender composition in the work participation rate is an important aspect to be studied further.

   - The PMU added that a stock assessment of contemporary issues at the panchayat level regarding the patterns of revenue, migration, tourism and unemployment over

two decades could give a comprehensive picture of the socio-economic scenario in the project landscape. PMU also stressed the need to record the livelihood patterns of the new generation in the project landscape, not dependent on the tea industry.

- Proposed interventions by KILA intend to bring forth a comprehensive picture of livelihood patterns, indirect indicators of market dependence and history of the landscape.

- It was decided to convene a separate meeting of KILA with the PMU.

5. Dr. Jibini V. Kurian from KILA further presented the updates on "Social change among Tribes – trajectory of development – focus on Edamalakudy". They proposed the tools to be used for the study and informed that 20% of the total households (874) would be considered for the sample survey.

   - The Chairman suggested that there is a need for focusing on the cultural history and detailed review of literature is needed.

   - The State Nodal Officer pointed out that effect of cardamom cultivation on the socio-economic framework needs to be included and that the newly introduced high yielding varieties of cardamom and its impact on the forest fragmentation is to be studied in detail, since there has been a shift from collectors and gatherers to agriculturists. She asked KILA to elucidate the impact of introduction of high-yielding variety of cardamom on the socio-economic fabric. She also stressed the need to focus on the trend of indigenous cardamom variety being taken over by high-yielding variety by proxy planters. She further requested to explore the possibilities of system reversion and restoration of gene pool; undertake specific review of literature as a prerequisite for the study; focus on migration of Muthuvans and its economic implications and also on fragmentation due to roads, total electrification, etc. and clarify on end-market for produce.

   - Shri Baiju suggested to explore socio-economic effects of man-animal conflicts and assess the degree of change in forest dependence.

- The PMU suggested that higher focus may be placed on life and livelihoods; dependence on the forest-based livelihoods; change of food habits over the period; status on the use of traditional knowledge and the influence of proxy planters.

6. The third presentation was made by Team Leader, Shri C Dinil Sony, Senior Principal Scientist, Centre for Water Resources Development and management (CWRDM) on "Hydrological Investigations in the High Range Mountain Landscape, Kerala."

   - The presentation was based on proposed outcomes such as hydrological investigations in high range landscape, water availability, estimation of water demand, preparation of water resource management plan and technical support to LSGIs. He explained that the Government water schemes are based on the spring/streams-based water sources and water availability is adversely affected during the summer season. Five water samples were reported to be collected from each location except Edamalakudy and three wards of Athirappilly, making a total of 597 samples. The highest pH value was reported to be obtained from ward 5 of Athirappilly (9.02) and the least value from ward 3 of Marayoor (4.52).

   - State Nodal Officer specified that 20% increase in the water quality is one of the indicators to be achieved by the end of this project and hence, other relevant factors influencing the water quality needs to be focused in detail; post flood scenario is to be taken into consideration and the audit of available structures and the ones clogged post flood needs to be taken up. She reiterated that CWRDM is expected to come up with specific recommendations towards the achievement of the desired outcomes.

   - The Chairman indicated that there is a need for checking the availability of watershed maps and the data regarding the ground water/other water resources.

   - The PMU stressed on the requirement of GIS maps indicating the water sources and possible infrastructure that require renovation in the landscape at the earliest. PMU further explained that the project aims to develop one demonstration model in each panchayat and therefore, among the 11 Gram Panchayaths, at least one structure each requiring renovation needs to be identified scientifically within this year to

initiate implementation. Also, the PMU requested support for determining the causes of pollution and devising remedial measures for the revival of Nallathanni River.

7. The fourth presentation was made by Principle Investigator, Dr. R Jayaraj, Scientist, Kerala Forest Research Institute (KFRI) on "The pattern of usage of pesticides and their impact on the ecosystem of plantations and adjacent areas in the GEF Munnar Landscape project area". He explained that the study focuses on the major cropping systems in the project area and pattern of pesticide usage in the region, analysis of various potential pesticide residues in different matrices and effect on the environment and fauna. He further informed that the sample collection strategy would be random sampling method.

   - The State Nodal Officer requested to specify the end results of the study. In response to this, the Principal Investigator indicated that there is extensive use of pesticides in tea estates in the landscape and recommendations for sustainable practices could be stated. However, the Principal Investigator opined that adoption of such practices by the tea estates may not be practicable due to various other factors.

     The Chairman suggested to include more data from the impact areas and stressed on the need to focus more on sustainability and conservation. He suggested to collect more samples from downstream and compare with forest near plantations and forest in upper reaches. With regard to studies on animals, The Chairman requested to strategize sample collection from road kills, natural death, etc. in coordination with forest officials.

   - Shri Baiju suggested to focus on pesticides proposed to be banned or alternatives suggested for recommendation to government.

   - The PMU suggested to formulate mitigation plans / best practices for pesticides across India.

   - The Chairman requested KFRI to focus on sustainability of crops subjected to pesticide use and deduce means to mainstream conservation in production sectors.

- Dr. V. B. Sreekumar from KFRI further presented the updates on "Study on diversity and current status of fish and fisheries in GEF-Munnar landscape project area". The presentation focused on the fish species and biodiversity pattern and reported that 53 fish samples were collected from 15 field surveys and 61 species of fishes were identified, including. critically endangered (02), endangered (09), vulnerable (06) and near threatened (01). The need to study the adverse effects in the Chalakkudy region due to the floods were highlighted. It was also informed that pre-flood data is not available. The highest number of fish species were reported to be identified from Athirappilly (49 species), followed by 25 species from Kuttampuzha covering the Pooyamkutty and Edamalayar. The interlinkage of migratory birds and fish fauna in Thattekad and the lack of sufficient literature on this topic from the project landscape were also highlighted. Further, general findings such as community fishing from dam areas such as Gundala, Mattupetty and Athirappilly areas were presented.

- The State Nodal Officer suggested to study the changes in fish diversity pre and post floods, wherever it is applicable. She stressed on the need for recommendations towards regenerating or reintroducing the indigenous varieties. She also asked to elucidate the dependence of local community on fishing, taking into consideration the impacts of introduction of exotic species. She further suggested to explore any shift in fish species post flood, analyse pre-flood and post-flood scenario and means of revival. She also requested to record the extent of invasive species in bird sanctuaries, since migratory birds are dependent on indigenous fish species.

- The PMU suggested to study the impact of the loss of riparian forests in the project landscape on the indigenous fish varieties.

- The Chairman requested the PMU to immediately follow-up the status of the proposal to study the impact of invasive alien species on ecology of GEF-Munnar landscape project area and adopt requisite measures to facilitate commissioning of the study on urgent basis.

8. The fifth presentation was made by The Kerala State Biodiversity Board (KSBB) on "Documentation and compilation of existing information on various taxa (flora and fauna), and identification of critical gaps in knowledge in the GEF-Munnar landscape

project area." KSBB identified several gaps in maintenance of People's Biodiversity Registers (PBRs) in the panchayats and reported that the Biodiversity Management Committees (BMCs) are ineffective in the project areas. Another finding reported was pertaining to the overexploitation of medicinal plants and lack of awareness in Access and Benefit Sharing (ABS) was raised as a major concern. Trade analysis of Pinari, Karimkurinji, Marotti and Pachottitholi was shown in the presentation.

- The Chairman and the State Nodal Officer enquired whether sufficient literature was available from the project area. They suggested to focus more on the prominent bio-resources such as honey, jaggery etc. They also indicated that the project implementation should focus on the capacity building of BMCs and suggested KSBB to work in collaboration with the PMU. The State Nodal Officer further suggested to focus on the biodiversity heritage sites, documentation of traditional knowledge and its use in livelihoods and water conservation. In response to this, KSBB specified that only limited literature is available on tradeable bio-resource.

- The PMU suggested to focus on value-chain analysis of potential products like honey, jaggery, cardamom, etc. It was also decided to convene a separate meeting between the PMU and KSBB to device conservation strategies to protect the RET species and degraded forests.

- KSBB further presented the updates on "Review of ecological and development history of various sectors and changes in selected ecological units in GEF-Munnar landscape project area".

- The Chairman and the State Nodal Officer specified the need to source secondary information from earliest timeline available by reviewing Gazettes, old work plans and Reserve Notifications. They also requested to define the gaps in secondary data.

- Shri Baiju suggested to focus on vulnerable and endangered specific niches and habitats.

9. The following modalities were suggested by The Chairman and the State Nodal Officer to enable the smooth functioning and implementation of the project.

- Monthly review meeting between the Technical Agencies and the PMU by means of Skype calls/Video Conferences, wherein, the alignment of project activities with outcome may be reviewed.

- All studies should state necessary literature review and based on it the uniqueness of the study.

- The project deliverables may be reviewed by a group of experts, selected by the State Nodal Officer, State Project Director and PMU.

- Status of payment can be intimated to Principal Investigator and PMU.

- Project officers of PMU will be the point of contact of all Technical Agencies and all reports may be copied to PMU.

- For duplication check of project activities, as well to have better coherence with the Project objectives and outcomes, the PMU will share a template to the Technical Agencies for sharing information on the nature of work and data.

- Field visits in Munnar landscape will be facilitated by the PMU, upon prior intimation through the State Nodal Officer. Visits of various agencies to remote areas like Edamalakudy may be coordinated and calendar may be prepared for the visits.

- The second progress report may be submitted by the Technical Agencies to UNDP with copy to PMU, incorporating the comments and reviews of this meeting.

10. The Chairman thanked the committee members for their valuable presence and updates and requested a coordinated effort between the Technical Agencies and PMU to avoid duplication and facilitate implementation of the project.

List of participants of the first Technical Agencies meeting for the GoI-UNDP-GEF India High Range Mountain Landscape Project, held on 18.06.2019.

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KERALA STATE BIODIVERSITY BOARD

Meeting minutes
June 26, 2019

Opening:

The regular meeting with consultative experts for the implementation of UNDP-HRML-projects- (i) Documentation and Compilation of Existing Information on Various Taxa (Flora and Fauna), and Identification of Critical Gaps in Knowledge in the GEF-Munnar Landscape Project Area; (ii) Review of ecological and development history of various sectors and changes in selected ecological units in Gef-Munnar landscape project area.
was called to order at 11:00 AM on June 26, 2019 in the Head Quarters of Kerala State Biodiversity Board.

Present:

Dr. S. C. Joshi IFS (Retd.), Chairman, KSBB (Principal Investigator)
Prof. (Dr.) B. R. Reghunath, Retd. Dean, Agro biodiversity, Kerala Agriculture University, Vellayani
Prof. E. Kunhikrishnan, Associate Prof. (Retd.), Dept. of Zoology, University of Kerala, TVM
Dr. Radhakrishnan P., Director Project, Global Urban Canopy, Thrissur
Mr. Anand Zacharias, Scientist, MSSRF, Changanassery
Dr. V. Balakrishnan, Member Secretary, KSBB (Co-Principal Investigator)
Dr. N. Preetha, KSBB (Technical Associate)
Dr. S. Rajasekharan, Senior Project Consultant (only in AN session)
Mr. A. L. Aneesh kumar, KSBB (Research Associate)
Mr. M. K. Justin, KSBB (Research Associate)
Mrs. Haritha, KSBB (Project Assistant)
Miss. A. Bindya, KSBB (Project Assistant)

Presentations:

Aneesh kumar and Justin presented the activities done so far and major difficulties faced in the field level implementation. In between the presentation, chairman and other technical experts raised questions and suggestions were made for next level programme. The highlighted suggestions are listed below.

Key outcomes:

The key outcomes of the Study 1 based on discussions and the review meeting of UNDP are:

1. Data of flora and fauna of project areas Focus on threatened and endemic species.
2. Data of tradable bio-resources Focus on medicinal plants and threatened species.
3. Identification of areas of biodiversity importance (e.g. Areas where endemic species of Balsam are found).
4. Checklist of RET and endemic flora of Anjunad valley.
5. One of the most important outcome is to develop methodology for PBR upgradation. (This should be done as suggested in Technical suggestion point 2)
6. (Video and Success stories) of best practices related to Biodiversity conservation.
7. Checklist of Illegal (smuggling) and unsustainable bio-resources traded with emphasis on medicinal plants and threatened species.

8. Identification of bio-resources with ABS potential. Chairman suggested that this should be done after discussing with foresters, angadikada people, Vaidyans, tribal societies and other known sources as suggested by Dr. B.R.Reghunth in Technical suggestion point 9. Chairman in gist suggested to use all possible sources of information both secondary and primary after brainstorming on propable sources with the help of experts on the subject both of line department, stakeholders (Tribals, Tribal Cooperative Society, Angadikada, middle men, final consumers or traders etc.)
9. Documentation of the impact of landslides/ floods on selected ecosystems and Keystone/ Indicator species and suggest management practises based on this.

The key outcomes of the Study 2 based on discussions and the review meeting of UNDP are:

1. Spatial delineation of landscape-level changes in Munnar
2. Details on cultural, historical events and development activities that led to landscape changes
3. Documentation of agents that driven landscape changes; its impacts and root causes
4. Finally to suggest strategies of Sustainable development.

Technical suggestions:

1. Chairman pointed out that during identification of areas of biodiversity importance the criteria should include ecologically significant flora and fauna along with economically significant ones.
2. Chairman also pointed that social impacts and livelihood of natives will be worked in the area and developmental activities in the development sectors such as (i) Plantations & horticulture; (ii) Animal Husbandry; (iii) Tourism; (iv) Transportations and (v) Hydel (buffer zone impacts); (vi) Quarries (vii)Man-Animal Interactions (various Social-Rehabilitation Policies). In the plantation sector, the following sub-sectors can be prioritized, Tea, Cardamom, Eucalyptus, sugaecane, Fruit and vegetable crops; Rattans; Sandals. He also mentioned that the impact of swapping cultivation of tea to eucalypts and vise versa should be included in the study. In short Chairman emphasized for the second project a landscape level change ie. how different land uses have changed with increased tourism, conversion of CHR area into resorts, conversion of CHR areas into hardy cardamon crop after felling evergreen species, taking up cultivation on slopes, changing courses of rivers etc.
3. Chairman suggested that II study should ultimately be suggesting probable strategies for sustainable development of the area for future based on the changes, factors causing changes, all consequences.
4. Chairman pointed out that solutions for sustainable management also be included after the analysis of landscape changes regard to all the usually not captured details.
5. It was stressed that development of a methodology for updation of PBR should be a significant outcome. Essentially to identify and standardise the techniques of field level data collection through personal interaction with formal and informal tools with regard to all the usually not captured details. For identification of species/ varieties best possible software can be suggested after thorough search and study of existing software.
6. Kunhikrishnan Sir suggested that clarity about the selected Grama panchayath and study area should be there. Also, it was suggested that instead of 'Anjunad Valley' study area should be mentioned as 'Munnar Landscape'. Another suggestion is that

Periyar catchment area should be assigned as prime concern other than Chalakudy catchment area as all the 10 panchayath except Athirapally is coming in Periyar catchment. This is supported and agreed by the Chairman, KSBB. Dr.Kunhikrishnan suggested that landscape study should be based on (i) Riparian; (ii) Sholas and (iii) Grasslands. These are the fragile ecosystems which dramatically change the Munnar landscape. 20 years changes will be compared with the help of Satellite images.

7. Tribal's socio-economic activities and other life styles which include handicrafts and associated cultural activities should be considered, along with other missing details in existing PBR and how to capture them through a tool proof practical methodology. Methodology has to be discussed and standardised.
8. Categorization of RET list of flora and fauna should focus on two specific aspect (i) Economic significance and (ii) ecological significance.
9. Prof.(Dr).B.R. Reghunath suggested that data for tradable bioresources can be obtained from tribal societies. Prepare questionnaires and discussions should be focussed in to Tribal Co-operative sectors, Forest watchers, traditional practitioners etc. For collecting primary data related to the tradable bio-resources there will be practical difficulty in obtaining data from Angadi kada.
10. Soil information should be collected and soil maps obtained from Soil survey dept. / Panchayath/ agriculture Dept. / Land use board etc.
11. Mr Anand zakariya pointed that the soil texture is completely changed after the flood. So comparison study (Area in 10 years before flood; present; 10 years after flood) is necessary and can be used for wider area planning such as soil quality assessments and conservation in future.
12. Mr Anand zakariya suggested the identification of BHS with the help of free software 'MaxEnt' (from AMNH) which is used for modelling species niches and distributions. https://biodiversityinformatics.amnh.org/open_source/maxent/
13. Dr.V Balakrishnan pointed that encroachments/ Anayirankal/ Ecological issues related to legal and illegal quarries/ Natural disasters/landslides/climate change/soil&drainage problems should be studied under the sector Social-Rehabilitation Policies. And measuring the carrying capacity of protected areas will be helpful for analysing the tourism sector and thereby ecological issues.
14. Balakrishnan also pointed that Dynamic quantification of canopy architecture is needed for the characterization of Tree vigour should included the study.
15. FRAGSTATS: A software programme for spatial pattern analysis is recommended by Anand zakariya. Recently this programme is upgraded in to the ArcGIS 10 (Version 4.2). Dr Radhakrishnan also added additional points to this such as analysis of Batch processing/ Sampling strategies/ Structural and functional metrics/ Surface metrics/ cell-based metrics/ Patch-based metrics/command line execution etc. https://www.umass.edu/landeco/research/fragstats/fragstats.html
16. Dr Radhakrishnan suggested that dynamics and changes in landscape pattern over a time and landscape fragmentation can be analysed through patch analysis using satellite images and Geotagging of Bio resource should be included in this study. Study of Changes in Landscape ecology is necessary for developing management plan
17. Dr Radhakrishnan suggested that GIS based landscaping is more relevant in this study. For that purpose he recommended the data collected from Bhuvan, EarthExplorer and NRSC https://bhuvan.nrsc.gov.in/bhuvan_links.php; https://earthexplorer.usgs.gov/ ; https://www.nrsc.gov.in/

18. Radhakrishnan sir also recommended books (Principles of landscape ecology),(Assessing landscape changes & dynamics using patch analysis and GIS modelling) and research articles etc. for the landscape study.

Methodology/ Suggestion for achieving outcomes

1. Identification of BHS : Areas showing high genetic diversity in various Genus of plant and animal such as *Andrographis* and *Orchids* etc may be marked as Biodiversity Heritage Site (BHS). This can be done on the basis of PRA, RRA, Expert consultancy and analysis of images from free software 'MaxEnt' (from AMNH)
2. Checklist of RET and endemic plants: This can be done on the basis of secondary data, along with random field verification to confirm the ground situation.
3. Documentation of best practises of biodiversity conservation: This can be done on the basis of PRA and RRA after meeting identified best practioners on the basis of preliminary enquiries from foresters, aquacultural officials, Animal husbandry officials, research organizations, NGOs and other local knowledgeable persons
4. Illegal/ Unsustainable harvest : This can be done discussing with tribal collectors, local medical practioners, forest guards, Societies etc.

   Some eg: Drosera peltata (Conservation status: Least concern), commonly called the Shield sundew/ Pale sundew, locally known as Azhukanni/ Kosuvettipullu/ Kocuvetti seen in higher altitudes (Marayoor) is illegally exported into foreign countries from the Thoothukudi Port. This species is used in Siddha and Folk medicine. However, its actual use is not reported. *Rhododendron* leaves and several *Mosses* are also illegally transported to various part of India and abroad. *Rhododendrons* are valuable species in horticulture as well as Montane ecosystem. Vagavurrai village contain several exotic *Rhododendrons* are found. Also, these areas are rich wild life (Elephants, Bison, Chevrotain, Sambars and Porcupine.
5. It was decided that instead of purchasing images to download landsat images of the years 1999, 2009 and 2019 for the purpose.
6. It is necessary to get toposheet (1:50000) of study area from the Survey of India.
7. The information available in Bhuvans portal - thematic areas to be collected.
8. The major sectors to be considered are as (i) Plantations & horticulture; (ii) Animal Husbandry; (iii) Tourism; (iv) Transportations and road network (v) Hydel (buffer zone impacts); (vi) Quarries (vii)Man-Animal Interactions (various Social-Rehabilitation Policies).
   i. In the plantation sector, the following sub-sectors can be prioritized, Tea, Cardamom, Eucalyptus, sugarcane, Fruit and vegetable crops; Rattans
   ii. Land occupancy and Encroachments and impact of KPT Act amendments can be included in Land Policy.
   iii. The details of licensed quarries can be obtained from Mining and geology and revenue department. For details of existing and abandoned quarries and unauthroized quarries primary data collection will be required.

Meeting concluded at 5:15 PM. The next meeting will be conducted on the upcoming month.

Minutes submitted by: Dr. N. Preetha, KSBB (Technical Associate)

Chairman, KSBB

Annexure IV

Trade survey

1	Local name of the plant
2	Habit
3	Wild/Cultivated
4	Habitat
5	Part used
6	Dried/ Fresh
7	Distribution Status
8	Changes in abundance of the plants for the last 10 years
9	Processing details
10	Used in single/Combination
11	Is it sold
12	Quantity sold per day/month/year
13	Amount collected per year
14	Buyers
15	Price/kg
16	Condition of the plant sold (Dry/Fresh)
17	Brought to the Market (daily/ Weekly/ Monthly)
18	% of the people in the area doing the business
19	Availability
20	How much sold now as compared to the last 10 years (more/ Same/ Less)
21	Why? (less available for harvest/any other reason)
22	What kinds of Traditional methods are being used for the processing after harvesting
23	What are the problems faced in this business
24	Any other uses

KSDB

Annexure VI

Questionnaire for BMC members

1. **What are the major tradable bio-resources in that panchayath?**
2. **As a BMC member have you ever notice the vulnerability of tradable bio-resources in your locality?**
3. **Have you ever notice the increasing trend of replacing the commercial crops instead of the natural resources?**
4. **What are the major programmes organized by BMC for the protection of tradable bio-resources?**
5. **Who are the collectors of the tradable bio-resources? (Private industries, forest department or individuals)**
6. **What are the changes noticed the bio-diversity during the recent 10 years?**
7. **Do you think that the tradable bio-resources get affected adversely if this situation prevails?**

   If yes, what are the steps will you take to overcome that situation?
8. **Do you think that there is a possibility of tradable bio-resources to get extinct is the prevailing situation lasts for the next 10 years?**
9. **Is there any limit for the collectors for the quantity of collected tradable bio-resources?**
10. **Have you noticed the over exploitation of natural resources for the profit of the individuals?**
11. **Thus the BMC members collect levy from the sellers of tradable bio-resources?**
12. **If no what are the reasons for that?**
13. **What is the current status of the utilization tradable bio-resources?**
14. **Have you updated the validity of PBR for tradable bio-resources?**

KSBB

Annexure V I

Major identified gaps in PBR

1	**Tribal knowledge/Traditional knowledge**
2	**Traditional practices**
3	**Corrections or modifications in existing information if any required.**
4	**Commercially traded bio-resources and details of various agencies involved and nature of market.**
5	**Sacred groves/ponds**
6	**Major ecosystems/degraded ecosystems/quarries**
7	**Unique ecosystems as Mangroves, laterite hills etc**
8	**Riparian diversity**
9	**People Scape**
10	**Soil and related information**
11	**Areas which can be proposed for BHS**
12	**Areas which can be proposed for Miyawaki forests**
13	**Wetlands data**
14	**Endemic/ local landraces for GI registration**
15	**Prevailing management practices/ Community conservation.**
16	**List of local Vaidyas/ Hakims/ TK holders**

KSBB

Annexure 7

QUESTIONNAIRE

1. Name of the panchayath:

2. Name of the Village:

3. Name of the Farmer:

4. Religion of the Farmer: H /M /C /O

5. Cast: OC /BC /SC /ST

6. Total family members:

7. No. of People engaged in Agriculture:

8. No. of Labour using per hectare:

9. Total Agricultural land of the farmer: Acres / Hectares:

10. Land under cultivation:

11. Land under different crops:

Crop	Area	Yielding	Crop	Area	Yielding
a.			e.		
b.			f.		
c.			g.		
d.			h.		

12. Land under Irrigation:

13. Land under fallow: a. Current fallows: b: Other fallows:

14. Land under common agriculture:

15. Land under Fruit crops: A: B: C:

16 Land under Permanent Grass lands:

17. Number of farm animals:

18. Number of Draught animals:

19. Poultry:

No Yields:

20. Milk animals: a. Cows: b: Buffalos:

Yields: Yields:

c. Goats: others:

Yields: Yields

21. Number of fertilizers are using for cultivation:

Which are they? a. d.

b. e.

c. f

22. When compared to the past, the availability of water is less:

yes ☐ No ☐

23. We cultivate vegetables organically at home:

yes ☐ No ☐

24.Do you believe that the sudden climate changes are due to the deeds of mankind?

yes ☐ No ☐

25.We are forced to use chemical fertilizers for cultivation:

yes ☐ No ☐

If agree description:

26. Do you think that the illegal quarries in your area causes landslide?

yes ☐ No ☐

27.The last year flood caused you a lot of damage:

yes ☐ No ☐

28. Does the development of tourism beneficial for you:

yes ☐ No ☐

29.The harassment of wild animals is increasing year by year:

Yes ☐ No ☐

If yes which animals:

Description:

30. Tourism in your area results in pollution:

Yes ☐ No ☐

31. Do you believe that tourism helped you to increase the life status?

Yes ☐ No ☐

32. Tourism led to increased life expenses:

yes ☐ No ☐

33. The development in tourism in your area causes the flow of many vehicles to the area:

yes ☐ No ☐

34. Since 10 years, there were lots of developments taking place in your area:

yes ☐ No ☐

35. According to the reports, there were many people migrating to your area:

yes ☐ No ☐

36. You have noticed many unlicensed quarries coming up in your area

yes ☐ No ☐

37. You like people coming to visit your area as a part of tourism:

yes ☐ No ☐

38. The plantation sector helped the people in your area with job opportunities:

yes ☐ No ☐

39. The flow of tourists in your area gave more job opportunities to the people:

Yes ☐ No ☐

Annexure 8

Kerala State Biodiversity Board

Two Day Consultative Workshop – Developing Standardized Protocol for biodiversity Survey through Citizen Science for PBR Updation.

Minutes

Opening:
Two day consultative workshop for developing standardized protocol for biodiversity survey through citizen science for PBR updation opened at KSCSTE, Pattom, Thiruvanathapuram on 10:30 AM, 21st November 2019.
Welcome speech was address by Dr. Chandramohanan, Member, KSBB. Dr. V. Balakrishnan (Member Secretary, KSBB) briefly introduced the consultants to the workshop. Dr. S.C. Joshi (Retd IFS), Chairman, KSBB delivered keynotes address.

Chairman's keynotes address:
Chairman pointed out that development of a methodology for updation of PBR should be a significant outcome. Essentially to identify and standardise the techniques of field level data collection through personal interaction with formal and informal tools with regard to all the usually not captured details. For identification of species/ varieties best possible software can be suggested after thorough search and study of existing software.
Significance of PBR by stressing at its grassroot level. Mentioned the format of PBR and the need for filling the gaps in the following areas such as BHS, Peoplescape, wetlands, management practises etc.

Overview of the workshop by Dr. V. Balakrishnan, Member secretary:
Member secretary had a brief talk about why PBR has developed in first place and its need for updation for developing an action and strategy plan for conservation and future references.
MS pointed about the importance of associated knowledge that remained as the major gap in the previously developed PBR.
MS stressed that the potential beneficiaries of the workshop has to be citizens and the formation of ePBR should the based biodiversity survey utilizing citizen science.
MS introduced the existing format of PBR to the consultants. He also showed the layout of the developing ePBR.
MS discussed the issues regarding existing PBR- Lack of uniform replicable standardized protocol for survey of flora/ fauna/ecosystem, Lack of training tools for volunteers, Difficulty in data interpretation, available data which cannot be utilized for biodiversity monitoring/ management

Questions to be addressed - Who Are the Potential Volunteers? How Should Biodiversity Be Recorded? What is the methodology for Field survey for flora and fauna and associated knowledge to be adopted for a citizen science project? What is the methodology for Ecological survey for identification of Biodiversity rich site? What Should Be Recorded? How Can Technology Support Recording? How to verify accuracy of data? How Should the Data Be Used to Produce Relevant Outputs? What are the training tools requirement for volunteers ?
Finally MS showed the experts the reporting format to be submitted after group discussions.
Lead talks by experts based on the use of citizen science for Biodiversity survey:

1. First lead talks by Dr. Bijikumar. A, Professor and Dean, Dept of Aquatic biology and Fisheries, University of Kerala. He pointed out various drawbacks in PBR and its methodology. He also suggested that :

- Collaboration should be needed between institutions (national and international) involving taxonomists and biodiversity experts.
- Developing trained manpower in biodiversity surveys, monitoring and preparation of repots/action plans
- Local/regional field guides and survey manuals on major groups and for local biodiversity surveys/rapid biodiversity assessments
- Prioritising work on HOTSPOTS and knowledge gaps
- Scientific work undertaken by common people, in collaboration with scientists and research institutes
- Electronic field guides (Required more for various groups- develops e-guides and circulate to all members in the team)

2. Talk by Dr. T. Sabu, Program director, CED
He suggested different methods to collect floristic data and analysis using citizen scientists.

- Proper documentation of biodiversity outside the protected areas needs capacity building and awareness creation of policy makers as well as common people
- Mentioned various tools for capacity building such as flowing plants of Kerala - Software developed by Dr. N Sasidharan, KFRI, FRLHT ENVIS website to check medicinal value –Search facility Botanical/Vernacular name http://envis.frlht.org/bot_search, The *Useful Tropical Plants Database* - contains information on the edible, medicinal and many other uses of around 12 thousand plants that can be grown in tropical regions. http://tropical.theferns.info/

3. Dr. Amitabachan K.H, Assistant professor, MES Asmabi college, he talked about indigenous communities, address their traditional right, instincts and also the livelihood dependence.
    - Ecosystem conservation, monitoring, ecorestoration and sustainable harvesting projects at GP level
    - Need a special design and format for long-term monitoring of specific function

4. Mr. Arun, ICFOSS, talked about Geospatial tools which can easily incorporated in the field of biodiversity. He recommended Open Street Mapping using platforms such as SYMBIOTA, odk (oldest version for user friendly).

5. Dr. V.V.Sivan, MSSRF talked about Agrobiodiversity, he suggested that how to collect data from the field by means of different survey methods (Tansect walk, Household survey, Focus Group Discussion, Interview with KI)
   He proposed various criteria's to be recorded for Agrobiodiversity.

6. Dr. Rajasekharan, Senior consultant, KSBB and JNTBGRI, talked about Protection of Traditional Knowledge.
   - He mentioned the significance of TK, Integration of TK in to planning process for the various developmental activities at grass root level
   - TK related to art and culture, Agriculture, Animal husbandry, Architecture, Biodiversity conservation and utilization, eco-friendly practices, fisheries, forest and management, health care, medicinal and food plants, rural technology.
7. Mr. Roshnath Ramesh, MARC, explained about Bird Atlas, and it can be used as a citizen model and its protocol.

After these presentations, a brainstorming session to develop a standardized protocol of Biodiversity survey, for that three groups were formulated based on Flora, Fauna and Ecosystem. The format was circulated in each groups and final output was presented by Dr T Sabu, Sujith V Gopalan, Balakrishnan Valappil and Amithabachan. Dr Edison chaired the panel discussion that was held as a part of group discussion.

Vote of thanks by Dr. Sudheesh, Scientific Officer, KSBB.