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UNITED NATIONS DEVELOPMENT PROGRAMME
Country: India

PROJECT DOCUMENT

Project Title:	**India High Range Landscape Project** - Developing an effective multiple-use management framework for conserving biodiversity in the mountain landscape of the High Ranges, the Western Ghats, India.
UNDAF Outcome(s)/ Indicator(s):	Inclusive and equitable growth policies and poverty reduction strategies of the Government are strengthened to ensure that most vulnerable and marginalized people in rural and urban areas have greater access to productive assets, decent employment, skill development, social protection and sustainable livelihoods.
UNDP Strategic Plan Environment and Sustainable Development Primary Outcome:	Mainstreaming biodiversity conservation and sustainable use into production landscapes.
Expected CPAP Outcome(s) /Output/Indicator(s):	Sustainable management of biodiversity and land resource is enhanced.
Executing Entity/ Implementing Partner	Ministry of Environment & Forests (MoEF), Government of India
Implementing Entity/ Responsible Partner	Department of Forests and Wildlife, Government of Kerala

Brief description

High Range Mountain Landscape (HRML) in the Western Ghats mountains of peninsular India is globally significant biodiversity region. It's key attributes are: a) high levels of endemism and biological diversity; b) World Heritage Site and Important Bird Area; c) presence of globally threatened species of fauna and flora; d) part of one of the five viable breeding centre of tiger in India; e) harbour the largest global population of Nilgiri tahr and a significant population of Grizzled Giant Squirrel (both threatened species); f) catchment of three major river systems of peninsular India; g) strong eco-cultural affinities; and h) support important economic sectors like cardamom, tea and tourism. There are eight Protected Areas (PAs) in the region. At present, HRML is a complex mosaic of land uses where conservation, economic production and livelihood requirements assume equal primacy and profoundly influence each other. As a result, HRML has contradictory sectoral directives, multitudes of actors and contrary aspirations. Cumulatively, these are contributing to injudicious use of natural resources and eventual disruption of vital ecological processes. The rapidly altering developmental context, demographic contours, resource use configurations and new and emerging challenges make the situation increasingly precarious for HRML's long term ecological sustainability and livelihood security. The existing planning and policy framework, as well as the institutional arrangements in HRML are inadequate for addressing biodiversity conservation from a landscape perspective. The project aims to put in place collaborative governance and know-how for multiple-use management of HRML. The project will engineer a paradigm shift from current sector based and unsustainable practices to integrated multiple-use management of mountain landscapes to deliver global environmental benefits. The project aims to achieve this through the following Outcomes: a) Effective governance framework for multiple-use mountain landscape management in place; b) Multiple-use mountain landscape management is applied securing the ecological integrity of HRML; and c) Strengthened capacities for community based sustainable use and management of wild resources.

Programme Period: 2014-2018
Atlas Award ID: 00075746
Atlas Project ID: 00087493
PIMS:
Start date: March 2014
End Date: December 2018
LPAC Meeting Date:
Management Arrangements: Direct Implementation

Total budget: US$ 36,275,000
Total allocated resources (GEF): US$ 6,275,000
Partner-managed
- **Government** US$ 28,000,000
- **UNDP-managed** US$ 1,000,000
- **Private sector** US$ 1,000,000

Agreed by Implementing Partner (Government of India): (एस. एस. गर्ब्याल) (S. S. GARBYAL) (वन्यजीव) of Forests (WL) & Forests दिल्ली

Agreed by Responsible Partner (Government of Kerala):

Agreed by (UNDP): 15/05/2014

P.K. MOHANTY
Additional Chief Secretary
Forest & Wildlife, Environment and
Parliamentary Affairs Depts.

Alexandra Solovieva
UNDP Deputy County Director

Table of Contents

ACRONYMS

APR	Annual Project Review
ATLAS	UNDP's Enterprise Resources Platform
AWP	Annual Work Plan
BCPs	Biodiversity Conservation Plans
BDA	Biological Diversity Act
BSAP	Biodiversity Strategy and Action Plan
CB	Conservation Biologist
CBD	Convention on Biological Diversity
CBOs	Community Based Organisations
CEC	Centre for Education and Communication
CER	Corporate Environment Responsibility
CESS	Centre for Earth Science Studies
CDR	Combined Delivery Report
CHR	Cardamom Hill Reserve
CO	Country Office
COP	Conference of Parties
COS	Communication and Outreach Specialist
CP	(UNDP) Country Programme
CPAP	(UNDP) Country Programme Action Plan
CRC	Cardamom for Rainforest Conservation
CRS	Cardamom Research Station
CSO	Civil Society Organisation
CSR	Corporate Social Responsibility
CTCT	Community to Community Training
EB	Executive Body
EBA	Endemic Bird Area
EDC	Eco-Development Committee
EIA	Environmental Impact Assessment
EPA	Environmental (Protection) Act, 1986
FA	Financial Assistant
FAA	Financial and Administrative Assistant
FD	Forest Department
FDA	Forest Development Agency
FRA	Forest Right Act
GB	Governing Body
GDP	Gross Domestic Product
GEF	Global Environment Facility
GHG	Green House Gas
GoI	Government of India
GP	Grama Panchayat
HNL	Hindustan Newsprint Limited
HRML	High Range Mountain Landscape
HVBA	High Value Biodiversity Area
HRSDS	High Range Sustainable Development Society
HRWEPA	High Range Wildlife and Environment Preservation Association
IBA	Important Bird Area
IC	Incremental Cost
ICAR	Indian Council for Agricultural Research
IMG	Institute of Management in Government
INTACH	Indian National Trust for Art and Cultural Heritage
IP	Implementing Partner
IR	Inception Report
IUCN	World Conservation Union
IW	Inception Workshop
JFM	Joint Forest Management
JFMCs	Joint Forest Management Committees
KDH	Kanan Devan Hills
KDHP	Kanan Devan Hill Produce

KFD	Kerala Forest Department
KFDC	Kerala Forest Development Corporation
KFRI	Kerala Forest Research Institute
KILA	Kerala Institute of Local Administration
KITTS	Kerala Institute of Travel and Tourism Studies
KSBC	Kerala State Bamboo Corporation
KSEB	Kerala State Electricity Board
LLPMU	Landscape-Level Project Management Unit
LLLUP	Landscape Level Land Use Plan
LP	Landscape Plan
LPAC	Local Project Appraisal Committee
LSGs	Local Self Governments
M&E	Monitoring and Evaluation
MGNREGA	Mahatma Gandhi National Rural Employment Guarantee Act
MoEF	Ministry of Environment and Forests
MSL	Mean Sea Level
NAPCC	National Action Plan on Climate Change
NBAP	National Biodiversity Action Plan
NCF	Nature Conservation Foundation
NFC	National Forest Commission
NGO	Non-government Organization
NIAS	National Institute of Advanced Studies
NPD	National Project Director
NPMU	National Project Management Unit
NTCA	National Tiger Conservation Authority
NTFP	Non Timber Forest Produce
PA	Project Associate
PAs	Protected Areas
PCCF	Principal Chief Conservator of Forests
PFM	Participatory Forest Management
PIMS	Project Information Management System
PIR	Project Implementation Review
PC	Project Coordinator
PM	Project Manager
PPG	Project Preparation Grant
PRIs	Panchayati Raj Institutions
PSC	Project Steering Committee
PWD	Public Works Department
RCU	Regional Coordination Unit
RGCB	Rajiv Gandhi Centre for Biotechnology
RKVY	Rashtriya Krishi Vignan Yojana
SBAA	Standard Basic Assistance Agreement
SC	Scheduled Caste
SE	Subject Expert
SELS	Socio-economic and Livelihoods Specialist
SHG	Self-Help Group
SO-2	(GEF's) Strategic Objective 2 (under the Biodiversity Focal Area)
SPD	State Project Director
SPMU	State Project Management Unit
SPSC	State Project Steering Committee
SRF	Strategic Results Framework
ST	Scheduled Tribe
TAG	Technical Advisory Group
TOR	Terms of Reference
TPR	Tri-partite Review
TTR	Terminal Tri-partite Review
ULOs	Unit Level Organisations
UNDAF	United Nations Development Assistance Framework
UNDP	United Nations Development Programme
UNDP-CO	United Nations Development Programme – Country Office

UNDP-GEF	United Nations Development Programme – Global Environment Facility Unit
UPASI	United Planters Association of South India
USD	United States Dollar
VLI	Village Level Institutions
VSS	Van Samrakshana Samiti
WCMC	World Conservation Monitoring Centre
WTI	Wildlife Trust of India
WWF	World Wide Fund for Nature

I. Situation Analysis

A: CONTEXT

National context

1. In the mountains we confront our future (Nair, 1994).[1] Encompassing 27 percent of the Earth's land surface (across all continents, latitudes and principal biomes), they directly support 22 percent of the world's people (CBD, 2012).[2] Mountains support a broad spectrum of biological diversity and provide diverse goods and services (including water, energy, timber, non-timber forest produce (NTFP), biodiversity maintenance, recreation and spiritual renewal) to well over half of the world's seven billion people (Price *et al.*, 2011[3] and ICIMOD, 2010[4]). They harbor a significant portion of distinct ethnic groups, remnants of cultural traditions, environmental knowledge, complex agro-cultural gene pools and traditional management practices and habitat adaptations (CBD, 2012).[5] Since the Rio Summit in 1992, there has been increasing global awareness of the importance of mountain areas. The Rio +20 Conference on Sustainable Development, 2012 reiterated that the benefits derived from mountains are essential for sustainable development and called for greater efforts towards their conservation.[6]

2. India, with an area of 329 million ha, lies between $8^0 4'$ to $37^0 6'$ N and $68^0 7'$ to $97^0 25'$ E. It has the second highest population (c.1.21 billion); the third largest and the 10th most industrialized economy, where, but over half (58.2 percent) the workforce is still employed in agriculture and as much as 29.8 percent of the population living in poverty (Planning Commission, 2010).[7] With just 2.4 percent of the world's surface area but with 16.7 percent human population, India is one of the 17 "mega-diverse" countries and accounts for 7-8 percent of recorded species of the world. Of the 34 global 'biodiversity hotspots', India has four, i.e., the Himalayas; Indo-Burma; the Western Ghats and Sri Lanka; and Sundaland.[8] It has some of the prominent mountain systems in the world *viz.*, the Himalayas in the north, Aravallis in the west-central region, Vindhyas and Satpuras in the central highlands and the Eastern Ghats and the Western Ghats in peninsular India. India's mountain regions cover an area close to 100 million ha (around 30 percent of India's landmass) (MoEF, 2009)[9], that constitutes more than 90 percent of the 'biodiversity hotspots' in the country.

3. Running parallel to the west coast, the Western Ghats, also known as *Sahyadris*, form the fluted western edge of the Indian peninsular plateau, which are stable Archaean and Pre-Cambrian formations (Nair, 1991).[10] These mountains, 1,600 km long and 160,000 km^2 in extent (around 4.8 percent of India's land area), pass through the Indian states of Gujarat, Maharashtra, Goa, Karnataka, Tamil Nadu and Kerala. The average elevation is 1,200 m above MSL, increasing towards the south where the mountains often transcend 2,000 m above MSL (NFC, 2006).[11] Towards the south, the Western Ghats is divided by the Palghat Gap bisecting a physically homogeneous high altitude plateau into two rather distinct biogeographic units *viz.*, the Nilgiris complex in the north and the Anamalai-High Ranges-

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[1] Satis Chandran Nair, 1994. *The High Ranges: Problems and potential of a hill region in the southern Western Ghats*, INTACH

[2] Available from http://www.cbd.int/mountain/importance.shtml. Accessed 28 January 2013

[3] Price, Martin F, George Gratzer, Lalisa Alemayehu Duguma, Thomas Kohler, Daniel Maselli, and Rosalaura Romeo (editors), 2011. *Mountain Forests in a Changing World - Realizing Values, addressing challenges* FAO/MPS and SDC, Rome.

[4] ICIMOD, 2010. International Expert Consultation Meeting: Mountain Initiative on Climate Change Convened by the Government of Nepal and ICIMOD 23 - 24 September 2010, Kathmandu, Nepal

[5] Available from http://www.cbd.int/mountain/importance.shtml. Accessed 28 January 2013

[6] The Future We Want, 2012: Outcome statement of the Rio +20 Conference

[7] Various documents of Planning Commission, India.

[8] Available from http://www.conservation.org/where/priority_areas/hotspots/asia-_pacific/Sundaland/Pages/default.aspx. Accessed 28 January 2013.

[9] MoEF, 2009. *Fourth National Report to CBD*, MoEF, New Delhi.

[10] Satis Chandran Nair, 1991. *The Southern Western Ghats – A Biodiversity Conservation Plan*, INTACH, New Delhi

[11] National Forest Commission Report, 2006, Ministry of Environment and Forests

Palnis complex in the south, resembling a 'fossil landscape' (Dikshit, 2001).[12] Here are found the highest peaks south of Himalayas in India *viz.*, Anaimudi (High Ranges), Misappuli Malai (High Ranges) and Doddabetta (Nilgiri Hills), at 2,695 m, 2,637 m and 2,634 m above MSL respectively (Daniel and Vencatesan, 2008).[13]

4. The Western Ghats harbor 27 percent of India's floral wealth in a number of vegetation types including tropical wet evergreen, montane evergreen, moist deciduous, dry thorn & scrub forests and high altitude *shola*-grasslands ecosystems. Nearly a third of all flowering plant species of India are found here with around 1,500 endemic species of Angiosperms. Of the 490 arborescent taxa reported from the Western Ghats, as many as 308 are endemic and there are 112 endemic orchids among the 245 species. Overall, around 38 percent of India's flowering plants and 63 percent of evergreen woody plant species are endemic to the Western Ghats. Many species are considered threatened, including 235 species of endemic flowering plants (NFC, 2006[14]; Daniel and Vencatesan, 2008[15]; MoEF, 2009[16]). The Western Ghats is rich in faunal wealth as well with 189 species of fishes, 111 reptiles, 161 amphibians, 34 butterflies, 16 birds and 14 mammals as endemics. The Western Ghats is an Endemic Bird Area (EBA) and given High Priority status by Bird Life International. The World Conservation Monitoring Centre (WCMC) has identified the Western Ghats as an important area of freshwater biodiversity (MoEF, 2009[17] and Molur *et al.*, 2011[18]). Considering its immense biodiversity value, a cluster of 39 biodiversity rich areas in the Western Ghats has been designated as a World Heritage site in 2012 (UNESCO, 2012).[19] Over 45 million people depend directly on the Western Ghats for livelihoods. Moreover, approximately 245 million people living in peninsular India receive most of their water from rivers originating in the Western Ghats (draining 40 percent of India's landmass) (NFC, 2006).[20] Population density in the region varies from 100 to 300 inhabitants per km^2.[21] The Western Ghats have been subjected to large-scale human interventions such as conversion of forests for commercial tree plantations (e.g. teak and eucalyptus), cultivation of cash crops (e.g. cardamom, coffee, tea, rubber and pepper), cattle ranching, road construction, river valley projects, urbanization, and mass tourism. This has led to erosion of biological and cultural diversity, ecosystem malfunctions and disruption of local livelihoods (Krishnan, 2004).[22]

Geo-physical and geographical context

5. The High Range Mountain Landscape (hereafter referred as HRML), epitomizes the Western Ghats in terms of its ecological attributes, socio-economic profile and development trajectory. It is characterized by extremely rich biological diversity, intricate human-ecological affinities, escalating developmental pressure, diminishing resources, expanding production sector and high vulnerability to climate change. Though 'High Ranges' in a broader sense extends over 600,000 ha, the area of direct focus of the project (HRML) is around 310,000 ha. The project landscape has been identified based on a) the pioneering works on the prioritization of forest landscapes of the southern Western Ghats (Nair, 1991[23]; Nair, 1994[24]; French Institute,

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[12] Dikshit K.R., 2001. *The Western Ghats: A Geomorphic Overview,* Geological Society of India. No 47. pp 159-183

[13] Ranjit Daniels and Jayshree Vencatesan, 2008. *Western Ghats: Biodiversity, people and conservation*, Rupa Com.

[14] National Forest Commission Report, 2006. Ministry of Environment and Forests

[15] Ranjit Daniels and Jayshree Vencatesan, 2008. *Western Ghats: Biodiversity, people and conservation*, Rupa Com.

[16] MoEF, 2009. *Fourth National Report to CBD*, MoEF, New Delhi

[17] MoEF, 2009. *Fourth National Report to CBD*, MoEF, New Delhi

[18] S.Molur, K.G.Smith, B.A.Daniel and W.R.T. Darwall, 2011. *Status and Distribution of Freshwater Diversity in India*, IUCN

[19] Available from http://en.wikipedia.org/wiki/Western_Ghats#UNESCO_World_Heritage_Site Accessed on 23 February 2013

[20] National Forest Commission Report, 2006, MoEF.

[21] Census figures 2011, Government of India.

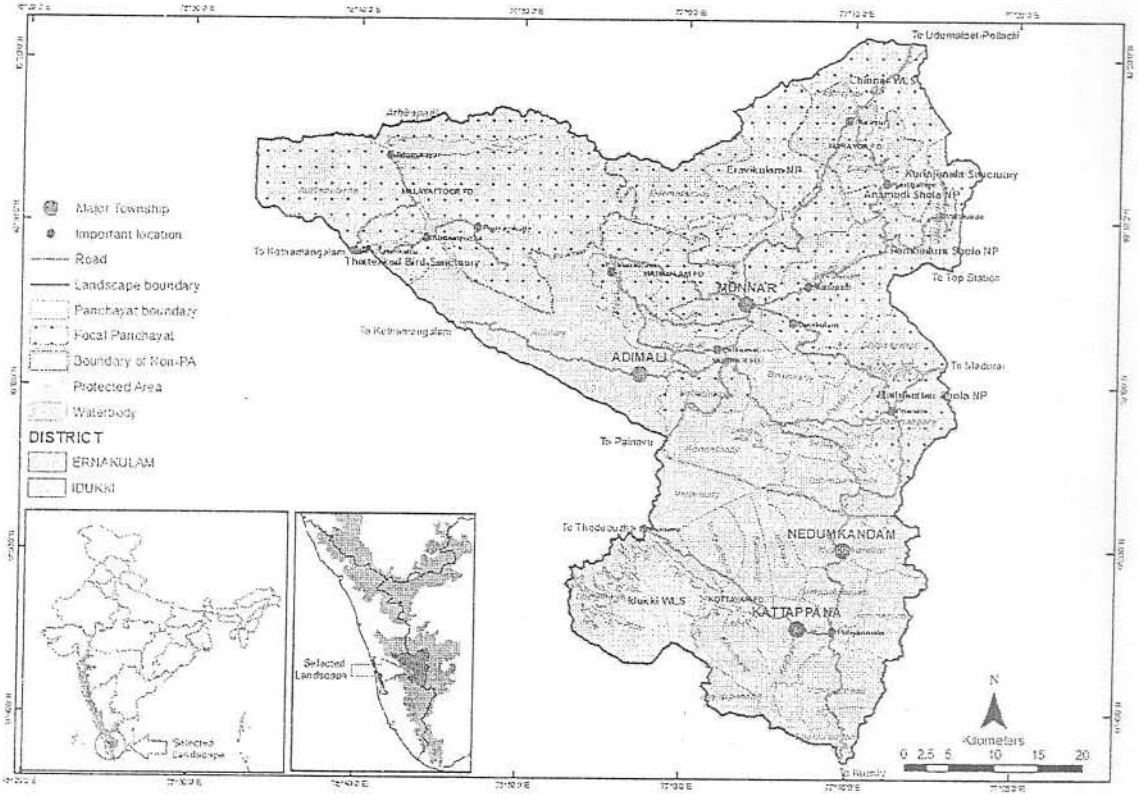
[22] Krishnan, P, 2004. *Mainstreaming Biodiversity Objectives into the Tea Industry: A Case Study of the High Ranges, Western Ghats, India* in the publication – *Mainstreaming Biodiversity in Production Landscapes* (editors: Petersen and Huntley), Global Environmental Facility

[23] Satis Chandran Nair, 1991. *The Southern Western Ghats – A Biodiversity Conservation Plan*, INTACH

2003[25]; Ramesh and Gurukkal, 2007[26]), b) several rounds of expert consultations, and c) administrative suitability and compactness.

6. As mentioned in the previous paragraph, the project landscape (HRML) located in the state of Kerala covers an area of 3,100 km^2 between 9^{0}38' to 10^{0}21' N and 76^{0}33' to 77^{0}18' E (see Map 1). HRML is roughly a horseshoe-shaped region with a few high ridges and characterized by steep rugged terrain and highly dissected valleys forming the source of three major river systems (Periyar, Cauvery, and Chalakkudi). HRML is close to other prominent geographical entities of southern Western Ghats - Nelliampathy Hills, Anamalai Hills and the western portion of Palni Hills. It has high mountain peaks rising over 2,000 m above MSL including two highest peaks south of Himalayas - Anaimudi (2,695 m) and Misappuli Malai (2,637 m).

Map 1: The Project landscape



7. HRML lies between the interstate boarder of Kerala and Tamil Nadu on the east and the Periyar River on the west. The northern part consisting of the Edamala and Pooyamkutti valleys is connected to Sholayar forests of Vazhachal Forest Division (buffer zone of Parambikulam Tiger Reserve). On the Tamil Nadu side, HRML (for its most part) is connected to Anamalai Tiger Reserve and also to Palni Hills Reserve forests. The southern portion of the landscape abuts a tenuously forested slope of Theni Forest Division running right down to Periyar Tiger Reserve further south. Except for the isolated tracts of Idukki Wildlife Sanctuary and surroundings (190 km^2) and Mathikettan National Park (12.75 km^2), the landscape has ecological continuity, though chequered by settlements, enclosures, plantations, dams, roads and linear intrusions like canals.

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[24]Satis Chandran Nair, 1994.*The High Ranges: Problems and potential of a hill region in the southern Western Ghats*, INTACH

[25] French Institute, 2003. *Conservation Review for Rationalization of Protected Area Network in Kerala*, Pondicherry.

[26]Ramesh and Gurukkal, 2007.*Forest Landscapes of the Southern Western Ghats, India – Biodiversity, Human Ecology and Management Strategies*, French Institute, Pondicherry.

8. Most of the forests in HRML are on the western slopes drained by Idamalayar, Pooyamkuttiar and their valleys located mostly in Malayattoor Forest Division. The high Kannan Devan Hills (KDH) and plateau around Munnar straddles Eravikulam, Anaimudi shola and Pampadum shola National Parks and contain a matrix of *shola*-grassland ecosystems, *Eucalyptus* plantations and tea estates. Its eastern extremity merges into the Palnis through Vattavada valley and Kurinjimala Wildlife Sanctuary. The drier tracts of Anchanad Valley with its river head in the KDH and the east facing *sholas* drain towards Amaravathi River (tributary of Cauvery River) through Chinnar. The Idukki-Cardamom Hills stretch of the High Ranges is one of the widest reaches (about 45 km) in the Western Ghats and plays a crucial role in regulating weather and climate not only within the landscape but also in an extensive area of Kerala and Tamil Nadu states. The 'Unreserves'[27] of Pallivasal and Chinnakanal have significant areas under shade cardamom and forest fragments that still harbor an array of plant and animal species.

9. To the south of the high country of KDH, separated by the Chinnakanal valley, lies the Cardamom Hills. It is a plateau sloping from east to west and partly from north to south with a more or less uniform elevation of 900-1,200 m above MSL. The Cardamom Hill Reserve (CHR), even though notified as a Reserved Forest in 1897 with an area of 865 km^2, has only a marginal portion under exclusive conservation regimes (e.g. Mathikettan National Park); the rest being production areas under varied land use - from small towns like Kattappana and Nedumkandom through cardamom estates to forested revenue lands. Together with the adjoining forests of Tamil Nadu and Kerala, contiguous forests in the region (embedding HRML) come to around 4,800 km^2.

10. Due to unique topographical features, the climate in HRML is highly variable. Average annual rainfall in the rain-fed regions ranges from 3,000 to 8,890 mm and in the Anjanad Valley it goes as low as 1,270 mm (Nair, 1994).[28] Temperature varies between sub-zero and 42° C and the dry season commences from January and lasts until May on the western side, and in the eastern valley it extends to July. Nine river valley reservoirs (at different altitudes) including the Idukki mega hydel project dot the landscape. Seven faults/ lineaments criss-cross HRML and one seismic epicenter occurs towards its southern part (near Nedumkandom). Besides, an area of 247.6 km^2 has been identified as highly prone to landslides (CESS, 2009).[29]

Biodiversity and ecological context

Floristic attributes of HRML

11. Broadly, the natural vegetation of HRML can be divided into: 1) high elevation montane forests and grasslands, 2) humid high elevation forests, 3) humid mid elevation forests, 4) humid low elevation forests, and 5) dry forests (Map 2). Detailed floral wealth of HRML is given at Annexure 1.

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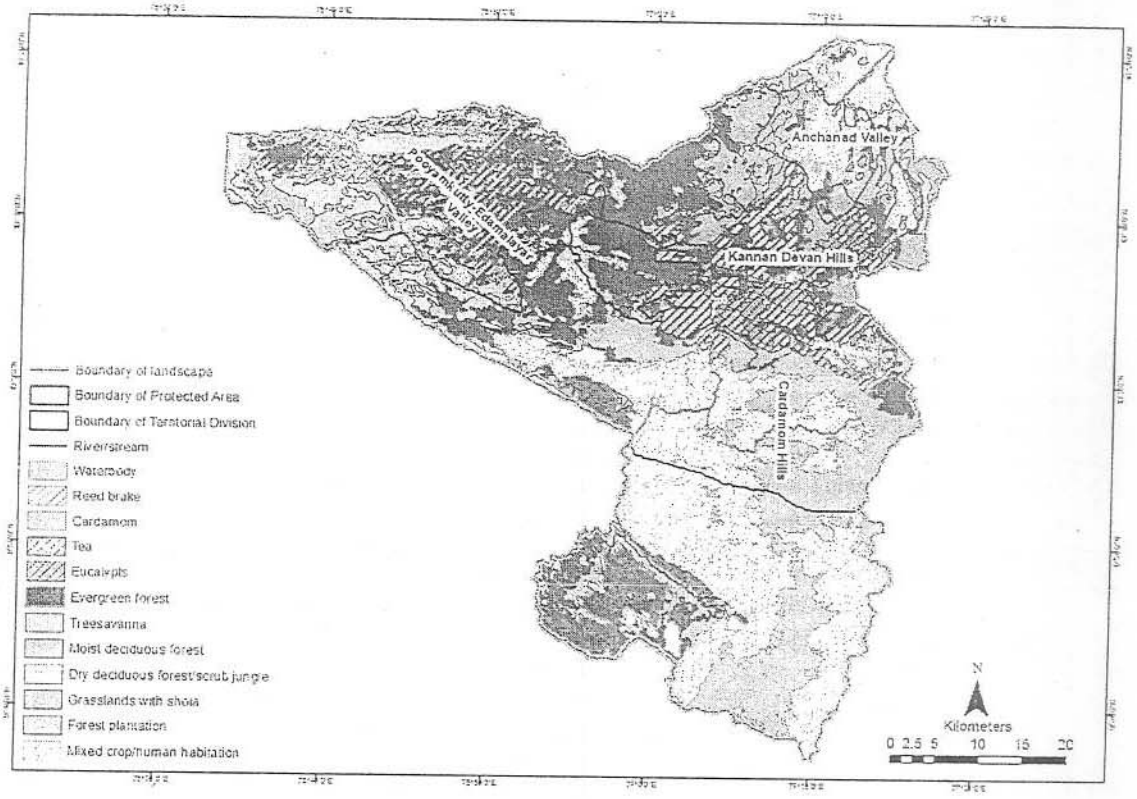
[27]These are land at the disposal of the government under a special legal category.

[28]Satis Chandran Nair, 1994.*The High Ranges:Problems and potential of a hill region in the southern Western Ghats*, INTACH.

[29]CESS, 2009. Multiple hazard zonation map, Kerala

Map 2: Vegetation map of HRML



High elevation montane forests and grasslands

12. Higher reaches of HRML are dominated by high-elevation montane evergreen forests known as *sholas* found within sheltered valleys interspersed with grasslands. Attaining a maximum height of 16-18 mts, *sholas* constitute the only temperate forests in south Indian tropics. The *sholas* are a relict vegetation harboring species that have survived the climatic and ecological changes occurred since the last glacial era, 30,000 to 20,000 years ago. These Pleistocene refugia are among the most endangered ecosystems in the world (Nair, 1991).[30] The botanical richness of the High Ranges had long been noticed (Barnes, 1939[31]; Shetty and Vivekanandan, 1971[32]). The floral elements in the *sholas* comprise mostly of Myrtaceae, Simplococeae, Lauraceae, Styraceae, Ternstroemiaceae, Rubiaceae and Acanthaceae. During the early explorations of Barnes, several new species of plants such as *Habenaria flabelliformis, Impatiens anamudica, Impatiens coelotropis, Impatiens pandata, Impatiens platyadena, Impatiens chinensis* var *brevicornis, Impatiens johnii, Impatiens munnarensis, Ischane fisheri, Sonerilla nemakadensis, Anaphalis barnesii, Aresaema attenuatum, Aresaema peltatum, Aresaema psittacus, Begonia aliciae, Didymocarpus macrostachya, Ophiorriza barnesii, Ophiorriza caudata* and *Ophiorriza munnarensis* were discovered. Shetty and Vivekanandan (1971)[33] collected 182 taxa of flowering plants from the High Ranges, of which 82 were found in the *sholas*, six along streams and the rest from the grasslands. As per the Red Data Book of Indian Plants (Nayar and Sastry, 1990[34]), *Impatiens*

[30]Satis Chandran Nair, 1991.*The Southern Western Ghats – A Biodiversity Conservation Plan*, INTACH
[31]Barnes, 1939.*The species of Geraniaceae occurring on the Travancore High Range including the description of a new balsam.* J Indian Bot. Soc. 18: 95-105
[32]Shetty B V and K Vivekanandan, 1971.*Studies on the vascular flora of Anamudi and the surrounding regions, Kottayam District, Kerala.* Bull. Bot. Surv. India, Vol. 13. Nos.1&2, pp 16-42
[33]Shetty B V and K Vivekanandan , 1971.*Studies on the vascular flora of Anamudi and the surrounding regions, Kottayam District, Kerala.* Bull. Bot. Surv. India, Vol. 13. Nos.1&2, pp 16-42
[34]Nayar M. P and A. R. K Sastry. 1990.*Red Data Book of Indian Plants. Vol. 3.* pp. 54-61. Botanical Survey of India

anamudica, *Impatiens johnii* and *Impatiens macrocarpa* are Endangered or Possibly Extinct. In peninsular India, phylogenetically primitive families like Magnoliaceae, Schisandraceae, Ranunculaceae etc. are confined to the high altitudes of High Ranges (Nayar, 1996).[35]

13. There are 94 species of endemic plants with restricted distribution in the Anamalai-High Ranges. Important endemic trees occurring in the Anamalai-High Ranges region (some may be extending to Palni Hills also) are *Cryptocarya anamalayana*, *Neolitsea fischeri*, *Symplocos anamallayana*, *Symplocos pulchra* sub-sp. *villosa*, *Pittosporum anamallayense*, *Eugenia rottleriana*, *Syzygium chandrasekharanii*, *Syzygium chavaran*, *Homalium travancoricum*, *Pseudoglochidion anamalayanum*, *Amoora beddomei*, *Dysoxylum ficiforme*, *Valeriana beddomei*, *Vernonia anamudica*, *Vernonia recurva*, *Vernonia anamallica*, *Vernonia multibracteata*, *Vernonia pulneyensis*, *Vernonia fysonii*, *Pimpinella pulneyensis*, *Antistrophe glabra*, *Schefflera chandrasekharanii* and *Sonerilla puleyensis*. In terms of diversity of balsams (*Impatiens sp*), HRML is richest in the world and one of the major centres of endemism (e.g. *Impatiens anamudica*, *Impatiens chandrasekharani*, *Impatiens cochinica*, *Impatiens coelotropis*, *Impatiens concinna*, *Impatiens elegans*, *Impatiens johnii*, *Impatiens leptura*, *Impatiens macrocarpa*, *Impatiens munnarensis*, *Impatiens pallidiflora*, *Impatiens pandata*, *Impatiens platyadena*, *Impatiens rivulicola*, *Impatiens tangachee*, *Impatiens verecunda* and *Impatiens kulamavensis)*. Alpine species of *Gaultheria*, *Mahonia*, *Rhododendron*, and *Rhodomyrtus* are also seen in the High Ranges. A significant feature of the landscape is the occurrence of gregarious flowering ("outburst" once in 12 years) of a plant species - *kurinji* (*Strobilanthes kunthianus*) that literally carpets the grasslands giving them a veritable blue hue. The last gregarious flowering of *kurinji* occurred in 2006 and the next bloom is expected in 2018.

Humid high elevation forests

14. The humid high elevation region of HRML comprises largely of tropical wet evergreen forests where cardamom (*Elettaria cardamomum*) used to be a natural under-storey species. Though a large part of it is converted to cardamom plantations during the last two centuries, a few patches of natural vegetation still exist. A recent study of floral diversity in this region recorded 1,044 species of flowering plants (Augustine, 2012)[36], of which, 395 are endemic to southern Western Ghats and 38 rare or threatened. At 39 percent, the degree of endemism here is higher than any other forest areas in Kerala, signifying its ecological uniqueness. In Mathikettan shola (an area rrepresenting the original vegetal cover of the region), 740 species of plants were reported, of which 346 endemic to the Western Ghats. There is high good representation of Orchids (40 species) with 20 endemics. Twenty species of *Impatiens* were recorded of which 16 are endemic to southern Western Ghats. A rapid bio-depletion assessment of Mathikettan region in HRML revealed the presence of five species of plants previously considered as "Possibly Extinct" (Augustine, 2002).[37] Further, an epiphytic orchid *Taeniophyllum scaberulum*, yet another species considered as "Possibly Extinct" in the Red Data Book, is reported from a small geographical location near Mankuthimedu.

15. The dominant tree species of the humid high elevation forests of HRML include *Palaquium ellipticum*, *Mesua ferrea*, *Prunus ceylanica*, *Myristica beddomei*, *Calophyllum polyanthum*, *Syzygium hemisphericum*, *Syzygium ceylanicum*, *Syzygium gardnerii*, *Syzygium cumini*, *Bhesa indica*, *Acrocarpus fraxinifolius*, *Cullenia exarillata*, *Toona ciliata*, *Elaeocarpus oblongus*, *Gordonia obtusa*, *Persia macrantha*, *Dysoxylum binectariferum*, *Dysoxylum beddomei*, *Vateria indica*, *Canarium strictum*, *Bombax ceiba*, *Canthium umbellatum*, *Cryptocareya beddomei*, *Cryptocareya bourdillonii*, *Actinodaphne bourdillonii*, *Actinodaphne malabarica*,

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[35] M P Nayar, 1996. *Hotspots of endemic plants of India, Nepal and Bhutan*. Tropical Botanic Garden and Research Institute, Palode, Thiruvananthapuram

[36] Augustine J. 2012. *Agricultural land use pattern and the flowering plant diversity in the Cardamom Hill Reserve (CHR), southern Western Ghats, Kerala*, India. Paper presented at Kerala Environment Science Congress, 2012, RGCB, Thiruvananthapuram

[37] Augustine J. 2002. *Mathikettan shola national park - a new attempt for the conservation of flowering plants in the Western Ghats, India*. Report submitted to the Forest and Wildlife Department, Government of Kerala

Litsea insegnis, Litsea oleoides, Litsea coriacea, Litsea floribunda, Hydnocarpus alpina, Garcinia cambogia, Ligustrum perrottetii, Vernonia arborea, Chionanthus mala-elengi, Celtis cinnamomea, Mallotus tetracoccus, Mallotus phillippinensis etc. The shrub layer is composed of *Debregeasia longifolia, Psychotria spp. Strobilanthes spp, Maesa indica, Elatostemma lineolatum, Allopohyllus cobbe, Chasalia ophioxyloides, Pavetta brevifolia, Ixora spp, Pogostemon benghalensis, Rauvolfia densiflora, Sarcococca trinervia, Solanum spp.* and *Clerodendron viscosum*. The riversides and stream banks have herbs such as *Impatiens maculata, Impatiens verticillata* and *Impatiens cordata*.

Humid mid elevation forests

16. At mid elevation (e.g. parts of Malayattoor, Munnar and Idukki Forest Divisions), the vegetation ranges from wet evergreen, semi evergreen to moist deciduous forests. High levels of species assemblage are noted in these areas. In Malayattoor Forest Division alone, 215 species of flowering plants (Angiosperms) have been reported.[38] One km^2 area of Sulimudi (at an altitude of 900-1300 m above MSL) in Idamalayar forests recorded 124 species of flowering plants belonging to 56 families and 114 genera. Among these, 34 species are endemic to the Western Ghats. Besides, species such as *Vateria indica* (Critically Endangered), *Euphorbia santapaui* (Endangered), *Belosynapsis vivipara*, *Bentinckia condapanna* and *Dalbergia latifolia* (Vulnerable) are under different threat categories in the IUCN Red List (Mahesh and Menon, 2011)[39]. Important species of plants recorded from the forests of mid elevation of HRML are *Garcinia spicata, Agrostistachys barneensis, Litsia stocksii, Cinnamomum sulphuratum, Knema attenuata, Holigarna arnottiana, Myristica beddomei, Rauvolfia densiflora, Atlantia racemosa, Aporosa acuminata, Neurocalyx calycinus, Strobilanthes lawsonii, Persia macrantha, Palaquium ellipticum, Cullenia exarillata, Mesua ferrea, Thottea siliquosa, Begonia malabarica, Drypetes wightii, Psychotria anamalayana, Saprosma simplicifolia, Syzygium gardeneri, Flacourtia montana, Vernonia arborea, Artocarpus heterophyllus, Elaeocarpus serratus, Sterculia guttata, Diospyros assimilis, Diospyros montana* etc.

17. *Bambusa arundinacea* Retz and *Ochlandra travancorica* (Bedd.) are the common bamboo and reed species occurring at this elevation respectively. *Ochlandra rheedii* (Ammei) is a smaller reed found along streams and *Calamus rotang* L. and *Calamus travancoricus* Bedd. form the most abundant species of cane (rattan). The humid evergreen forests of mid elevation have extensive area under reed breaks. Bamboo grows in moist deciduous and occasionally in semi-evergreen habitats. These forests also harbour the largest teak (*Tectona grandis*) trees in the world. For instance, one such tree at Ottakkallan (in Malayattoor Forest Division) measured 7.65 m girth at breast height (Nagaraj, 2012).[40]

Humid low elevation forests

18. Seen towards the lower reaches of Malayattoor and Munnar Forest Divisions and Thattekkad, on the banks of the Periyar River, they are among the few remaining relic lowland wet evergreen forests in the southern Western Ghats. These forests were extensively worked in the past (including for commercial teak plantations) that at many places had degraded to semi evergreen/ moist deciduous types. Wet evergreen forests are now confined to stream banks and between ridges in a few sheltered valleys in areas of high rainfall and have a rich assemblage of species. The canopy is dense and closed with four distinctive layers. The top canopy species include *Dipterocarpus indicus, Dipterocarpus bourdillonii, Hopea parviflora, Vateria indica, Canarium strictum, Elaeocarpus tuberculatus* and *Palaquium ellipticum*. In a recent survey, 728 species of plants belonging to 109 families were reported from the humid

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[38] Working Plan. Malayattoor Forest Division 2003-2012.

[39] Mahesh G and A.R.R.Menon, 2011. *Vegetation status, species diversity and endemism of Sulimudi forests of southern Western Ghats of Kerala, India*. Indian Forester, p.304-311

[40] Nagaraj, 2013. Personal communication

low elevation forests of Thattekkad, including 125 species endemic to southern Western Ghats.[41]

19. Some of the endemics seen in these forests are *Clematis munroniana, Desmos lawii, Goniothalamus wightii, Goniothalamus wyanaadensis, Stephania wightii, Calophyllum calaba, Calophyllum polyanthum, Garcinia wightii, Poeciloneuron indicum, Pterospermum reticulatum, Elaeocarpus munronii, Impatiens cordata, Impatiens herbicola, Impatiens leptura, Impatiens lucida, Impatiens scapiflora, Impatiens verticillata, Impatiens viscosa, Dysoxylum beddomei, Dysoxylum malabaricum, Holigarna ferruginea, Dialium travancoricum* and *Kunstleria keralensis*. The species *Vateria macrocarpa* is Critically Endangered and *Hydnocarpus macrocarpus* is found only in Neriyamangalam area of HRML (Augustine, 2013).[42]

Dry forests

20. Compared to rest of the landscape, its north-eastern extremity, known as the Anchanad valley, is quite distinct. Rainfall is much less and consequently the vegetation is of a drier type (Nair, 1988)[43]. The Anchanad valley starts from the narrow steeply descending Thalayar Gap (1,220 m above MSL) in KDH, opens out into the flat sandal wood tracts of Marayur and again slopes towards the dry forests of Chinnar plains (457 m above MSL). The lower portions of the valley lie in a rain shadow region during the south west monsoon, and support dry thorn and scrub forests and some unique habitats (e.g. riverine forests, sandal tract etc.). The dry deciduous forests around Marayur provide ideal conditions for sandalwood trees. The canopy is uneven and remains leafless for a long period. Major tree species found are *Acacia leucophloea, Acacia ferruginea, Albizia odoratissima, Anogeissus latifolia, Atalantia racemosa, Salmalia malabarica, Careya arborea, Cassia fistula, Chloroxylon swietenia, Chukrasia tabularis, Cipadessa fruticosa, Clausena willdenowii, Dalbergia latifolia, Gmelina arborea, Grewia tiliifolia, Lannea grandis, Protium caudatum, Pterocarpus marsupium, Emblica officinalis, Phoenix sp, Santalum album, Shorea talura* and *Terminalia chebula*. Though rare, *Diospyros ebenum* (ebony) also occurs.

21. The dry thorn and scrub forests in the Chinnar plains are well-known repository of medicinal plants and xerophytes. The representative species are *Acacia spp., Euphorbia spp., Capparis spp., Opuntia spp., Zizyphus spp., Grewia spp., Cordia spp., Albizia amara, Atalantia monophylla, Pleiospermium alatum, Prosopis juliflora, Dichrostachys cinerea, Diospyros cordifolia, Pisonia aculeata, Carissa carandas, Strychnos potatorum, Ceropegia juncea* and *Pergularia daemia*. A Critically Endangered tree, *Albizia lathamii*, occurs in these dry forests. The riparian forests characterized by evergreen and semi evergreen species are restricted to the fringes of streams and rivers. Dominant species are *Terminalia arjuna, Hopea parviflora, Bischofia javanica, Mangifera indica, Drypetes roxburghii, Vitex leucoxylon, Pongamia pinnata* and *Garcinia gummi-gutta*.

Faunal attributes of HRML

22. Globally significant fauna distributed in HRML include Nilgiri tahr (*Hemitragus hylocrius (nilgiritragus)*), Indian elephant (*Elephas maximus*), Tiger (*Panthera tigris*), Gaur (*Bos gaurus*), Nilgiri langur (*Trachypithecus johnii*), Lion-tailed macaque (*Macaca silenus*), Slender loris (*Loris tardigradus*), Leopard (*Panthera pardus*), Jungle cat (*Felis chaus*), Sambar deer (*Cervus unicolor*), Grizzled giant squirrel (*Ratufa macroura*), Malabar giant squirrel (*Ratufa indica*), Dusky striped squirrel (*Funambulus sublineatus*), Nilgiri marten (*Martes gwatkinsi*), Travancore flying squirrel (*Petinomys fuscocapillus*), Stripe-necked mongoose (*Herpestes vitticollis*), Brown mongoose (*Herpestes brachyurus*), Brown palm

[41] Management Plan, 2013-2012, Thattekkad Bird Sanctuary, Kerala Forest Department
[42] Jomi Augustine, 2013. Personal communication.
[43] Satis Chandran Nair. 1988.Long Term Conservation Potential of Natural Forests in the Southern Western Ghats of Kerala, Part II. Report submitted to Department of Environment, Government of India

civet (*Paradoxurus jerdoni*), Wild dog (*Cuon alpinus*) and avian species such as the Great Indian hornbill (*Buceros bicornis*) and Black and rufous flycatcher (*Ficedula nigrorufa*).Two hundred and sixty five species of butterflies (22 endemic to the Western Ghats), 310 species of birds (15 endemic to the Western Ghats), 72 species of fishes (23 endemic to the Western Ghats, one Critically Endangered, 8 Endangered, 6 Vulnerable and 4 Near Threatened), 79 species of mammals (9 endemic to the Western Ghats), 122 species of reptiles (42 endemic to the Western Ghats), 50 species of amphibians (43 endemic to the Western Ghats) and 111 species of Odonata (44 endemic to the Western Ghats) are reported from HRML.[44]

23. HRML is part of one of the five viable breeding population centres of tigers in India (NTCA, 2012)[45] and contains almost half the remaining global population of less than 2,000 individuals of Nilgiri tahr (mostly in Eravikulam National Park) and one of the last populations of Grizzled giant squirrel (mostly in Chinnar Wildlife Sanctuary). There are 11 endemic butterflies reported from the montane *shola* forests of Munnar (Mathew and Mohandas, 2001)[46]. Kelaart's long-clawed shrew (*Feroculus feroculus*) is a new record from Eravikulam National Park (Daniel and Vencatesan, 2008).[47] Interestingly, there are also reports (though not yet confirmed by science) of a cat, presumably a new species known locally as *pukaiyan* (smoky) from the higher reaches of HRML.

24. The forests of HRML have long been acclaimed for its rich avian and faunal wealth (Ali, 1984).[48] Fifteen of the 16 endemic birds of the Western Ghats are reported from the project landscape (Table 1). Of these, Nilgiri wood-pigeon, Broad-tailed grass bird, Kerala laughing thrush, White bellied short wing, Black-and-rufous flycatcher, Nilgiri flycatcher, White-bellied blue-flycatcher, Crimson-backed sunbird and Nilgiri pipit are habitat specialists more or less confined to the high altitudes of the High Ranges. Kerala Laughing thrush (considered Near Threatened as per the IUCN Red List) has a fairly good population in Munnar hills, Eravikulam National Park, Mannavan shola and upper reaches of Chinnar Wildlife Sanctuary (Sasikumar *et al.*, 2011).[49]

Table 1: Endemic birds of HRML

Common Name	Scientific Name	IUCN Status
Nilgiri wood-pigeon	*Columba elphinstonii*	VU
Malabar parakeet	*Psittacula columboides*	LC
Malabar grey hornbill	*Ocyceros griseus*	LC
White-bellied treepie	*Dendrocitta leucogastra*	LC
Grey-headed bulbul	*Pycnonotus priocephalus*	NT
Broad-tailed grass bird	*Schoenicola platyurus*	VU
Rufous babbler	*Turdoides subrufa*	LC
Wynad laughing thrush	*Garrulax delesserti*	LC
Kerala laughing thrush	*T. fairbanki fairbanki*	NT
White bellied shortwing	*Brachypteryx major*	NT
Black-and-rufous flycatcher	*Ficedula nigrorufa*	NT
Nilgiri flycatcher	*Eumyias albicaudatus*	NT

[44] Compiled from various sources.
[45] Various reports of National Tiger Conservation Authority, MoEF, 2012
[46] Mathew, G. and Mohandas, K., 2001. *Insect fauna of the shola forests of Munnar and Wynad.* KFRI Research Report No.206: 38 pp (mimeo).
[47] Ranjit Daniels and Jayshree Vencatesan, 2008. *Western Ghats: Biodiversity, people and conservation*, Rupa Com.
[48] Ali S. 1984. *Fall of a sparrow*. pp. 82-84
[49] Sasikumar C, Praveen J, Muhammed Jafer Palot and P O Nameer, 2011. *Birds of Kerala – Status and Distribution*. D C Books, Kottayam, India. pp. 590-593.

White-bellied blue-flycatcher	*Cyornis pallipes*	LC
Crimson-backed sunbird	*Nectarinia minima*	LC
Nilgiri pipit	*Anthus nilghiriensis*	VU

25. The renowned Ornithologist Salim Ali had recorded 167 species of birds from the low elevation forests for HRML in 1933.[50] Recent assessments place the avian diversity at Thattekkad (a representative area of low elevation forests) at 284 (Sugathan and Varghese, 1996).[51] Three toed forest kingfisher and Ceylon frogmouth are two indicative species of rarity found at this elevation. Grey headed bulbul, another Western Ghats endemic (listed as Near Threatened by IUCN) has a good population in Thattekkad and Mankulam. The low land evergreen forests of HRML, lying contiguous to Idamalayar- Pooyamkutti valley, are a known viable breeding ground for all the four species of hornbills (Great Indian, Malabar pied, Malabar grey and Indian grey hornbills) found in the Western Ghats (Bachan *et al.*, 2011).[52] Birds like Black-headed babbler and endemic butterflies like Travancore evening brown, Bicolour ace and Tamil cats eye are confined to the reed breaks. Reed breaks also support endemic frogs like *Raorchestes chalazodes*, *Raorchestes ochlandrae* and *Raorchestes manoharie*. An interesting phenomenon occurs in the Anakkulam region of the project landscape where hundreds of elephants congregate in the river, for reasons not known for certainty. Further, there are reports from the low elevation forests of Malayattoor on the occurrence of Malabar civet (*Viverra civettina)*, which is believed to be 'extinct'.

26. Higher elevations of HRML are known for unique amphibian diversity with several new species of frogs discovered recently (e.g. *Raorchestes griet, Raorchestes resplendens, Raorchestes dubois, Raorchestes chlorosoma, Raorchestes kadalarensis*, and *Raorchestes theuerkaufi)* (Zachariah *et al.*, 2011).[53] One species, *Raorchestes resplendens* is confined to Eravikulam National Park alone (Biju *et al.*, 2010).[54] The Agamid lizard-*Salea anamallayana,* the Forest Gecko – *Hemidactylus anamallayana* and the Mountain wine snake – *Ahaetulla dispar* are rare endemic reptiles confined to the higher reaches of the project landscape. The drier tracts of HRML are also resplendent with faunal wealth. Chinnar Wildlife Sanctuary has recorded the largest number of reptilian species (including the Mugger crocodile) in Kerala. The dry forests of Marayur and Chinnar have a viable population of the highly endangered Grizzled giant squirrel and also Starred tortoise. Marayur-Chinnar tract is the only known habitat of Tufted grey langur (*Semnopithecus priam*) in Kerala.

27. The recorded faunal wealth of HRML is summarized in Table 2 below and the details of fauna and the population status of key species are given at Annexure 2 and Annexure 3 respectively.

Table 2: Faunal wealth of HRML[55]

Name of the Protected Area/ Forest Division	Number of species recorded					
	Mammals	Birds	Reptiles	Amphibians	Fishes	Butterflies
Eravikulam National Park	48	133	13	21	3	101
Idukki Wildlife Sanctuary	28	172	55	28	30	76
Chinnar Wildlife Sanctuary	28	225	52	15	14	156

[50] Management Plan, 2013-2022, Thattekkad Bird Sanctuary, KFD

[51] Sugathan.R and Varghese A.P., 1996. *A Review of Birds of Thattekkad Bird Sanctuary,Kerala*. J.Bombay.Nat.Hist. Soc.93(3):487-506

[52] Bachan A.K.H, Kannan R.,Muraledharan S.,& Kumar S., 2011. *Participatory conservation and monitoring of great Indian hornbills and Malabar pied hornbills with the involvement of endemic Kadar tribe in the Anamalai Hills of southern Western Ghats, India.* The Raffles Bulletin of Zoology, Supplement No. 24: 37-43.

[53] Anil Zachariah, K.P. Dinesh, E. Kunhikrishnan, Sandeep Das, David V. Raju, C. Radhakrishnan, Muhamed Jafer Palot& S. Kalesh. 2011. *Nine new species of frogs of the genus Raorchestes (Amphibia: Anura: Rhacophoridae) from southern Western Ghats, India.* Biosystematica, 5 (1): 25-48

[54] Biju, S.D., Y. Shouche, A. Dubois, S. K. Dutta and F. Bossuyt. 2010. *A ground-dwelling rhacophorid frog from the highest mountain peak of the Western Ghats of India.* Current Science, 98 (8): 119-1125

[55] Compiled from Management Plans and Working Plans

Thattekkad Wildlife Sanctuary	39	284	34	17	52	222
Mathikettan National Park	9	27	ND	ND	ND	52
Pampadum shola National Park	9	76	ND	ND	ND	100
Mannavan shola National Park	13	76	ND	ND	ND	100
Kurinjimala Wildlife Sanctuary	15	76	ND	ND	ND	100
Munnar Division	36	135	16	14	16	26
Marayur Division	31	165	13	14	14	26
Malayattoor Division	38	270	29	27	55	76
Mankulam Division	25	134	ND	18	28	87

ND – No Data

Ecological attributes of HRML

28. Due to their complex topography and a biogeographic history featuring regular altitudinal migrations of vegetation zones in response to changing climate, the montane ecosystems around the globe have distinct biological communities and high levels of endemism (Gentry, 1993).[56] Three proximate factors give HRML its intrinsic biological opulence. First, there is an astounding spectrum of exclusive ecological niches over a range of altitudes that houses highly sensitive biodiversity elements. For instance, from the Anaimudi peak (2,695 m above MSL), the altitude cascades along precipitous cliffs and valleys, down to about 40 m above MSL (at Pooyamkutti and Thattekkad) within a short geographical span of about 38 km. Second, the landscape experiences a highly varied climate regime that is manifested through differential patterns of precipitation, humidity, temperature and wind; and third, the constant interplay of human activities and natural processes has sculptured a curious mixture of bio-physical niches (ranging from montane evergreen forests to dry thorn and scrub forests).

29. Considering the species richness, diversity of vegetation and the presence of unique habitats, the ecosystem value of HRML is of the highest order. On a ten point scale, the ecosystem value of the HRML ranges between 9 and 10 (Ramesh *et al.,* 2003).[57] These habitats also underpin key ecosystem functions including water security of the plains (through Rivers Periyar, Chalakkudi and Cauvery), availability of water for hydel and irrigation projects (Table 9), raw material to industries (e.g. Hindustan News Print Ltd. and Kerala State Bamboo Corporation), supporting livelihoods of local communities (e.g. NTFPs, artisanal crafts etc.), tourism etc.

30. HRML is highly ecologically diverse and an epicenter of ecological processes and progressions. High degree of endemism is a characteristic feature of HRML particularly its higher reaches. This is largely due to their relative insularity and evolution in isolation. Small population, narrow geographical distribution and extremely conditioned and specialized habitat preferences are the distinct features of the endemic species of the landscape. For instance, Bryophytes such as *Fissidens longtonianus* (2005)[58], *Chiloscyphus chinnarensis* (2011)[59], *Aerobryopsis eravikulamensis* (2012)[60] are new additions from HRML. Endemism is relatively high in isolated peaks and plateau compared to the lower regions. Such exclusive ecological niches of the High Ranges resemble island biogeography mentioned by Stebbins (1980).[61] At the same time, there are also parallels in the flora of the High Ranges, Nilgiris

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[56] Gentry, A.H., 1993. *Patterns of and floristic composition in neotropical montane forests.* Proceedings of Neotropical Montane Ecosystem Symposium, New York.

[57] Ramesh, B.R., Lo Seen, D. Karunakaran, P.V., Balasubramanian, M. and Sankar, M., 2003. *Conservation Review for Rationalization of Protected Area Network in Kerala.* Final Report. French Institute of Pondicherry.

[58] Iwatsuki, Z. and T. Suzuki. 2005. Notes on *Fissidenspulchellus, F.subpulchellus and F. longtonianus sp. nov. (Bryopsida: Fissidentaceae)* in India. Journal of Bryology. 27: 241-245.

[59] Manju C.N., Rajesh, K.P. &Madhusoodanan, P.V. 2011. *Chiloscyphus chinnarensis (Lophocoleaceae, Hepaticae)*: A new species from the Western Ghats of India. Acta Bot. Hungarica 53: 151-157.

[60] Manju, C.N., Martin, K.P., Sreekumar, V.B. and K.P. Rajesh. 2012. Morphological and molecular differentiation of *Aerobryopsis eravikulamensis sp. nov.(Meteoriaceae: Bryophyta)* and closely related taxa of the Western Ghats of India. Bryologist: 115(1): 42-50.

[61] Stebbins, 1980. *Rarity of plant species: a synthetic view point.* Rhodora 82(829):77-86

and Adams Peak in Sri Lanka (Subramayam and Nayar (1974).[62] For instance, the monotypic *Kendrikia walkeri* (Melastomaceae) is restricted to Anaimudi peak in HRML and Adams peak in Sri Lanka, both areas having similar altitude and eco-climatic conditions.

31. The ecological status of *shola*–grassland formation has been a subject of controversy over the years with several postulations and contestations made. Ranganathan (1938)[63] believed that these are climax vegetation; but on the contrary many consider them as sub-climax (Raghavan, 1957[64]; Gupta, 1960[65]) and several others as edaphic climax (Champion and Seth, 1968)[66]. Sukumar (1995)[67] suggested the evolution of this formation in relation to global climate change i.e. shift from cooler epoch to warmer epoch. Nair (1994)[68] is of the view that anthropogenic factors and fire play an important role in their maintenance. It is also observed that the ecotone between *shola* and grassland is very sharp and maintained by a combination of frost and fire (Meher-Homji, 1984).[69]

Administrative and governance context:

32. The project landscape spreads over two administrative districts in Kerala *viz.*, Idukki (82 percent of the landscape) and Ernakulam (18 percent)[70]. It has five territorial Forest Divisions managed by the Forest Department (i.e. Malayattoor, Munnar, Mankulam, Marayur and Kottayam) that cover an area of 1,216 km^2 (39 percent) and two exclusive Wildlife Divisions (Munnar and Idukki) with an area of 371 km^2 (11.96 percent). HRML is mostly located in the upper regions of Idukki district, the rest being in Kuttampuzha and Vengoor Grama Panchayats (GPs -an arm of the local self-government called Panchayati Raj Institutions (PRIs)[71]) of Ernakulam district and a portion of Athirapilly GP.[72] Administratively, HRML covers 34 GPs (31 from Idukki, two from Ernakulam and one in Thrissur districts), five Taluks (Devikulam, Udumpanchola, Kothamangalam, Kunnathunaduand Mukundapuram) and eight Block Panchayats. Of the 34 GPs, 11 are of critical relevance in the project due to their geographical positioning, biodiversity value, and varied threat perception (both existing and emerging) (Table 3). The list of Panchayats, Blocks, Taluks and Districts in HRML is given at Annexure 4. Details of other governance and administrative institutions are dealt in the next section.

Table 3: Summary of biodiversity rich Panchayats, Blocks, and Taluks in HRML

Sl.No.	Name of the Panchayat	Name of the Taluk	Name of the Block	District
1.	Munnar	Devikulam	Devikulam	Idukki
2.	Devikulam	Devikulam	Devikulam	Idukki

[62] Subramanyam K. and M. P. Nayar, 1974.*Ecology and Biogeography in India*. Ed. M.S.Mani. DR. W. Junk Publishers the Hague. pp. 178-196).

[63]Ranganathan, 1938.*Studies on the ecology of shola grassland vegetation of the Nilgiris Plateau*. Indian Forester.64:523-541.

[64] Raghavan, N., 1957. *Ecological status of the south Indian grasslands*.J.IndianBot.Soc. 36.596

[65] Gupta, R.K., 1960. *Ecological notes on vegetation of Kodaikanal*, J.Indian.Bot.Soc.39:601-17

[66] Champion, H.G. and Seth, S.K., 1968. *A revised survey of the forest types of India*. Manager, Govt. of India Press, Nasik.

[67] R. Sukumar, H.S. Suresh, and R.Ramesh, 1995. *Climate Change and its impact on tropical montane ecosystems in southern India*, Journal of Biogeography 22, 533-536

[68] Satis Chandran Nair, 1994, The High Ranges: Problems and potential of a hill region in the southern western ghats, INTACH

[69] Meher-Homji, V.M., 1984 Udhagamandalam (Ootacamund): A biogeographic perspective. Ind.Geogr.J.59(2). 205-213

[70] Though a small part of it falls in Thrissur district also, it is very negligible.

[71]PRIs are local-level institutions for self-governance in rural areas that are recognized by the Constitution of India. These are elected bodies and operate at three levels, at village, at the block (a cluster of villages) and at the district level. PRIs are responsible for the preparation of plans for economic development and social justice and also for the implementation of schemes as entrusted to them by the respective state governments and also by the GOI.

[72]Three tribal hamlets (Adichilithotti, Kappayam and Vettivittakadu) are included under Athirapilly GP for administrative reasons.

3.	Kanthalloor	Devikulam	Devikulam	Idukki
4.	Vattavada	Devikulam	Devikulam	Idukki
5.	Edamalakudi	Devikulam	Devikulam	Idukki
6.	Mankulam	Devikulam	Devikulam	Idukki
7.	Marayoor	Devikulam	Devikulam	Idukki
8.	Chinnakkanal	Udumbanchola	Devikulam	Idukki
9.	Santhanpara	Udumbanchola	Devikulam	Idukki
10.	Kuttampuzha	Kothamangalam	Kothamangalam	Ernakulam
11.	Athirapilly	Mukundapuram	Chalakudi	Thrissur

Socio-economic context

33. HRML has diverse cultural (tribals and non-tribals) and linguistic affinities (Malayalam, Tamil and tribal dialects). According to 2001 figures, the region had 672,462 inhabitants (including 337,343 women) and 159,541 households[73]; Nedumkandom, Kattappana, Adimali, Upputhara, Vandanmedu and Konnathady being densely populated areas. Average family size in the landscape is four. Sex ratio (females per thousand males) is lower than the state average. The child sex ratio (age group between 0-6 years) is also showing a similar trend (see Annexure 5 for details). Munnar (54 percent), Chinnakanal (39 percent), Marayur (30 percent) and Kanthalloor (26 percent) have significant population of Scheduled Castes. While Edamalakudy is a 100 percent tribal populated Panchayat, Marayur, Kanthalloor, Vattavada, Mankulam and Kuttampuzha Panchayats have significant tribal population.

34. According to the provisional census figures of 2011, there has been 1.93 percent reduction in the rate of population growth in Idukki district (covering more than 80 percent of the project landscape) compared to 2001 (see Annexure 6). However, the number of individual households seems to have increased during the same period by around 11,600. The population density is 282 persons per km^2 (see Annexure 7). Population density is highest at Kattappana (751 persons per km^2) followed by Kamakshi, Erattayar, Karunapuram and Vathikudy. Places like Mankulam (75persons per km^2), Vattavada (80 persons per km^2), Kanthalloor and Edamalakudy have relatively low population density.[74]

35. Literacy rate is 88.69 percent, which is marginally lower than the state average (93.91 percent). Literacy among women (85.02 percent) is also low compared to men. Literacy levels are significantly lower among tribal communities (62.78 percent) with Malayarayans and Ulladan communities faring better. There are 133 Lower Primary, 69 Upper Primary, 44 High, 27 Higher Secondary, five Vocational Higher Secondary Schools, two engineering colleges, seven arts & science colleges and two technical institutes distributed largely around the urban areas of the landscape. Health and education facilities are relatively poor in the tribal areas. Another noteworthy feature is the increased social mobility among Malayarayans, due to high literacy and their ability to avail the opportunities offered by modernity (more on tribal communities is dealt separately).

36. Agriculture and allied activities form the mainstay of employment in HRML. The workforce[75] in the landscape can be broadly categorized into: a) cultivators; b) agricultural labour; c) industrial labour; and d) other categories. In Munnar 96 percent of the work force is categorized under other categories which mostly include Plantation workers in tea estates.[76]

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[73] Edamalakudy and Devikulam are the newly formed Panchayats by splitting the Munnar Panchayat. Therefore the 2001 population of Munnar Panchayat also includes the populations of the present Edamalakudy and Devikulam panchayats.

[74] Places like Mankulam show lower population density due to of large extent of forested areas that confound the population figures that is confined concentrated habitations.

[75] As per the Census figures, workers are those who avail more than six months of employment opportunities in a year

[76] These are based on Census figures of 2001 Since then there has been a clear trend of more people taking up tourism related employment

Similarly Pallivasal (57 percent), Chinnakanal (53 percent) and Mankulam (32 percent) also have significant plantation workers. See Annexure 8 for details. Industrial units like tea processing units and micro-enterprises (e.g. processing *jaggery* (country-made sugar), lemon grass oil etc.) and tourism provide most of the employment in the industrial sector. Spatial distribution of workforce in HRML is given in Annexure 9. The workforce mostly comprises of men-folk; however certain sectors (e.g. tea and cardamom) employ women in large numbers (see Annexure 10). There are around 19,000 and 74,000 workers employed in tea and cardamom estates respectively while the tourism industry supports 8,000 people. In addition, around 3,700 families are fully or partially engaged in the reed extraction and related cottage enterprises. *Kudumbasree*, a highly successful and flagship women empowerment programme of the state government (coordinated at the district level and functioning through Local Self Governments (LSGs)) has extensive reach at grassroots in the project landscape.

37. In terms of number of landholdings[77], 86 percent are marginal holdings with less than one ha of land. There are 310 large holdings with more than 10 ha of land. Apart from operational holdings, 1,944 institutional holdings are in the landscape. Of this about 7 percent are large holdings of above 10 ha. Though the number of large holding is less when compared with individual operational holdings, in actual extent, large holdings will outnumber the overall marginal and small holdings (Table 4).

Table 4: Landholding Pattern in HRML[78]

Holding Size	Landholding Pattern (no)			
	Operational	Percentage	Institutional	Percentage
Up to 1 ha (Marginal)	163,898	86.49	1311	67.44
Between 1and 1.99 ha (Small holding)	18,970	10.01	239	12.29
Between 2 and 3.99 ha (Semi Medium)	4,885	2.58	170	8.75
Between 4 and 9.99 ha (Medium)	1,426	0.76	90	4.63
Above 10 ha (Large)	310	0.16	134	6.89
Total	**189,489**	**100.00**	**1,944**	**100**

38. It is estimated that HRML has about 33,829 tribal persons in 9,029 families. Among the 13 different tribal communities (Table 5), Muthuvan, Mannan, Hill Pulaya, Oorali, Malavedan and Malayan have relatively longer association with HRML. They have distinct cultural practices, settlement patterns and livelihood strategies. Tribal hamlets are located either deep in the forests or along the fringes where subsistence farming is mostly the way of life. Collection of forest produce, artisanal handicrafts and forest and agriculture labour provide supplementary income. Details on the geographical spread of tribal communities are given in Annexure 11.

Table 5: Details of tribal communities in HRML[79]

Sl No.	Community	No of families	% among the Scheduled Tribes	No. of persons	% of Individuals
1	Hill Pulaya	960	10.63	3415	10.09
2	Mannan	1776	19.67	6688	19.77
3	Muthuvan	3334	36.93	12399	36.65

[77] Landholding is considered as the possession of land document and one person can have more than one landholding
[78] Govt. of Kerala (2009) HD Data Series II, Agriculture. Kerala State Planning Board and Dept. of Economics and Statistics.
[79] Economics & Statistics Department, Government of Kerala

4	Paliyar	358	3.97	1281	3.79
5	Ulladar	609	6.74	2379	7.03
6	Oorali	823	9.12	3044	9.00
7	Malaipandaram	12	0.13	45	0.13
8	Malayarayar	957	10.60	3835	11.34
9	Malavedan	46	0.51	177	0.52
10	Malayan	151	1.67	551	1.63
11	Irular	1	0.01	5	0.01
12	Kanikkar	1	0.01	6	0.02
13	Kattunaikar	1	0.01	4	0.01
Total		**9,029**	**100**	**33,829**	**100**

39. Collection and trade in NTFPs form the principal livelihood for 1,963 tribal families with Muthuvans and Hill Pulayans having strong reliance on natural resources. For instance, in Chinnar Wildlife Sanctuary alone, among the 141 species of plants recorded as ethno-botanically important[80], around 57 were used exclusively by Hill Pulayas and 27 by Muthuvans. Cultivation of lemon grass (531 ha) is an important livelihood strategy for Muthuvans and Hill Pulayas in the drier tracts of HRML. Extraction of fuel wood for lemon grass distillation is a major forest dependency among them (about 494,361 kg per year). Collection of *Phoenix sylvestris* leaves from the grasslands for making house-hold utility items is a supplementary source of income for tribals in Marayur, Chinnar and Vattavada. In Kuttampuzha and Mankulam, artisanal mat weaving (reed) is a prominent source of income. Most of them (36.88 percent) sell their products directly in the markets at Chalakkudi, Muvattupuzha, Adimali, Marayur, Kothamangalam, Kaladi and Kattappana; while about 34 percent sell their products through intermediaries. Only about 15 percent of the families sell their products to Tribal Cooperative Societies. The sale of NTFPs through the participatory forest management institutions set up by the Forest Department (Vana Samrakshana Samities (VSS) and Ecodevelopment Committees (EDCs) is negligible (less than 3 percent).[81]

Land use and developmental context

40. HRML has an intricate development history that has resulted in a mosaic of land uses as is seen today. This section details the highly complex developmental context of the landscape in two parts. First, the development history of HRML and second, the current land use pattern.

Development history of HRML

41. Archaeological evidence suggests human presence in the High Ranges seven to eight thousand years ago (Gurukkal, 1999).[82] During the 19th century, the region was part of the then Princely State of Travancore. There were two discernible streams of migration to HRML during the last two centuries - one centered on plantations and wealth creation, and second for subsistence (Varghese, 2009).[83] During second half of the 20th century, various government programmes such as 'Grow More Food', 'High Range Colonization Scheme' 'Co-operative Settlement Scheme' and 'Settlement of Agricultural Labourers', encouraged migration to HRML. Further, river valley projects and road networks provided access to hitherto remote locations. All these have significantly altered the ecological complexion of HRML though the

[80] Ramakrishnan, P. S (Eds.) 2000. Mountain Biodiversity, Land Use Dynamics and Traditional Ecological Knowledge, UNESCO. Oxford & IBH Publishers, New Delhi. P. 353

[81] GOK, 2011.Baseline Survey of Scheduled Tribes, Department of LSG and Tribal Development

[82] R.Gurukkal, 1999.Cultural History of Kerala. Department of Cultural Publications, Govt. of Kerala

[83] Varghese, V.J., 2009. Land, Labour and Migration – Understanding Kerala's Economic Modernity. Working Paper, CDS, Trivandrum

pattern and its impacts varied differently across the landscape. A brief account of the patterns and impacts of human migration to different parts of HRML is given below.

42. **Kannan Devan Hills (KDH),** also known as the 'High Ranges proper', extent over 55,000 ha in the upper reaches of HRML. First surveyed by Lts.Ward and Connor (1817), this region was leased out to J.D. Monroe, Supt. of Cardamom Hills in 1877. With planters from Europe and labour from eastern Tamil plains moving in, by late 19th century, conversion of forests and grasslands in KDH became extensive. First Cinchona and later coffee were attempted and finally large areas were opened up for tea. However, mainly as a measure of protection from desiccating winds, for water sourcing and game hunting, several forest fragments were retained within the plantations. Amalgamating small proprietary tea plantations, the Kannan Devan Hills Produce Company, then the largest tea company in the world was formed during late 19th century. Subsequently, under the Kannan Devan Hills (Resumption of Lands) Act of 1971, the government took control over the KDH land. Part of it was later resumed to the Company while the rest was assigned to Forest Department for wildlife conservation (Eravikulam National Park) and commercial forestry. Around the same time, a portion of the pristine moist evergreen forests of Mankulam was assigned for occupation (for landless) and had also undergone a spate of encroachments. An Indian corporate house took over the management of tea estates in 1983. During late 1990s, Munnar became a bustling tourism destination and massive infrastructure – both planned and unplanned sprang up; a trend that spilled over to the adjoining areas as well (e.g. Chinnakanal and Pallivasal). By 2010, around 7,000 ha area of KDH and major portion of Mankulam were also declared as Reserve Forest.

43. **Cardamom Hills,** predominantly moist evergreen forests, had small-scale extraction of wild cardamom since long. During early 19th century, the Travancore State monopolized cardamom trade and in 1897 major cardamom growing areas were notified as Cardamom Hill Reserve (CHR) (Moench, 1991).[84] Cardamom cultivation expanded considerably during the early decades of the 20thcentury with a concomitant rise in population (particularly during 1911 to 1951). With this, the imperatives of production soon eclipsed the concerns of conservation in CHR.[85] Subsequently, the region witnessed massive changes in land-use and complex landholding patterns and highly ambiguous land tenure systems became the hallmark of CHR. In 2003, a portion of CHR was gazetted as a National Park (Mathikettan).

44. **Anchanad Valley**, the drier east facing tracts of HRML, had human presence even in pre-historic times which is evident from the remnants of cultural artifacts like dolmens and rock paintings. The region, however, remained largely insular to modernity till recent times due to its relative inaccessibility. It was only during the 1950s that settlers from the plains started migrating to Kanthalloor and Marayur. Lemon grass cultivation became extensive since late 1970s, with a proportionate increase in fuel wood collection from the forests. The unique sandal bearing forests of Marayur faced heavy onslaught of illegal felling during the last decade and development of tourism brought in increased vehicular traffic. Extensive rice growing areas (irrigated by the waters of *shola* forests) were also converted to sugarcane.

45. **Lower Valleys of HRML** draining into Periyar River were known for their veritable timber resources. With the advent of the British, the forests became state property and hardwood, primarily teak (initially from natural forests and later from plantations) a major source of revenue. During the 18th and 19th centuries, shifting cultivation was wide-spread though it was subsequently prohibited. In 1895, the Malayattoor Forest Division was notified as a Forest Reserve. At the time of India's independence, these forests were managed primarily for timber and a part for fuel wood production. Large areas of reed breaks were allotted for commercial extraction by the Hindustan Newsprint Ltd and the Kerala State Bamboo Corporation. The region also has a history of capture of wild elephants. The now abandoned road between Munnar and Cochin that passed through the forests of Malayattoor became the

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[84] Marcus Moench, 1991. Politics of Deforestation: Case Study of Cardamom Hills of Kerala. Economic and Political Weekly, January, 1991

[85] In early years, cardamom was considered as a forest crop managed under wild conditions.

main artery for reed extraction and migration during 1960s and 70s. Spurt in population, induced by various food promotion / colonization schemes, alienated tribal lands at several places and dislocated them further to deeper forests to a life of drudgery and destitution (e.g. Adichilithotti) (Amruth and Gurukkal, 2007).[86]

Current land-use context:

46. At present, HRML is a complex mosaic of land uses with an admixture of conservation, commercial and subsistence activities. The primacy accorded to various land use practices (from natural forests to subsistence farming to commercial plantations and finally to mass tourism) at different points of historical timescale has sculptured the current complexion of the landscape. A brief account of the current land use pattern in HRML is given below. See also Table 10 and Map 3.

47. **Protected Areas (PAs):** Conservation history in the region started with the establishment of Eravikulam National Park (as a Game Reserve by early planters). There are eight PAs extending over 37,100 ha constituting 11.96 percent of the project landscape (Table 6). Five of them are physically connected in a crescent shaped configuration with tea estates filling up the interstices. Eravikulam National Park encompasses extensive areas of undisturbed *shola*-grassland ecosystems. Chinnar Wildlife Sanctuary, shaped like a bowl, has predominantly drier vegetation types and scattered tribal settlements. Anaimudi shola and Pampadum shola National Parks are montane evergreen forests significant for their biological and hydrological values. Kurinjimala Wildlife Sanctuary is a recently formed PA with a major portion under exotic species (*Eucalyptus* and Wattle (*Acacia mearnsii*)). Mathikettan National Park (representing the remnant vegetation of Cardamom Hills) and Idukki Wildlife Sanctuary are isolated PAs with more or less lost connectivities. The low-lying Thattekkad Wildlife Sanctuary still has connectivity to the rest of the forests of the landscape. Some of the PAs have unworked commercial plantations (e.g. teak and mahagony (*Switenia mahagony*) in Thattekkad).

Table 6: Protected Areas of HRML

Protected Area	Area (ha)	Vegetation Types
Eravikulam National Park	9,700	*Shola*-grasslands, wet evergreen forests
Chinnar Wildlife Sanctuary	9,040	Dry thorn and scrub forests, riverine forests
Kurinjimala Wildlife Sanctuary	3,200	*Shola*-grassland, deciduous forests, wattle plantations
Anaimudi National Park	750	*Shola*-grasslands, wattle and eucalyptus plantations
Pampadumshola National Park	130	*Shola*-grasslands, wattle and eucalyptus plantations
Mathikettanshola National Park	1,280	*Shola*, wet evergreen forests, abandoned cardamom
Thattekkad Wildlife Sanctuary	2,500	Low elevation evergreen forests, teak plantations
Idukki Wildlife Sanctuary	10,500	Mid elevation moist forests and savannas
TOTAL	37,100	

48. **High Value Biodiversity Areas (HVBAs):** Outside the PA system, there exist extensive tracts of High Value Biodiversity Areas (HVBAs), mostly in areas administered by the Forest Department and smaller fragments in Revenue and private lands. Extending over 84,600 ha, HVBAs cover about 27.29 percent of the project landscape. HVBAs of HRML include most of Mankulam Division, areas resumed from KDH, areas adjoining PAs and natural forests of Munnar, Malayattoor, Marayur, and Kottayam Forest Divisions. Some of the *sholas* and grasslands under the control of the Revenue Department (e.g. Manthan shola) also come under this category. The tea plantations of KDH have interspersed forests, grasslands and swamps within them; all crucial HVBAs. Apart from harbouring significant biological diversity (e.g. Nilgiri tahr, Nilgiri marten, Wood cock, Grizzled Giant Squirrel, Great Indian hornbill etc.), these HVBAs ensure linkages in the landscape and connectivity between PAs. The extent and vegetation types of HVBAs in HRML are given in Table 7.

[86] Amruth, M. and Rajan Gurukkal, 2007. Spatiality of subsistence and human ecology of landscape: towards self-regulatory Forest Communities

Table 7: Extent and vegetation types of HVBAs in HRML

High Value Biodiversity Area	Area (ha)	Vegetation Types
Mankulam Forest Division	9,000	Evergreen, montane temperate forests and plantations
Munnar Division	23,800	*Shola*-grasslands, evergreen forests, plantations, moist deciduous forests, reed breaks
Marayur Division	5,200	*Shola*-grasslands, sandal tracts, plantations
Malayattoor Division	37,100	Reed breaks, evergreen forests, moist deciduous forests, plantations
Kottayam Division	3,500	Mid elevation forests and savanna grasslands
Revenue areas	2,000	*Shola*-grasslands, montane forests (fragments)
Tea estates	4,000	*Shola*-grasslands, swamps (interspersed)
TOTAL	**84,600**	

49. **Commercial tree plantations:** Large extent of the project landscape (31,580 ha) is under commercial tree plantations of teak, *Eucalyptus*, wattle and other miscellaneous species which are mostly managed by the Forest Department. Teak plantations are extensive in Malayattoor and parts of Munnar Forest Divisions. High altitude grasslands of HRML had been planted with wattle around three decades ago. Hindustan News Print Ltd (HNL) and Kerala Forest Development Corporation (KFDC) have established short rotation *Eucalyptus* plantations for industrial raw material requirements on land taken on concessions from the Forest Department. Extensive *Eucalyptus* plantations have also been established by large tea companies (for sourcing fuel wood for curing tea) and private farmers in Vattavada and Kanthalloor (Table 8).

Table 8: Commercial tree plantations in HRML

Agency	Teak (ha)	Eucalyptus (ha)	Acacia (ha)	Miscellaneous (ha)
Forest Department	9,100	2,790	3,640	2,570
Corporate agencies	-	8,900	-	-
Farmers/ private	-	3,000	-	-
HNL, KFDC	-	1,250	310	20
Total	**9,100**	**15,940**	**3,950**	**2,590**

50. **Tea industry:** India is a leading producer (around 960 million kilograms per year) and consumer (70 percent of its own production) of tea globally. As a commodity, tea contributes to approximately 1.5 percent to 2 percent of India's GDP. The KDH and surrounding areas of HRML comprise the largest tea producing area in southern India (14,000 ha). The tea industry is a major employer in HRML with more than 19,000 persons in its pay roll and about 75,000 dependents. Tea processing is an energy intensive operation and relies heavily on biomass (197,836 m^3 annually) from captive fuel wood plantations (*Eucalyptus*). Tea industry has historically triggered forest conversion in the project landscape for a) the establishment of tea gardens, and b) mono-species fuel wood plantations. However, tea gardens of HRML still retain several interspersed forest fragments (varying in extent from 0.1 ha to 1,000 ha) along the crest line of mountains and in sheltered valleys. Moreover, these forest fragments (several of them HVBAs) act as stepping-stone corridors and store-houses of biodiversity especially for lower and lesser known life-forms like rodents, reptiles and amphibians. Apart from the large corporate plantations, several small tea gardens (200 ha) also lie scattered in the region.

51. **Cardamom farms:** Cardamom is the biggest employer (74,000 persons including 49,000 women in 35,000 families and at least 12,000 commuting workers from Tamil Nadu) in HRML. Mostly grown under original rainforest trees, cardamom is cultivated on private lands, leased lands and smallholder homesteads in around 42,000 ha of which about 70 percent are small farms, 20 percent medium farms and 10 percent large plantations. On an average, HRML produce around 13,000 metric tonnes of cardamom annually.[87] In recent times, there has been a perceptible shift towards more light-loving and drought-resistant varieties (e.g. *njallani*) (covering more than 80 percent of cardamom growing areas) that

[87] Stakeholder consultation at Munnar on 12 March 2013

require intensive farming practices, more openings in the tree canopy and heavy application of chemical fertilizers and pesticides. Like tea, cardamom also requires thermal energy (around 6 kg of firewood for making one kg dry cardamom) for curing that is largely met from existing tree growth and wood imported from outside. There is also a trend to plant fast growing species as shade trees (jack fruit, mahagony, silver oak etc.) in cardamom groves. As a commodity, cardamom is highly prone to market fluctuations and unfavourable regulatory trade practices that affect small and marginal farmers particularly adversely. Some of the cardamom areas around Munnar have also seen the emergence of tourism infrastructure and associated land use change.

52. **Reed extraction:** Reed *(Ochlandra travancorica)* collection and associated craft is an important economic activity in the lower reaches of the landscape (e.g. Kuttampuzha, Neriamangalam, Adimali, Edamalayar and Mankulam). In many areas, reeds grow profusely and gregariously and sustainable management and optimal extraction of reeds are ecologically rewarding. For instance, the tender shoots of reeds that sprout following the extraction of old culms form a significant portion of the forage of elephants in lower reaches of the project landscape. Reed extraction primarily occurs through concessions given by the government for a) purely commercial purpose (Hindustan Newsprint Ltd. (HNL) for pulp industry), b) supporting commercial as well as artisanal use (Kerala State Bamboo Corporation (KSBC)), and c) for own use by communities. The area of reed collection extends over 70,000 ha in HRML and reed extraction and associated livelihoods support around 3,700 families mostly Scheduled Castes (SCs) along the forest fringes and the Scheduled Tribes (STs) in Kuttampuzha and Edamalayar areas. Almost 80 percent of the reed extraction in the landscape is carried out by HNL. While KSBC has registered reed cutters and weavers, HNL works on a contractor based system. The details of reed collected from HRML are given below:

Agency	2009-10 (tonnes)	2010-11 (tonnes)	2011-12 (tonnes)
HNL	15,000	9,800	11,700
KSBC	2,579	2,595	2,492

53. KSBC promotes selective extraction of reeds for customized end-uses (e.g. mats). There are about 1,300 reed cutters with KSBC from Mankulam, Adimali, Idamalayar and Pooyamkuttiar including around 800 tribals. In recent years, there is a trend to employ contractual labour from neighbouring districts as well. The artisanal items produced include mat, basket and sifts and marketing of these items largely occur through KSBC depots. It is observed that as an economic activity, reed extraction is affected by a horde of factors such as shortage of labour, over harvesting, non-accessibility and remoteness of reed grown areas, poor marketing, availability of alternate raw materials etc.

54. **Heterogeneous cultivation:** The colder higher areas of the landscape lying towards the east (Vattavada and Kanthalloor) have vegetable farming (1,600 ha) and a large portion is under intensive *Eucalyptus grandis* plantations (owned mostly by absentee land owners) characterized by short rotation and short espacement (2m x 2m). Tourism is gradually gaining inroads here too. A few farmers cultivate crops such as apple, peach etc. In Anchanad valley, sugarcane (600 ha) is a dominant crop and lemon grass cultivation (531 ha) is prevalent while subsistence farming (e.g. ragi, millets, pulses etc.) prevails in remote areas. In the rest of the landscape, small homesteads generally practice multi-species and multi-tiered agroforestry - growing coffee, arecanut and pepper. These areas are rich in agro-biodiversity, especially that of wild cultivars and edible plants. Coffee, mostly grown in small farms, occupies an area of about 6,000 ha in HRML. Rubber (3,000 ha) is a much favoured crop in the lower valleys of Periyar River. However, with changes in climate and increase in average temperature, rubber plantations have started creeping up the hills. Animal husbandry is a major subsidiary activity and the share of animal husbandry to agricultural economy is about 10 percent. The tribes in the Anjanad valley keep cattle especially goats which forage mostly in the forests.

55. **Tribal settlements:** The prominent tribes of HRML *viz.*, Mannan, Muthuvan, Paliyan, Malaarayan, Oorali, Ulladan and Hill Pulaya (around 34,000 persons in 213 settlements (7,200 ha)) have distinct eco-cultural affinities over natural resources. The tribal hamlets are either scattered in the forests or located along its fringes. Smallholder farming (e.g. pepper and cardamom), collection of NTFPs (e.g. wild cardamom, honey, dammar, wild nutmeg, medicinal plants, *Garcinia* etc.) and small artisanal enterprises (e.g. lemon grass distillation, broom stick making, reed mat weaving etc.) underpin their livelihoods. Across the landscape, tribal hamlets show a wide range of agriculture adaptations ranging from cardamom cultivation in Edamalakudy to lemon grass cultivation in the Anchanad valley to rubber in Malayattoor. They also forage the forests for NTFPs, fuel wood and other subsistence needs. Tribes like Muthuvans cultivate a variety of vegetables and cereals for own consumption.

56. **River Valley Projects:** HRML has nine river valley projects covering an area of 10,416 ha established to harness hydro-energy (e.g. Idukki mega dam) and/ or irrigation (e.g. Bhoothathankettu). See Table 9 for details. Some of these reservoirs (e.g. Mattupetti, Idukki, Kundala etc.) promote tourism and inland fisheries. The reservoirs of these river valley projects had submerged large swathe of natural vegetation. Backwaters of some of these reservoirs are habitats for birds and aquatic life (e.g. Thattekkad)

Table 9: River valley projects in the project landscape

Sl.No.	Name	Extent of water body (ha)
1	Kundala	230
2	Mattupetti	324
3	Sengulam	33
4	Anayirangal	433
5	Ponmudi	260
6	Kallarkutty	58
7	Idukki	5,640
8	Bhoothathankettu	608
9	Edamalayar	2,830
Total		10,416

57. **Tourism:** During the last decade, HRML (particularly Munnar) has become a 'sought after' mass tourism destination that led to a flurry of infrastructure development, generation of vast quantity of solid wastes and effluents, land grab, increase in traffic etc. Annual visitation to Munnar exceeded 0.7 million in 2012 from just a few thousands in 1990s. There are around 250 resorts, hotels and homestays in and around Munnar with total bed capacity of over 7,500 per day. The tourism industry generates roughly USD 50 million annually. The surrounding areas of Chinnakanal and Pallivasal also have undergone land use changes due to expanding tourism. Unplanned infrastructural incursions on the periphery of KDH (e.g. Chinnakanal, Pallivasal and Pothamedu) have direct bearing on ecology as they come up mostly on cardamom areas interspersed with natural vegetation.

58. **Urban development:** Prominent towns of the landscape are Munnar, Adimali, Nedumkandom and Kattappana. They act as the nuclei of development and are expanding further with several peri-urban areas fast emerging around them. Extensive network of roads (450 km as major roads) crisscross the project landscape; some of them through ecologically fragile areas (e.g. Chinnar). Further, demand for new infrastructure and upgrading the existing ones is on the rise.

Table 10: Summary of current land use pattern in HRML*

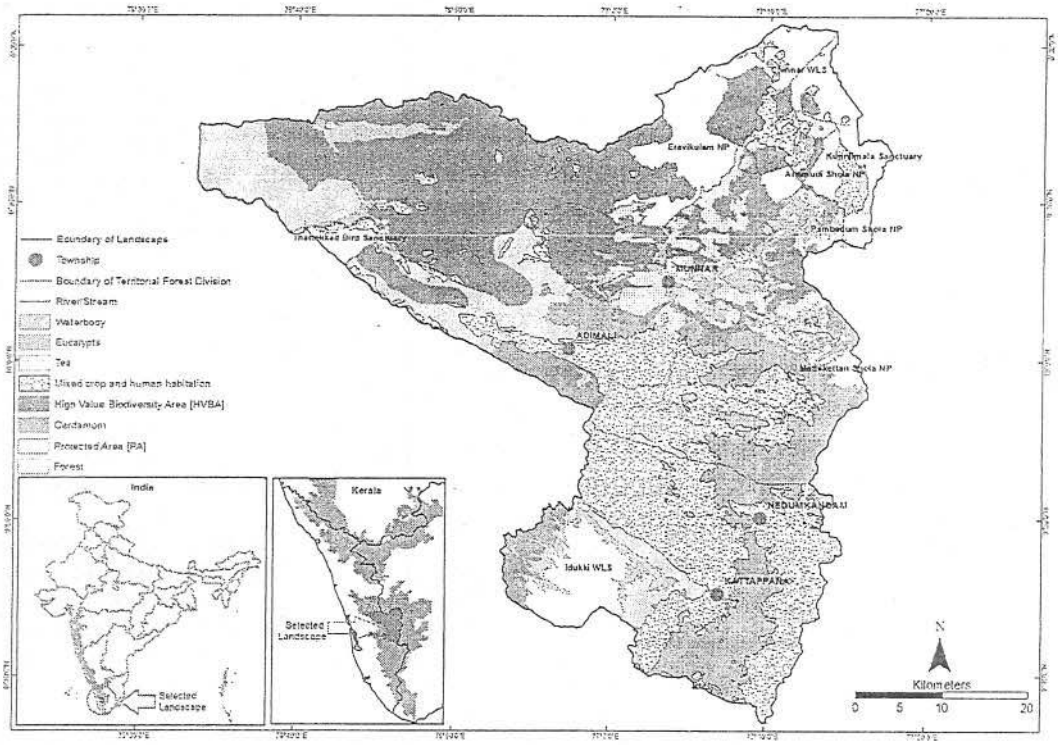
Land Use	Area (ha)	Land Use Description
Protected Areas	37,100	There are eight PAs and these largely comprise of high elevation *shola*-grasslands, wet evergreen forests, moist deciduous forests, dry thorn and scrub forests, and riverine forests. These PAs cover about

		12 percent of the landscape. At individual level, the performance of PAs are impressive; however at landscape level their management effectiveness are weak on account of small size, incomplete representation of biota, persisting and emerging threats etc.
High Value Biodiversity Areas / forest fragments	84,600	Mostly managed by and under the jurisdiction of the Forest Department – they overlap natural forests, commercial plantations and allotted reed areas. They also include forest fragments of varying sizes under corporate tea management and other government departments. In terms of conservation value, they are equally important as that of PAs. However, HVBAs/ forest fragments have limited conservation focus as of now.
Commercial tree plantations	31,580	Commercial tree plantations are mostly under the control of Forest Department (teak plantations in Malayattoor and wattle in the high altitude grasslands). HNL and KFDC have established short rotation *Eucalyptus* plantations for industrial raw material requirements. Extensive *Eucalyptus* plantations have also been established by large tea companies (for fuel wood for curing tea) and private farmers in Vattavada and Kanthalloor.
Tea industry	14,200	Extensive tea plantations belong to corporate sector and small farmers. There are several interspersed forest fragments amidst tea gardens that act as corridors and store-house of biodiversity. Tea industry heavily relies on *Eucalyptus* fuel lots for thermal energy.
Cardamom farms	42,000	Intensive cardamom cultivation (employing 74,000 persons) with fast depleting canopy cover. In recent times, there is a shift towards more light-loving varieties that require intensive farming practices, more openings in the tree canopy and heavy application of chemical fertilizers and pesticides. Thermal energy for curing cardamom is largely met from existing tree growth. Also witnessing emergence of tourism infrastructure and associated land use change.
Reed extraction	70,000	An important economic activity in the forests of the lower reaches of the landscape. Reed extraction occurs for commercial purpose, artisanal use and own use by communities. Reed industry is affected by a horde of factors such as shortage of labour, over harvesting, non-accessibility and remoteness of reed grown areas, invasive species, availability of alternate raw materials etc.
Heterogeneous cultivation	65,000	Colder higher areas lying towards the east have vegetable farming and intensive *Eucalyptus grandis* plantations. In Anchanad valley, cultivation of sugarcane and lemon grass is prevalent. Small homesteads generally practice multi-species and multi-tiered agroforestry (coffee, arecanut and pepper). Rubber is a much favoured crop in the lower reaches of Periyar valley. Animal husbandry is a major subsidiary activity.
Tribal hamlets	7,200	The tribal hamlets are either scattered in the forests or located along its fringes. Smallholder farming, collection of NTFPs, forest and agriculture labour and small artisanal enterprises are major livelihood practices.
River valley projects	10,416	Water spread area used primarily for generating hydro-electricity. Some of these reservoirs promote tourism and inland fisheries. Backwaters of some of these reservoirs are habitats for birds and aquatic life.
Tourism	10,000	Munnar is the hub of tourism in the landscape. This has brought in a flurry of infrastructure development (mostly unplanned), generation of vast quantity of solid wastes and effluents, land grab, increase in traffic etc. The surrounding areas of Chinnakanal and Pallivasal have undergone land use changes due to expanding tourism. Unplanned infrastructural incursions on the periphery of KDH have a direct bearing on ecology.
Urban development	1,000	Prominent towns - Munnar, Adimali, Nedumkandom and Kattappana - act as nuclei of development and are expanding further with several peri-urban areas fast emerging around them. Extensive network of

		roads crisscross the project landscape; some of them through ecologically fragile areas. Demand for new infrastructure and upgrading the existing ones is on the rise.
Other forest areas	37,000	Under the jurisdiction of Forest Department.

* There is considerable overlap between land uses.

Map 3: Major land use practices in HRML



Climate change context

59. HRML is already experiencing climate change. Ravindranath and Sukumar (1998)[88] predict a temperature rise of 2-2.5^0 C along the Western Ghats in the coming decades. Analysis of climate data, collected from six locations over a period ranging from 31-73 years shows clear patterns of changing climate in HRML. Rainfall is found decreasing over most of the landscape with major reduction noticed in south west monsoon. Total number of rainy days was also found varying. Available temperature data shows that while there was a rise in maximum temperature, the minimum temperature decreased. For instance, there is an increase of more than 2^{0}C in maximum temperature at Pampadumpara in the last 29 years (Swaminathan, 2008).[89]

60. Such oscillations in climate have major impacts on the structure and composition of montane ecosystems. For instance, C3 and C4 plants are known to have differential ecological preferences and higher CO_2 levels would enhance photosynthetic rates in C3 plants to a greater extent than in C4 plants (Tieszen *et.al.*, 1979).[90] Inhabitants in the landscape[91]

[88] N.H.Ravindranath and R.Sukumar, 1998, Climate change and tropical forests in India. Climate Change 39:563-581

[89] M.S.Swaminathan, 2008, Measures to mitigate agrarian distress in Idukki District of Kerala A study report by M.S.Swaminathan Research Foundation May 2008

[90] Tieszen, L.L., Senyimba,M.M., Imbamba,S.K. and Troughton, J.H, 1979, The distribution of C3 and C4 grasses and carbon isotope discrimination along an altitudinal and moisture gradient in Kenya. Oecologia 37, 337-350.

[91] Stakeholder consultations

corroborates the changes in climatic parameters over the years - increase in average and minimum temperature, reduction in humidity, increase in sunshine hours, erratic rainfall, increased soil temperature, loss of soil moisture and increase in evapo-transpiration. Parts of HRML is also experiencing more frequent occurrence of massive landslides induced by extreme weather events.

Legislative, policy and institutional context

Policies and legislation

61. To promote conservation and sustainable use of biodiversity and natural resources, India has an extensive body of constitutional provisions, laws and policies. See Annexure 12 for a comprehensive listing of legislations and policies relevant in the context of this project. The Indian Constitution clearly assigns responsibilities between the Union and State governments (Part XI and article 246) on various subjects. India is signatory to various international conventions and treaties related to environmental protection and has also taken numerous initiatives towards their implementation (Annexure 13). The most relevant national policies and legislation from this project's perspective are the Biological Diversity Act of 2002, National Forest Policy of 1988, National Water Policy of 2002, National Environmental Policy of 2006, Indian Forest Act of 1927 (and related state legislation), Forest (Conservation) Act of 1980, Wildlife (Protection) Act of 1972, Environmental (Protection) Act of 1986, Schedule Tribes and other Traditional Forest Dwellers (Recognition of Forest Rights) Act of 2006, Environmental Impact Assessment Notification of 2006, Factories Act of 1948, Mines and Minerals (Development and Regulation) Act of 1957, Energy Conservation Act of 2001, Air (Prevention & Control of pollution) Act of 1981,Water (Prevention & Control of pollution) Act of 1974, Cardamom Act of 1965, and Tea Act of 1953.

62. India's National Environment Policy (2006) seeks to achieve balance between conservation and development by mainstreaming environmental concerns in economic activities. Considering that the mountains are important but highly fragile ecosystems, National Biodiversity Action Plan (NBAP, 2008)[92] envisages major measures for conserving the mountain ecosystems. These *inter alia* include: i) adopting appropriate land-use planning and watershed management practices for sustainable development; ii) adopting "best practice" norms for infrastructure in mountain regions to avoid or minimize damage to sensitive ecosystems; iii) encouraging cultivation of traditional varieties by promotion of organic farming, enabling farmers to realize a price premium; iv) promoting sustainable tourism through adoption of "best practice" norms; and; v) considering unique mountain areas as entities of "Incomparable Values", in developing strategies for their protection. NBAP also specifically notes several action items (see Table 11 below) that are closely related to this project's objective.

Table 11: Relevant actions and key activities of the NBAP

Action		Activities
Action 2	Augmentation of natural resource base and its sustainable utilization: Ensuring inter and intra-generational equity	• Promote sustainable use concept and best practices for sustainable use of biodiversity in relevant economic sectors. • Integrate biodiversity concerns into sectoral and inter-sectoral policies and programmes. • Promote techniques for conservation and regeneration.
Action 5	Integration of biodiversity concerns in economic and social development	• Promote integrated approach to management of natural resources

[92]National Biodiversity Action Plan, 2008, MoEF, New Delhi

Action		Activities
Action 10	Use of economic instruments/ valuation in biodiversity related decision making processes	• Develop valuation models and a system for natural resource accounting (reflecting ecological and economic values of biodiversity). • Develop valuation models and validate through pilot studies

63. India has launched the National Action Plan on Climate Change (NAPCC) in 2008 that gives a comprehensive policy frame work for responding to climate change. The eight National Missions[93] forming the core of the NAPCC represent multi-pronged, long-term and integrated strategies to address climate change. Besides, pursuant to the objectives of CBD, India enacted the Biological Diversity Act (BDA) in 2002. The Act gives effect to the provisions of the CBD including issues on access to biological resources and associated traditional knowledge to ensure equitable sharing of benefits arising out of their sustainable use. Other important Legal and Policy Instruments relevant in the context of the project are the National Wildlife Action Plan (2002-16), National Conservation Strategy and Policy Statement on Environment and Development (1992), Policy Statement on Abatement of Pollution (1992), National Tourism Policy (1998), National Agricultural Policy (2000), the Joint Forest Management orders and rules promulgated by both the national and state governments at various years.

64. There are several Legal Instruments enacted at the state level that have a bearing on the project. These include the Kerala Forest Act of 1961, Kannan Devan Hills (Resumption of Lands) Act of 1971, Kerala Preservation of Trees Act of 1986, Kerala Forests (Vesting and Management of Ecologically Fragile Lands) Act of 2003, Kerala Promotion of Tree Growth in Non-Forest Areas Act of 2005, Kerala Restriction on Cutting And Destruction of Valuable Trees Act of 1974, Kerala Land Conservancy Act of 1957, Kerala (Restriction on Transfer of Lands and Restoration of Alienated Lands) Act of 1975, Kerala Conservation of Paddy Land & Wetlands Act of 2008, Kerala Ground Water (Control and Regulation) Act of 2002, Cardamom Rules of 1935, Kerala Government Land Assignment Act of 1960, Kerala Assignment of Government Land to the Schedules Tribes Rules of 2001, Kerala Panchayats Building Rules of 2011, Kerala State Organic Farming Policy, Strategy and Action Plan, 2010 etc.

Institutional framework

65. The Ministry of Environment & Forests (MoEF) is the nodal agency in the administrative structure of the Central Government for planning, promoting, coordinating and overseeing implementation of India's environmental, forestry, land degradation, climate change related policies and programmes. While implementing these policies and programmes, the Ministry is guided by the principle of sustainable development and enhancement of human well-being. The Ministry also facilitates the GEF programming to leverage additional resources and strategically align it with national priorities and GEF thematic areas. Other union ministries whose mandate coincides with this project are the Ministry of Agriculture (National Agricultural Policy, 2000); Ministry of Rural Development and Land Resources (for implementation of Mahatma Gandhi National Rural Employment Guarantee Act, 2005 (MGNREGA)); Ministry of Tribal Affairs (the Schedule Tribes and other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006); the Ministry of Panchayati Raj (issues related to Panchayat Raj Institutions (PRIs)[94]); Ministry of Power, Ministry of New and

[93] National Solar Mission, National Mission on Enhanced Energy Efficiency, National Mission on Sustainable Habitat, National Water Mission, National Mission for Sustaining Himalayan Eco-System, National Mission for Green India, National Mission for Sustainable Agriculture and National Mission on Strategic Knowledge for Climate Change

[94] PRIs are local-level institutions for self-governance in rural areas that are recognized by the Constitution of India. These are elected bodies and operate at three levels, at village, at the block (a cluster of villages) and at the district level. PRIs are

Renewable Energy (issues related to energy), Ministry of Commerce (trade related aspects particularly tea, coffee, cardamom and rubber), and the Ministry of Tourism (National Tourism Policy, 2002).

66. Kerala Forest Department (KFD) is mandated to protect, conserve and manage the state's forests and wildlife resources. There are a number of other Government Departments and agencies that regulate/ facilitate resource use in HRML. Departments such as Revenue, Tribal, Environment, Education, Agriculture, Animal Husbandry, Fisheries, Local Self Government (LSG), Tourism, Town & Country Planning, Public Works, Science & Technology, Planning, Water Resources, Irrigation, Kerala State Electricity Board, State Biodiversity Board, Pollution Control Board, Land Use Board, State Horticulture Mission etc. have key roles. District administration and PRIs are highly relevant in the context of the project. Local research/ educational institutions such as Agricultural Universities, technical institutions and units of Indian Council for Agricultural Research (ICAR) etc. have their presence in HRML and shall play a crucial role in the project particularly in building capacities at the grassroots level. Private Sector, Chambers of Commerce and Industry, Financial Institutions, Political parties, *Kudumbashree*, Self Help Groups (SHGs), Tribal Cooperatives, Youth and Religious Groups, Joint Forest Management (JFM) Committees (Eco-development Committees (EDCs), and Vana Samrakshana Samities (VSS)), Biodiversity Management Committees (BMCs), Forest Development Agency (FDA), Non-Governmental Organizations (NGOs), Civil Society Organizations (CSOs) /Community Based organizations (CBOs), Cardamom for Rainforest Conservation (CRC) and their Unit Level Organizations (ULOs) etc. are other organizations or institutions of relevance in the project landscape.

B: Threats, Root Causes and Impacts

67. At present, HRML is a complex juxtaposition of land uses where conservation and economic production systems assume equal primacy and profoundly influence each other. Baseline analysis carried out during the preparatory phase clearly shows that the project landscape has diverse baselines i.e. striking range of biological diversity, contesting land-use assertions, ambitious developmental imperatives, contradictory sectoral directives, multitudes of actors and contrary aspirations. Cumulatively, these are contributing to injudicious use of natural resources and eventual disruption of vital ecological processes. Despite several years of developmental interventions, the landscape still has substantial area under natural vegetation (both primeval and under varying degrees of degradation). However, the rapidly altering developmental context, demographic contours, resource use configurations, and new and emerging challenges make the situation increasingly precarious for HRML's long-term ecological sustainability. An analysis of the threats, root causes, impacts, patterns of change, and likely trajectory of conservation prospects (in the business-as-usual scenario) in HRML is outlined below.

68. The diverse nature of ecosystems and habitats, land use patterns and administrative overlays portend differential prospects for biodiversity conservation across HRML. This also means that the level, distribution and intensity of threats to biodiversity, their root causes and impacts are uneven across the landscape. An assessment of the existing and emerging challenges to biodiversity conservation in the project area reveals the following scenario: a) rapidly eroding biological diversity (at genetic, species and ecosystem level); b) key habitats getting degraded or fragmented; c) proliferation of invasive alien species; d) increasing human-animal conflicts; e) climate change impedes ecosystem functionality; e) over-exploitation of natural resources; f) unfavourable practices in economic production sectors adversely affecting biodiversity; g) weakening capacity for sustainable resource use

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responsible for the preparation of plans for economic development and social justice and also for the implementation of schemes as entrusted to them by the respective state governments and also by the GOI

particularly among tribal communities; h) diminishing livelihoods based on natural resources; and g) production imperatives overriding conservation considerations.

69. Broadly, for the sake of simplicity, the proximate threats to biodiversity in HRML can be put under four categories: **habitat loss and fragmentation, habitat degradation, over-exploitation,** and **adverse effects of climate change.** The relationship between the proximate threats to biodiversity and various land use practices are summarized in Table 12 below.

Table 12: Land use practices and proximate threats to biodiversity of HRML

Sectors	Proximate threats to biodiversity			
	Habitat loss and fragmentation	Habitat degradation	Over-exploitation	Adverse effects of climate change
Protected Areas	Small size; incomplete representation of biota; connectivity issues; changes in land use in adjoining areas.	Proliferation of invasive species; uncontrolled fire; increasing human-wildlife conflict; grazing.	Focal areas for mass tourism; excessive resource harvesting in a few PAs.	Ecosystem and species shift in the higher altitudes; dying back of *shola* patches; limited ability of species for adaptation and depletion; proliferation of invasive species; increasing aridity; change in hydrology.
High Value Biodiversity Areas / forest fragments	Infrastructure development; roads; canals; commercial forestry with less focus on conservation; changes in land use in adjoining areas.	Proliferation of invasive species; uncontrolled fire; increasing human-wildlife conflict; grazing	Unscientific reed extraction, unsustainable harvesting of NTFPs, excessive consumption of firewood in certain areas; unregulated tourism.	Ecosystem and species shift in the higher altitudes; dying back of *shola* patches; limited ability of species for adaptation and depletion; proliferation of invasive species; increasing aridity; human-wildlife conflict; change in hydrology
Commercial tree plantations	Promotion of monoculture by conversion of natural vegetation; management practices incompatible with conservation concerns; loss of connectivity between habitat patches.	Soil fertility depletion; Site Quality deterioration; reduction in ecosystem networking and functionality; reduction in genetic, species and ecosystem diversity.	Water stress; nutrient loss and excessive biomass removal.	Extensive mono culture plantations disrupts the buffering influences of natural forests to climate change by changes in microclimatic conditions; rising temperature favours the proliferation of monoculture tree species (e.g. wattle) at the expense of native species especially the high altitude grasslands; increasing aridity and disruption in hydrological cycle.
Tea industry	Conversion of interspersed HVBAs and natural habitats for economic production.	Intensive management and heavy agro-chemical inputs; monoculture plantations (tea and *Eucalyptus*); reduction in overall biological diversity particularly soil biota and other lower life forms	Nutrient loss; water stress.	Changes in rainfall pattern; tiny fragments of HVBAs under increasing threat from desiccation; weakening resilience to changes in climate regime.
Cardamom farms	Reduction of over wood: opening up of canopy; poor	Intensive pesticide and fertilizer	Excessive abstraction of nutrients and water	Unfavourable conditions for biodiversity-friendly cardamom cultivation

	regeneration and limited growth of understory species; reduction in biological diversity (e.g. sallying flycatchers, pollinators, Lion tailed macaque); disrupted ecosystem connectivity	application; soil fertility depletion; increasing soil erosion; loss of stepping stone corridors.	by intensive agriculture particularly high yielding varieties; removal of over wood for fuel and more sun light.	such as increase in average and minimum temperature, reduction in humidity, increase in sunshine hours, erratic rainfall, increased soil temperature, loss of soil moisture and increase in evapo-transpiration.
Reed extraction	Extensive construction of extraction roads in hitherto inaccessible ecologically rich areas; increasing road kills; prolonged presence of labour colonies within the forests.	Over harvesting in easily accessible areas; non-adherence of extraction cycles that impedes regeneration and quality of habitats; spread of invasive species.	Repeated and intensive extraction in easily accessible areas	Intensification of invasive species distribution; increasing aridity and changes in habitat quality; uncontrolled fire etc.
Heterogeneous cultivation	Loss of canopy continuity across the landscape; advent of monoculture farming practices lead to loss of agro-biodiversity.	Excessive use of pesticides and fertilizers; soil fertility depletion; deterioration in water quality.	Over use of water; rocks and minerals and sand; increasing quarrying.	Changes in cropping pattern; unsuitability of traditional crops; human-wildlife conflicts.
Tribal hamlets	Development of infrastructure; excessive and unsustainable use of natural resources; changes in lifestyles, aspirations and perception.	Reduction of farming cycles; adoption of intensive and intrusive farming methods.	Unsustainable NTFP harvesting; fuel wood collection.	Increasing aridity; sub-ambient conditions for cultivation; increasing vulnerability to the uncertainties of climate induced stressors; increasing human-wildlife conflicts.
River valley projects	Submergence and encroachments of prime habitats; increased infrastructural growth; habitat discontinuity.	Introduction of exotic fishes.	--	Climate change induced water scarcity spurs additional demands for water impounding facilities/ water diversion programmes.
Tourism & urban development	New infrastructure and encroachments; increasing demands for land use change; demand for opening up more tourism destinations	Pollution of water and air (e.g. solid waste, vehicle movement etc.)	Over-crowding; intensive resource use (water, energy); waste management	Increasing mass tourism; changes in salubrious environment; demand for energy intensive lifestyle in the wake increasing aridity.

70. Considering the cross-cutting and intricate nature of threats to biodiversity, their root causes and causative factors that are often difficult to segregate into clear linear elements, the results of the detailed threat-scape analysis carried out during the Project Preparatory Phase are categorized under the following four sub-headings: 1) threat to biodiversity in PAs and other High Value Biodiversity Areas (HVBAs); 2) threat to biodiversity from economic production sectors; 3) threat to biodiversity from climate change; and d) threat to biodiversity from changing socio-economic context. These are described in detail below.

Threats to biodiversity and their root causes in PAs and HVBAs

Fractioned and fragmented PAs and HVBAs

71. Two PAs (Mathikettan and Idukki) in the project landscape have critical habitat connectivity issues. In some areas, though the PAs are physically connected, the intervening areas are not accorded enough conservation priorities – neither legal nor operational (e.g. Pettimudi, Kathumala, Idlimotta, Manthan shola). Moreover, gradually, such areas are witnessing alternate land use aspirations such as roads, transmission lines, tourism infrastructure, grazing, waste disposal, settlements, changes in cropping patters etc. that will cause further fractioning of forests. Land-use changes in areas adjoining PAs/ HVBAs (e.g. degradation of forest fragments in tea estates, planting of grasslands in the higher reaches, mushrooming of tourism infrastructure etc.) have explicit impacts on the biodiversity of PAs. For instance, Chinnakkanal have isolated populations of stranded elephants. Some of the critically fragmented habitats of HRML are KDH-Mathikettan region, Neriamangalam, Bhoothathankettu right bank etc. If the present trend continues, PAs like Pambadum shola, Kurinji mala, Anamudi shola etc. will also come under increasing fragmentation in the years to come.

Proliferation of Invasive Alien Species

72. Proliferation of invasive species is a chronic problem in the landscape. Wattle (introduced three decades ago as part of a forest plantation programme in the high altitude grasslands) is occupying large portion of the landscape especially some of the vital ecological niches (Munnar Division). Further, three PAs (Anaimudishola, Pampadumshola and Kurinjimala) have significant area under *Eucalyptus* and wattle. Wattle and eucalyptus (both C3 plants) have high growth rates and coppice profusely. Wattle also invades grasslands and disturbed forests. In the coming years, rise in temperature and a reduction in the incidence of frost will enhance the photosynthetic rates in wattle and *Eucalyptus* that will enable them to spread to grasslands (where they are now absent) more rapidly than the slow growing forest tree and shrub species (Sukumar *et al.*, 1995).[95] Going by above, it is clear that high altitude grasslands ('the water towers' of the landscape) are among the most threatened ecosystems in HRML.

73. The project landscape is also witnessing the rapid proliferation of other invasive alien species such as *Mikania micrantha* and *Lantana camara* (low and mid-elevation forests) and *Eupatorium glandulosis*. They are more favourably adapted to live in new and narrow ecological niches created and have higher rates of survival and adaptability thereby forcing the ecological eviction of native 'specialist' species. For instance, in the Central Forest Circle (including Malayattoor Forest Division), 31 out of the 125 sites sampled had high (more than 1,000 stalks per ha) infestation of *Mikania* (Sreenivasan, 2003)[96] whereas in Idukki district, more than 8 out of the 12 sites were infested (Shankaran *et al.*, 2001).[97] *Mikania* and *Mimosa* are suppressing the regeneration of reed breaks in Malayattoor and Munnar Forest Division. *Parthenium sp.*, *Prosopis juliflora* (in Anchanad valley), Scotch broom (*Cytisus scoparius*), and *Mimosa diplotricha* are other invasive species threatening to colonize the landscape.

Increasing human-animal conflicts

74. In the landscape, human–animal conflict is rampant largely involving elephants, wild boars, guars and bonnet macaques (10 human deaths in Chinnakanal region alone in last five years due to elephants). There is also a perception among local people that the increasing

[95] R. Sukumar, H.S. Suresh, and R.Ramesh, 1995: Climate Change and its impact on tropical montane ecosystems in southern India, Journal of Biogeography 22, 533-536

[96] M.A.Sreenivasan, KFRI, 2003.Natural distribution and control of alien invasive weed *Mikania micrantha* in the Western Ghats, KFRI.Peechi, Thrissur

[97] K.V.Shankaran, P.K.Muraleedharan, V.Anitha, 2001.Integrated management of Alien invasive weed *Mikania micrantha* in the Western Ghats, KFRI, Peechi, Thrissur.

occurrence of human-animal conflict, at least partly, is related to climate change as increasing aridity, water scarcity, reduced availability of forage, proliferation of invasive species, shift in floral elements etc. drive wild animals from their natural habitats. There are large numbers of road kills that often go unreported. Increased volume of vehicular movement due to tourism is the primary reason for this. For instance, the number of vehicles passing through the Chinnar –Munnar High Way crossed more than 223,000 in 2012. In future, human-animal conflict is only likely to increase as there are new proposals for expansion of tourism, roads, reservoirs and revival of abandoned infrastructure.

Inadequate enforcement capacities within the conservation sector

75. There are several persisting enforcement related threats such as uncontrolled fire, poaching, illicit felling, grazing, over-harvesting of wild resources etc. that impinge on the integrity and management effectiveness of PAs and HVBAs. Illicit felling and poor regeneration of sandal trees are chronic problems in Marayur region. For instance, during 2000-2008, in Marayur Forest Division alone, 8,425 sandal trees were illegally felled which also caused serious collateral ecological damage such as poaching, clearing *sholas* for *gunja (Cannabis sativa)* cultivation etc. Similarly, the adjoining Chinnar Wildlife Sanctuary has pressure from grazing.

76. In the conservation sector (Forest Department), the capacities to effectively enforce conservation mandate are short of what is optimal (both in terms of manpower and technical know-how). Moreover unclear jurisdictional boundaries (e.g. Edamalakudy), incomplete consolidation of human settlements (e.g. Mankulam) and the complexities of production enclaves lying interspersed with HVBAs (e.g. tea estates in KDH), incompatible land use in adjoining areas (e.g. *Eucalyptus* plantations in proximity to Kurinjimala Wildlife Sanctuary), developmental pressure from tribal enclosures located within the PAs (e.g. Chinnar Wildlife Sanctuary), steep and unsustainable increase in tourist visitation levels (Eravikulam National Park) and liner intrusions like canals (Thattekkad wildlife Sanctuary) complicate the management challenges. Local communities utilize forest areas to collect firewood, to harvest NTFPs and for grazing. Such use is not being effectively managed, and is not always sustainable as currently practiced. For instance, in the Anchanad valley, biomass abstraction (about 494,361 kg per year) for lemon grass distillation is intensifying the stress on natural vegetation (in Chinnar and Marayur) as it is taking place in a region of low biomass productivity. Moreover, there are growing conflicts between community user groups, Forest Department and commercial interests over resource use rights. The major enforcement related threats to PAs and HVBAs are given in Table 13.

Table 13: Major threats to the PAs and HVBAs of HRML

Protected Area	Uncontrolled Fire	Poaching	Illicit felling	Grazing	Encroachment	Over harvest	Roads	Invasive species	Human-wildlife conflict
Eravikulam National Park	H	M	L	L	L	L	L	M	L
Chinnar Wildlife Sanctuary	M	M	H	H	L	H	H	M	M
Anaimudishola National Park	M	L	L	M	M	M	M	H	L
Kurinjimala Wildlife Sanctuary	M	L	L	L	H	L	M	H	L
Pampadumshola national Park	L	L	L	L	L	L	M	H	L
Mathikettan National Park	L	L	L	L	L	L	L	L	H
Idukki Wildlife Sanctuary	H	M	M	H	L	H	L	M	M
Thattekkad Wildlife Sanctuary	M	L	L	L	L	L	L	M	M
Malayattoor Forest Division	M	H	L	L	M	H	M	H	M
Mankulam Forest Division	L	H	L	L	H	M	M	L	L
Munnar Forest Division	H	H	M	M	M	M	M	H	H
Marayur Forest Division	M	M	H	H	L	L	L	H	H
Kottayam Forest Division	M	L	M	M	L	L	L	M	L
Fragments in Revenue, Tea Estates etc.	M	M	M	L	H	L	L	L	L

77. In addition, considerable knowledge deficit exists among the conservation sector staff as the complexities involved in managing biodiversity at a landscape level require more specialized skill sets. These include participatory resource governance, implementation of Forest Rights Act, man-animal conflict, climate change, invasive species, etc. Similarly, capacity for visitor management, both infrastructural and institutional, remains weak among Pas. Further, existing staff strength and infrastructure (jeeps, boats, camp sheds, equipments etc.) are considered inadequate/ obsolete. The capacities of conservation sector are additionally constrained by persisting staff vacancies and high attrition rate among the newly recruited field staff.

Sub-optimal geographical coverage of PAs

78. PAs continues to be the corner-stone of biodiversity conservation in HRML. However, their long-term management effectiveness is increasingly threatened by many factors (both direct and indirect). At individual level, the eight PAs in the landscape have performed an impressive role in preserving species diversity. However, at the landscape level their management effectiveness remains critically sub-optimal due to a) small size; b) incomplete representation of biota; c) connectivity issues; and d) prevailing and emerging threats (including climate change). With an average size of only 4,600 ha and covering less than 12 percent of the project landscape, the PAs clearly are unable to encompass and sustain the representative biodiversity of the region. Vast tracts of high conservation significance are still lying outside the premises of PAs (see Table 14). For instance, the crucial calving-cover of Nilgiri tahr transcends the ecological boundaries of Eravikulam National Park and seep into the surrounding non-PA regions. In the current scenario, the existing PAs, already small in size and under considerable stress from various factors - both extraneous and intraneous will lose their functional effectiveness with disastrous consequences for the ecological integrity of the region. During the PPG phase, the conservation values of HRML were reprioritized [98] as given in Table 14.

Table 14: Prioritization of conservation zones in HRML

Forest Administrative Units		Conservation value (km^2)			
		Low	Medium	High	Total
Protected Areas	Chinnar WLS	6	34.5	50	90.5
	Eravikulam NP	1	2	94	97
	Idukki WLS	39	44	22	105
	Thattekkad WLS	9	2	14	25
	Mathikettan NP	0	3	10	13
	Pambadum shola NP	0	0	1	1
	Anaimudi shola NP	0	0	7.5	7.5
	Kurinjimala WLS	11	12	9	32
Total		**66**	**97.5**	**207.5**	**371**
Non-Protected Areas[99]	Malayattoor Forest Division	19	170	371	560
	Mankulam Forest Division	0	0	90	90
	Munnar Forest Division	51	121	238	410
	Marayur Forest Division	0	10	52	62
	Kottayam Forest Division	40	19	35	94
Others	Fragments in Revenue, Tea Estates etc.	0	0	60	60
Total		70	320	846	1,276
Grand total		136	417.5	1,053.5	1,647

[98] Improved upon various studies of French Institute, Pondicherry.
[99] In the absence of adequate data, this has been arrived through broad approximations.

79. Two things are discernible here. First, even within the existing PAs (out of a total of 37,100 ha), only 20,750 ha falls under the high value conservation zone, the rest (16,350 ha) is already retrograded to low and medium value conservation zones due to various threats described in this section. At the same time, it is equally pertinent to note that around 84,600 ha of high value conservation areas are currently falling outside the purview of the PA system.

Weak conservation focus on High Value Biodiversity Areas (HVBAs)

80. HVBAs consist of large and medium sized forested blocks and small fragments outside the PA system with the largest habitat blocks lying on state forestlands and smaller blocks on Revenue lands and plantations. Extending over 84,600 ha, HVBAs cover about 27.29 percent of the project landscape. In terms of ecological values, they are equally important as that of PAs and a key connecting link between PAs. As already mentioned, the HVBAs of HRML include most of Mankulam Division; areas resumed from tea estates; areas adjoining PAs; portions of Reserved Forests of Munnar, Malayattoor, Kottayam and Marayur Forest Divisions; the *sholas* and grasslands under the control of the Revenue Department (e.g. Manthan shola); interspersed forests, grasslands and swamps within tea gardens etc.

81. However, in the existing resource management arrangements of HRML, HVBAs have not been given enough conservation priorities. For instance, the production practices employed in some of the HVBAs (e.g. reed extraction, teak and *Eucalyptus* plantations etc.) often overrides conservation priorities. In the absence of consistent conservation approaches, sustainable use regime and stronger governance framework, such areas will continue to be threatened leading to their eventual degradation and/ or even disappearance.

Delayed settlement of rights to tribals and other traditional forest dwellers hampers effective and inclusive biodiversity governance

82. Three PAs (Chinnar, Anaimudi shola and Idukki) have tribal settlements located within and demand for improved infrastructure is on the rise. At the same time, the mandatory settlement of rights under the Forest Rights Act, 2006 is yet to be completed. Further, unconsolidated boundaries still remain as threats in three PAs (Kurinjimala, Anaimudishola and Chinnar). Persistent enforcement related challenges (threat of encroachment, poaching, grazing and fire) and increasing human-animal conflict complicate the situation. In the case of HVBAs, threats primarily emanate from inadequate baseline information on HVBAs, their non-identification, ambiguous and intricate legal and policy implications, unclear mandates, developmental overshoot, misplaced notions on the Forest Rights Act and absence of a platform for appreciation of biodiversity concerns in matters of development.

83. Further, the scattered nature of settlements (both tribal and non-tribal) within HVBAs leads to increased demands for opening up or expanding infrastructural requirements like roads. In most cases, such aspirations are only genuine and necessary infrastructural services need to be provided to tribal communities living in remote areas (e.g. road to Edamalakudy Panchayat) for meeting their rightful developmental aspirations. However, in the absence of a holistic conservation strategy, the economic, social and ecological rationale of such demands and the possible trade-offs are not always worked out leaving the managers to go for *adhoc* decisions that often go against prudent use of resources making the existence of HVBAs more and more perilous.

Threats to biodiversity from production sectors, their root causes and future trajectory:

84. The biodiversity extant in the PAs and HVBAs are intricately connected to the adjoining production land uses. Hence, the changing contours of production operations pose several threats to the biological resources of HRML. For instance, of late, the tea industry has become increasingly prone to structural destabilization due to global economic compulsions (fluctuations in tea price), and the shortage of skilled labour. This is likely to have significant

ecological impacts (on account of change in land–use to less conservation compatible uses, and unsustainable land husbandry) and socio-economic impacts (deepening poverty and social unrest). Reckless use of chemical pesticides and change in cropping pattern to more sun-loving varieties (leading to loss of top canopy trees) are growing problems in the cardamom sector. Similarly, tourism industry has an unparalleled growth in HRML during the last one decade with significant bearing on the ecology of the region. The following section describes threats to biodiversity conservation (existing and emerging) from key economic production sectors, their root causes and trajectory in the business-as-usual scenario.

Tea industry

85. Tea industry decisively influences the ecological stability of HRML. The emergence of tea industry had led to large-scale decimation of primeval habitats in the past. However, several original forest fragments/ swamps/ streams/ rocky patches and slips/ jungle were retained at the time of establishment of tea gardens on ecological and legal grounds. The KDH Company had also helped in the establishment of Eravikulam National Park during 1970s. At present, the Company has a Management Plan that *inter alia* prescribes activities such as *shola* regeneration and engaging local tribes for ecological monitoring and enforcement. However, the existing model of conservation-production partnership in the tea industry is governed largely by conventions that originated in the colonial era than by any consistent interventions from the state, either in the form of any policy formulation or through large-scale political and financial support. The altering developmental context is fast threatening this milieu. The relationship between tea industry and biodiversity conservation in HRML is described in the following sub-sections:

Incomplete consolidation of HVBAs/ forest fragments and worsening environmental conditions

86. The corporate tea gardens of HRML still retain innumerable interspersed forest fragments (varying in extent from 0.1 ha to more than 1,000 ha) that cover an approximate area of 4,000 ha. Irrespective of their size, these fragments play a vital role in the existence and diversity of life-forms (Vasudevan, 2003).[100] Besides, like spokes in a wheel, they ensure linkages ('patch and habitat matrix' configuration) in the landscape by acting as stepping-stone corridors for wildlife moving between large habitat patches (including tiger, leopard, gaur, elephant, amphibians and reptiles) and also as potential 'escape routes' and 'connecting circuits' in the context of climate change; thus facilitating gene flow across the whole landscape. These interspersed forest fragments that resemble island biogeography, is neither catalogued, inventoried, demarcated nor under any kind of active conservation management as on now. Proximate threats to such HVBAs in tea gardens have already been listed in Table 12.

87. In addition, there are other environmental concerns within the tea production estates. Although the number of tea plantations in HRML has remained fairly stable during the past fifty years, their environmental status has deteriorated. In earlier times, the total area of tea garden was small in relation to the large swathe of forests surrounding them and the buffering influence of forests safeguarded the agro-climatic regime and stabilized the hydrological cycle, soil etc. But over the years, the forest cover in the landscape has diminished considerably, exposing the tea gardens to extreme fluctuations in the local climate. Moreover, intensive agronomic practices such as use of chemical fertilizers, pesticides, weedicides, growth regulators, and other agrochemicals have caused deleterious environmental effects on soil and biota. In the business-as-usual scenario, rather than seeking long-lasting solutions, the trend will be to seek short-term technological remedies for tiding over the environmental maladies (Nair 1991).[101]

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[100] Karthikeyan Vasudevan, 2003. A Report on the survey rainforest fragments in the Western Ghats for amphibian diversity (Chapter 19 of the Conservation of Rain forests in India, Envis, Wildlife Institute of India,

[101] Satis Chandran Nair, 1991. *The Southern Western Ghats – A Biodiversity Conservation Plan*, INTACH

Instability in tea industry and its implications on biodiversity

88. Tea industry is increasingly prone to market fluctuations (CEC, 2003)[102], which will have serious bearing on the biodiversity of HRML. The labor-intensive tea industry is a major employer of HRML (with more than 19,000 workers on payrolls) and social implications of unviability in tea industry will be massive. Tea estates are not just economic production units, but rather stable social institutions. The enclave economy of tea estates are built on the principles of dependence and heightened vulnerability. Located in remote localities, workers in these plantations lose not only employment, but also wages, social security measures and other statutory benefits like health, food, firewood, and education in case of unviability in tea industry. Workers will also lose amenities like safe drinking water, sanitation, and electricity, and this will force people to search for alternative livelihood options. In such an eventuality, the easiest options will be to a) nibble into the biodiversity of adjoining areas; and b) parcel land for alternate land use. In an analogous situation, in the state of West Bengal, following the closure of tea estates, around 70,000 people became solely dependent on the forested slopes of lower Himalayan Mountains and decimated it (Sarkar, 2003).[103] A similar disaster awaits HRML if the tea industry collapses. This could also lead to a deteriorating law and order situation, social unrest among local communities, and a never-ending vicious cycle of poverty and accelerated biodiversity depletion.

Dependence on biomass based thermal energy and carbon foot prints

89. Tea processing is an energy intensive process (constituting 30 percent of cost of production) and tea factories rely heavily on biomass from energy plantations (*Eucalyptus*) to meet thermal energy requirements. On an average, the energy mix for tea production is 50 percent thermal and 50 percent electrical. In the case of wood, the mean specific consumption is 1.89 kg of wood/ one kg of made tea while the mean specific cost is found to be Rs. 1.58. For electricity, the mean specific consumption is 0.66 kWh/ one kg of made tea and the mean specific cost is Rs. 1.97 (TIDE, 2012).[104] Adopting energy efficiency options in tea industry can bring down its dependency on mono culture plantations of *Eucalyptus* (that currently occupy 32 percent area of tea gardens) with significant co-benefits such as reduced Green House Gas (GHG) emissions. Preliminary Energy Audit assessment in the tea factories of HRML has revealed the scope for energy efficiency in three distinct areas, *viz.*, a) housekeeping and demand side management; b) energy conservation in electrical systems; and c) fuel conservation (firewood) on thermal side. Such savings in fuel wood in tea industry can reflect in the land use currently under *Eucalyptus* plantations in three ways: a) tea industry can strive for increasing tea production without putting additional pressure on biomass for energy requirements; b) such saved fuel wood can be distributed to other energy intensive economic production activities in the landscape that have heavy reliance on biomass and a cause of forest and tree cover depletion (e.g. cardamom curing and lemon grass distillation), and c) areas vacated by *Eucalyptus* woodlots could be allowed to re-grow into wilderness adding to the vegetal cover of the region. Either way, these options are highly promising from ecological, economic, livelihood and GHG emission reduction point of view.

90. Overall, in future (in the business-as-usual-scenario) tea industry will have important bearings on the trajectory of biodiversity conservation of HRML in three critical ways. Firstly and more proximately, by safeguarding the future of innumerable forest fragments interspersed in tea production areas. Secondly, by ensuring the viability of tea industry itself (while ensuring highest environmental standards) and providing livelihoods to large labour force, thus diverting pressure on natural resources. Thirdly, by proactively supporting the conservation-

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[102] Centre for Education and Communication, 2003. *Crisis in Indian Tea Industry: A Report.* New Delhi: Centre for Education and Communication.

[103] Sarkar, D. 2003."Burdensome Load: Laid-Off Tea Workers Fall Back on Forests in West Bengal." *Down to Earth* 12 (2): 42.

[104] TIDE, 2012. Process Document on Energy Conservation in Small Sector Tea Processing Units in South India

friendly production practices in the landscape (e.g. fuel wood support to other energy intensive economic production sectors).

Cardamom gardens

91. Cardamom Hill Reserve (CHR) is a crucial ecological entity in the project landscape. The high rising hills of CHR exert considerable effect on rainfall through orographic effect. They also influence wind and buffer climatic extremes both through incident solar energy and wind flow. The structure of the vegetation community, particularly the vertical profile of forests, has great influence on energy and moisture flow. The Cardamom Hills is significant because it is an extensive, gently undulating tract located at a medium elevation, juxtaposed between the western slopes of the Western Ghats receiving the onslaught of the monsoon and the eastern scarp which is low enough to permit the retreat monsoon to move into it. Hence it functioned as the largest reservoir of water to be fed into the river systems of HRML (Nair, 2004).[105]

92. Small cardamom (*Elettaria cardamomum)* is native to the tropical rainforests of the Western Ghats at an altitude of 600-1600 m above MSL. HRML contributes to more than 70 percent of the annual small cardamom production in India. There are about 37,000 farmers involved in cardamom cultivation in the landscape.[106] Though the area under cardamom cultivation has reduced from 60,000 ha in 1980 to 42,000 ha in 2010, the number of small holdings of cardamom has increased significantly during the last few decades. The current average yield is around 300 kg/ha. During the last 35 years, cardamom production has increased by 15 fold, largely due to the adoption of intensified agronomic practices and the arrival of high-yielding varieties (e.g. *Njallani*, *Kalarikkal*, *Panikulangara* etc. which now account for around 80 percent of the cultivation). Cardamom sector is estimated to contribute around USD 120 million annually to local and regional economy. The PPG team has identified several issues pertaining to cardamom sector that have implications on the ecology of HRML and is outlined below:

Changes in cropping pattern and opening up of over wood canopy

93. There are drastic changes happening in the cropping pattern in cardamom gardens with shade-loving traditional cardamom varieties replaced by more sun-loving varieties leading to loss of top canopy, habitat fragmentation and a significant reduction in biodiversity. The estimated canopy density of intensely managed cardamom gardens have now been reduced to around 35-50 percent whereas in the original condition it was 80-90 percent.[107] In 1978, Kurup[108] had reported the presence of Lion tailed macaque in several locations of Cardamom Hills. However, by 1997, most of these populations had become locally extinct due to habitat fragmentation (Easa *et al.,* 1997).[109] Only a small portion of CHR region is currently under exclusive conservation (Mathikettan National Park). Further fractioning of forests in CHR will affect HRML and adjoining areas through changes is precipitation pattern, temperature and moisture regime, increasing desiccation apart from hampering the gene flow and disrupting other ecological processes. Accelerated depletion of vegetation that has already become patchy and stretched will significantly affect the spatial habitat complexity, a hall mark of HRML leading not only to species loss but a much more sinister form of degradation – the extinction of ecological interactions as well.

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[105] Sathis Chandran Nair, 2004: The Ecology of Cardamom Hills: (in the Proceedings of the Workshop- conserving the biodiversity rich plantations of cardamom hills in the Western Ghats (edit. Easa P.S. and Unnikrishnan P.N).

[106] Spices Board data, 2010

[107] Murugan M., 2011. Factors and Patterns of Pesticide Usage and Sustainability of Cardamom in Indian Cardamom Hills, Unpublished PhD thesis submitted to National Institute of Advanced studies, Bangalore.

[108] Kurup G.U. (1978). Distribution of the lion tailed macaque, *Macaca silenus* (Linnaeus). J. Bombay Nat. Soc., 75, p. 312-340)

[109] Easa P.S., P.K.S.Asari, C.S.Basha.(1997) Status and distribution of the endangered lion tailed macaque *Macaca silenus* in Kerala, India. Biol.Conser 80 p 33-37

Intensive agriculture and increased chemical inputs impacts biodiversity

94. Reckless use of chemical pesticides aggravates the environmental issues of CHR. Pesticide use in cardamom plantations in CHR is reported to be one of the highest in the world and on an average, farmers use 27 kg/ ha of pesticides (NIAS, 2010).[110] High application of pesticides has health implications too with increased reports of diseases like dermatitis, asthma, cancer and reproductive disorders.[111] Besides, excess use of pesticides, changing agronomic practices, fragmentation and conversion of cardamom have serious impacts on pollinators as many of the original species have tenuous associations with plants that may not sync well with sound ecological considerations (Murugan *et al.*, 2011).[112] It is observed that in cardamom growing areas, there is perceptible decline in the number of sallying insectivorous birds (from 10 species in 1933 to five in 2009) which is attributed to chemical pesticides and removal of middle-storey perching canopy (Sasikumar *et al.*, 2009).[113]

Climate change impacts on the biodiversity of cardamom gardens

95. Climate change has started impacting the cardamom cultivation in the landscape. Observations made during the PPG consultations corroborate this. For instance, cardamom farmers in the landscape observe that there is change in the average and minimum temperature over the last ten years. Reduction in humidity, increase in sunshine hours, erratic rainfall, increased soil temperature, loss of soil moisture and increase in evapo-transpiration have created sub-ambient conditions for cardamom cultivation in the region. The impacts of climate change is also critical in the pollination of cardamom on account of the intricate relationship between phenology and pollinator biology. In the wake of these changes the tendency has been to further resort to short-term intensified production practices that are inimical to biodiversity conservation (e.g. opening up of canopy for sun loving varieties, increased agro-chemical inputs etc.).

Increasing thermal energy consumption for cardamom curing and its impact on canopy cover

96. Like tea, cardamom also requires vast amount of thermal energy for curing. At present, most of the curing units procure fuel wood from trees grown/ existing in the cardamom gardens that is marginally supplemented by wood brought from outside. It is estimated that the total quantity of firewood used in CHR for cardamom curing is around 80,000 metric tonnes per annum. Most of these curing units are also operating below par in terms of energy efficiency. Improvements in technology can bring in significant reduction in firewood use that will have a big influence in retaining the top canopy tree cover in cardamom gardens. Even a modest 20 percent reduction in fire wood consumption (achieved through energy efficiency interventions) in cardamom curing units will save 16,000 metric tonnes of firewood every year which will have a corresponding CO_2 emission reduction to the tune of 27.84 million kg.

Unfavourable market conditions hinder adoption of conservation friendly farming practices.

97. Cardamom industry is highly prone to persistent market risks and failures along with increasing cost of production (averaging around USD 3,000 per annum per ha). Markets show vast fluctuations that spread signals of distress and uncertainty in the sector. Cardamom markets are also plagued by the presence of intermediaries who form cartels and resort to illegal imports leading to low value realization and poor economic returns to farmers. In addition, cardamom sector is affected by pervasive and unfavourable trade regulations. Non availability labour is a recent issue. As a response measure, the tendency is to resort to more

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[110] National Institute of Advanced Studies (2010) Cross reference from Misra, S. S. (2011) Kerala gets cautious. *Down to Earth*, Feb. 2011

[111] Misra, S. S. (2011) Kerala gets cautious. *Down to Earth*, Feb. 2011

[112] Murugan M., Shetty P.K., Hiremath M.B., Ravi R. Subbiah A, 2011. Occurrence and activity of cardamom pests and honey bees as affected by pest management and climate change. International multi-disciplinary research journal. Vol 1/6 pp 3-12.

[113] C.Sasikumar, C.K.Vishnudas, S.Raju, S.Kannan and P.A.Vinayan, 2009 Along the Trail of Salim Ali – A study of avifauna and their habitats and ecological history. Kerala Forest Department p 247

intensified non-conservation-friendly production practices to squeeze out the last elusive profit through short-term means.

Ambiguous landholding pattern in CHR impedes effective biodiversity management

98. Cardamom Hill Reserve (CHR) is a tenurial enigma with a multitude of landholding patterns, often nebulous and highly ambiguous land tenure systems and overlapping jurisdictions that have adversely affected effective management of biodiversity. For instance, here, Forest Department officially has the responsibility of protecting trees; Revenue Department presides over the land; and cultivators own the crop. The complex and unclear arrangements of land tenure and the weak governance framework for administering it have rendered sustainable management of CHR a daunting proposition. While the loss of forest canopy within cardamom industry is an immediate imminent threat, adoption of environmentally malign technological/ land-use options, often disregarding the local ecological considerations, could spell wide-spread disaster in the landscape (Murugan, 2011).[114] Changing canopy cover and increased incidence of pests and diseases due to intensification of production are threatening the sustainability of cardamom cultivation itself (Swaminathan, 2008).[115] This trend is only likely to aggravate unless decisive interventions are made.

Tourism and urban development

99. Tourism is growing exponentially in the project landscape and the tourism industry provides employment to around 8,000 individuals. Tourism boom was particularly evident during the last decade especially in and around Munnar. There are more than 250 identified resorts and hotels in and around Munnar. Annual visitation to Munnar now exceeds 0.7 million (in 2012) from just a few thousands in 1990s (see Table 15).

Table 15: Details of annual visitation to important tourist spots in Munnar

Location	Year						
	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13(till jan.)
KFDC flower garden	56815	113061	221795	290125	358025	431316	461149
Rajamallay	452428	317843	378419	391151	384359	415019	449965
Hydel Tourism	429605	429658	405583	413122	382062	409607	392064

Impacts of tourism industry on biodiversity

100. Unparalleled growth in tourism has brought in associated infrastructure development (both planned and unplanned), generation of vast quantity of solid wastes and effluents (around 4,745 metric tonnes generated annually in Munnar alone)[116], increase in traffic (e.g. more than 200,000 vehicles passing through Chinnar Wildlife Sanctuary every year), water shortage etc. Unplanned expansion of tourism has a number of indirect impacts in the project landscape such as resource depletion, catalyzing growth in urban and peri-urban areas, mushrooming of high rise buildings, collection of curios form wild (e.g. sphagnum moss), expansion of roads and other infrastructure and associated land-use changes. The large 'floating population' of visitors with their relatively higher consumption requirements put additional stress on resources. Areas like Chinnakanal, Vattavada and Pallivasal have also undergone land-use changes due to expanding tourism. Infrastructural incursions on the

[114]Murugan M. *et al.*, 2011, Environmental impacts of intensive cardamom (small) cultivation in Indian cardamom hills: need for sustainable and efficient practices, *Recent Research in Science and Technology 2011, 3(2): 09-15*

[115] M.S.Swaminathan, 2008, Measures to mitigate agrarian distress in Idukki District of Kerala A study report by M.S.Swaminathan Research Foundation May 2008

[116]Department of Tourism, 2010. Tourism development plan for special tourism zone – Munnar of Idukki district Vol 1. Government of Kerala

periphery of Kannan Devan Hills (e.g. Chinnakanal, Pallivasal and Pothamedu) have a direct bearing on ecology as they come up mostly in cardamom areas interspersed with natural vegetation.

101. Other side-effects of tourism expansion include hike in land value, illegal land grab and rampant encroachment of public space; a trend that reached its peak during the last decade. Even the remote Vattavada valley which had a predominant land use of subsistence farming got in the wake of the tourism boom during 1990s. The influx of 'cash-surplus city-dwellers' has triggered significant land use change including extensive planting of *Eucalyptus* trees (mostly absentee cultivation) in such areas.

102. Mass tourism is placing heavy pressures on PA managers leaving them less time to deal with other pressures. For instance, annual visitation to Eravikulam National Park is around 450,000 per annum. The increasing influx of tourists into PAs is spurring new demands to open up more areas for commercial tourism operations and is also affecting animal behavior particularly as a result of disturbance from vehicular traffic (e.g. aggressive elephants on the Munnar-Udumalpet highway). Increased traffic is also leading to road kills, affecting wildlife movements (e.g. elephants) and other imperceptible changes (e.g. affecting the flight of bats).[117]

Projected trends in tourism industry and its impacts on biodiversity

103. Salubrious climate and exceptional aesthetics are the 'unique selling property' of the region. Unplanned infrastructure development and climate change are likely to impact the tourism industry and demography of HRML in two ways in future. In the short-term, HRML will continue to attract tourists and people who seek a 'second home' in the ambient environs of the landscape. These neo-colonizers will bring in an element externality to the landscape both in terms of resource use, consumption pattern, life-style, and demographic profile. If not managed properly, such an upland migration will intensify the encumbrance on fragile resources which are already strained from multiple stressors.

104. However, in the long-run, the situation may change in the opposite direction. Irresponsible tourism and unregulated resource use along with climate change could spell doom for the innate characteristics of the region – especially the very salubrious climate and aesthetics. Such a retrogression will take the 'sheen off' the tourism industry and adversely impact the local economy. The massive economic and human infrastructure (both physical and service based) built around the leisure-industry may become economically unviable leading to livelihood disruptions in the region and the potential fall-out of such a disaster will be the accelerated dependence and depletion of biological resources.

Commercial forestry operations

105. Around 20,000 ha of the project landscape is under commercial forestry mostly under the management of Forest Department (90 percent) and marginally with HNL and KFDC (10 percent). The following section analyzes commercial forestry operations in HRML from the perspective of biodiversity conservation.

Wattle and *Eucalyptus* plantations threatening the biodiversity of HRML

106. Wattle and *Eucalyptus* extensively occupy the high altitude grasslands of HRML. These were introduced at a time (1980s) when grasslands were considered as waste lands and commercial considerations were the focus of forest management. However, wattle has since lost its market demand (for tannin in leather industry). Besides, after the enunciation of the National Forest Policy in 1988, conservation priorities have overridden commercial considerations. Though wattle and *Eucalyptus* are being removed as a management practice in some areas (albeit in small-scale) (e.g. Anaimudi shola National Park), more concerted eco-

[117] Victoria J. Bennet and Arthur A Zurcher, 2013. When corridors collide: Road related disturbance in commuting bats. The Journal of Wildlife Management, 77 (1).

restoration efforts (both technical and financial) are required to bring the original habitats back. There are also clear indications that the continued presence of these exotic plantations facilitates the expansion of woody vegetation at the expense of grasslands (the most threatened ecosystem in HRML).

107. The *Eucalyptus* plantations raised and managed by corporate tea companies are used exclusively for the fuel requirements of tea factories and labour lines. Next to the original forest fragments, these areas also perform ancillary ecological functions such as cover, corridor etc. As mentioned earlier, any potential reduction in fuel wood demand in tea industry and subsequent reduction in dependence on these plantations will have positive impacts on the vegetal cover of HRML. At the same time, 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 leads to disruption of local livelihoods, cultural drift, impoverishment of communities as well as ecosystem malfunctioning. This situation is only likely to worsen in future.

Reed industry and its implications on biodiversity conservation of HRML

108. Reed industry is beset with certain issues that hamper the adoption of sustainable practices. The cost of extraction of reeds from the project landscape is increasing substantially. According to HNL, the average landing cost (rent, extraction and transportation) of reeds is currently around USD 100/MT. To reduce the cost of transportation, the contractors compete to get allocations along existing roads. Moreover, the prescribed extraction cycle of three years is often ignored and there are incidences where extraction resumes within a gap of 3-4 months. This impedes regeneration and affects the quality of reeds in preferred extraction areas. At the same time, the interior areas are often neglected, where the density of reed culms increases and subsequently affects the under-growth. As a result of labour scarcity, damage to resource base, over extraction in certain areas, suppression by invasive species and poor regeneration, both HNL and KSBC are collecting much less than what is allotted to them annually. Interestingly, most of the current reed cutters are of above 50 years and the younger generation is not keen in reed based occupations. Overall, due to unscientific collection, fire, suppression by weeds and lack of regeneration, there is substantial depletion of reed breaks (Amruth and Gurukkal, 2007).[118]

Teak plantations

109. Teak plantations occupy almost 50 percent of the area covered under commercial forestry operations especially the lower valleys of the landscape. Most of the teak plantations are showing signs of declining productivity and 'second rotation decline'. At many places, the Site Quality in teak plantations has degraded from I to III.[119] High cost and limited availability of labour deter timely silvicultural operations (e.g. thinning and invasive species management) that further compromise effective management of these plantations. At the same time, intensively managed teak plantations are seem to be less biodiversity-rich while some of the failed and low yielding plantations have profuse regeneration of natural vegetation. In future, in the business-as-usual scenario, teak plantation management may traverse the following pathways: (1) adoption of intensive silvicultural practices for better productivity with mechanized support; and (2) conversion of these areas to other hardy fast growing species (e.g. *Acacia mangium*). Unless explicit conservation-friendly practices are factored in, both these prospects do not bode well for the overall ecological integrity of HRML.

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[118] Amruth. M. and Rajan Gurukkal, 2007. Spatiality of subsistence and human ecology of landscape: towards self-regulatory Forest Communities

[119] Various research Reports of Kerala Forest Research Institute, Kerala

Threats to biodiversity from climate change

110. Climate change exacerbates the vulnerability of HRML. Considering that high altitude ecosystems of HRML are delicately calibrated to the nuances of environmental parameters, even slight changes in the prevailing climate will unsettle the ecology of the region. Impacts of climate change have already started manifesting in the region and there are clear indications of alterations in ecosystem types, forest boundaries, species-assemblages, die-back of forests, species loss, migration, regeneration, pollination dynamics, spread of invasive species and disruption to ecosystem networking and functionality. The Project Preparatory Team has undertaken a preliminary climate vulnerability assessment of HRML and the findings do not augur well for the ecological integrity of the project landscape in the business-as-usual scenario. Important observations in this regard are as below:

111. First, Thuiller (2007)[120] postulated that every 1^0Celsius rise in temperature will result in shifting the zone of occurrence of several specialist species by 160 m vertically and 160 km horizontally (to reach similar ecosystem conditions). At several locations in HRML, shift in vegetation boundaries has been observed with species adapted to the warmer, lower elevations migrating to higher altitudes. Generalist birds (e.g. Red-vented bulbul) have started moving up into the high altitude habitats of HRML causing severe competition for endemic and specialist forms (Sasikumar *et al.*, 2009).[121] Besides, there are indicative reports of certain species (e.g. Black and rufous flycatcher) shifting their lower limits of distribution to higher reaches and sporadic dying of patches of *shola* forests with the rise in surface temperatures.[122] Some pioneering studies conducted in the project landscape also show that endemic mammals like Nilgiri tahr face increased risk of extinction due to climate change (Sukumar *et al.*, 1995).[123] Ambient temperature regime is a critical factor in determining the sex ratio in many reptilian and amphibian species. HRML being a region of significant reptilian and amphibian diversity, climate change will have serious deleterious impacts on them.

112. Second, oscillations in climate have major impacts on the structure and composition of montane ecosystems. For instance, C3 and C4 plants are known to have differential ecological preferences and higher CO_2 levels would enhance photosynthetic rates in C3 plants to a greater extent than in C4 plants (Tieszen *et.al.*, 1979).[124] As a result, the montane evergreen forests dominated by Lauraceae and Rubiaceae are expected to expand into the grasslands in the higher reaches of HRML (e.g. Eravikulam National Park), while C3 grasses and herbs could potentially replace C4 grasses. Species which are pioneer colonizers of the grasslands and ecotones include *Rhododendron arboream, Rhodomyrtus tomentosus, Strobilanthes spp., Dodonea viscosa, Wendlandia notoniana, Hedyotis stylosa, Mahonia leschenaultii, Berberis tinctoria* and *Gaultheria fragrentissima*. These could be the first to respond to a warmer climate followed by other species with more tropical affinities which are otherwise limited by cool temperature and frost.

113. Third, wattle and *Eucalyptus* (both C3 plants) have high growth rates and coppice profusely. A reduction in the incidence of frost combined with enhanced photosynthetic rates (from elevated CO_2 levels) in wattles (an invasive alien species) could enable them to spread to highly threatened high altitude grasslands more rapidly than the slow growing forest tree and shrub species (Sukumar *et al.*, 1995).[125] Climate change is already causing the proliferation of other invasive species such as *Mikania micrantha*, *Mimosa inervis* and

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[120] Thuiller,W, 2007. Biodiversity: Climate Change and the Ecologist, Nature 448, 550-552 (2 August 2007)

[121] C.Sasikumar, C.K.Vishnudas, S.Raju, S.Kannan, and P.A.Vinayan, 2009. Along the Trail of Salim Ali – A study of avifauna and their habitats and ecological history. Kerala Forest Department p 247

[122] Stakeholder consultations

[123] R. Sukumar, H.S. Suresh, and R.Ramesh, 1995: Climate Change and its impact on tropical montane ecosystems in southern India, Journal of Biogeography 22, 533-536

[124] Tieszen, L.L., Senyimba,M.M., Imbamba,S.K. and Troughton, J.H, 1979, The distribution of C3 and C4 frasses and carbon isotope discrimination along an altitudinal and moisture gradient in Kenya. Oecologia 37, 337-350.

[125] R. Sukumar, H.S. Suresh, and R.Ramesh, 1995: Climate Change and its impact on tropical montane ecosystems in southern India, Journal of Biogeography 22, 533-536

Eupatorium spp., Lantana camara in HRML. Species with better dispersal abilities (animal-dispersed, such as *Syzygium spp.* and *Cinnamomum spp.*) could also be favoured over those with poor dispersal abilities (*ibid*). Anthropogenic factors, (prevailing as well as emerging) may, however, compound or confound the effect of climate change induced vegetation alterations in HRML. Fourth, increase in dry season length will place some forest types such as dry and moist deciduous forests at increased risk from dry season fires (Ravindranath and Sukumar, 1996)[126], which will be particularly relevant in the low and mid elevation forests of HRML.

114. Fifth, cardamom farmers in the landscape observe[127] that changes in climatic parameters over the years (increase in average and minimum temperature, reduction in humidity, increase in sunshine hours, erratic rainfall, increased soil temperature, loss of soil moisture and increase in evapo-transpiration) have created sub-optimal conditions for cardamom cultivation. At the same time, with rise in temperature, crops like rubber (normally a midland crop) are increasingly planted in areas that were hitherto unsuitable for them.

115. Sixth, the tribal communities in the landscape have developed tenuous livelihood strategies based on natural resource base – both at species and ecosystem level. Climate change induced changes in ecosystem and species dynamics will have significant impact on such livelihood options (e.g. the availability and seasonality of NTFPs). There is also a perception among the local people that the causative factor for the increasing occurrence of human-animal conflict, at least partly, is related to climate change as increasing aridity, water scarcity, reduced availability of forage, proliferation of invasive species, shift in floral elements etc. drive wild animals from their natural habitats.

Threats to biodiversity from social and cultural changes

116. The project landscape is witnessing rapid changes in the socio-economic context. During the PPG phase, the project preparatory team analyzed these changes in the context of threats to biodiversity. Some of the sector-specific socio-economic changes and its impact on biodiversity have already been dealt in the previous sections. The following section details other related changes.

Weakening sustainable natural resource based livelihoods

117. Though NTFPs form the primary source of income to only a relatively small number of families, collection of small wood and other resources for own-consumption and also as supplementary income is crucial to tribal life in the region. Major items collected/ sold by tribal communities for income are reed, cardamom, bamboo, honey, dammar, gooseberry, lemon grass oil, medicinal plants etc. The marketing of NTFPs are mostly through Scheduled Tribe Development Cooperative Societies that often function below par efficiency. Though JFMCs have also stepped in to the marketing scene, these are yet to gain the confidence of communities as an efficient marketing channel. In the absence of any efficient, trustworthy marketing mechanism, tribal communities depend on private intermediaries who procure NTFPs from collectors by advancing pittance. These intermediaries who have scant regard for ecological considerations form a major threat to sustainable NTFP use in the region. Besides, local communities have limited capacities for value addition and upscaling natural resource based livelihoods to economically viable sustainable enterprises. In addition, in the absence of appropriate tenurial and usufruct security (dealt in previous sections), most of the resource use practices of tribal communities continue to be 'extra-legal dependency' that offer little incentives for sustainable use. Cumulatively, these lead to a vicious circle of continuing exploitation, poverty and unsustainable use of natural resources.

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[126] N.H.Ravindranath and R.Sukumar, 1996, Impacts of climate change on forest cover in India. Commonwealth Forestry Review 75(1), 1996.

[127] Stakeholder consultations

Disintegration of traditional lifestyles and their impacts on biodiversity

118. The rapid transformations in the landscape, spurred primarily by tourism, have mystified and alienated the marginalized communities especially the tribes. This is manifested through changes in traditional life styles and loss of cultural cohesion. The changing mindscapes of tribals directly lead to biodiversity depletion. Erosion of traditional knowledge due to non-codification, non-transfer and non-application disrupts the continuity of sustainable resource management. Changes in culinary habits portend depletion of agro-biodiversity, reduced dependence on wild varieties and consequent knowledge loss. Changes in perception about 'nature' also disrupt the foundations of sustainable use (e.g. destructive collection of black dammar, fishing using dynamite and electric shock etc.). In the existing scenario, such issues are only likely to intensify. The limited experience of communities to cope with the rapid developments occurring in the landscape is a serious factor threatening the biodiversity of HRML. The growing disconnect between conventional and non-conventional livelihoods is quite true for non-tribal communities too. For instance, among the younger generation of tea plantation workers, there is a trend to engage in tourism related ancillary occupations such as guiding, vendoring etc.

Changes in aspirations and differential access to social mobility among tribal communities impacting conservation prospects

119. Triggered by increased exposure to market, influences of media, cellular connectivity and increased reach of modern education, the tribal communities of HRML are undergoing accelerated social change. These changes are highly relevant in HRML as natural resources still form the resource base for most of them. Some of the discernible biodiversity related impacts associated with this change include the inter-generational inability to transfer traditional knowledge on natural resource management; changing patterns of resource dependence and over exploitation of natural resources. Though access to modern education is considered as an important factor for social mobility, in the case of tribal communities education alone cannot be considered as a driver of social change. Debt trap is rampant among tribal communities and the landholding pattern varies widely with Malaaraya and Muthuvan communities being relatively better off than others. Though the process of implementation of the Schedule Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006 has been initiated in the state of Kerala, owing to a number of factors, the settlement of Community Forest Rights (CFR) are yet to be implemented in the landscape. In addition, the physical remoteness of some of the tribal hamlets (e.g. Edamalakudy) leads to poor implementation of even the regular welfare measures of government and other agencies. Such differential positioning of tribal communities (geographical, economic and social) and the strategies devised to reach out to them will be very crucial in deciding the ecological trajectory of HRML.

Increasing trend in resource consumption and its impacts on biodiversity

120. The region embedding HRML has been identified as the most vulnerable eco-region among the global biodiversity hotspots due to high population density (Cincotta *et al.*, 2000).[128] It is now widely accepted that irrespective of absolute changes in population, increase in households have more impact on biodiversity as it leads to higher per capita resource use even when the overall population declines (Jianguo, 2003).[129]This trend is quite significant in the context of HRML. According to 2011 provisional census figures, even though there was a reduction in the population of the project district by 1.93 percent (compared to the previous decade), the number of households on the other hand increased during the period by around 11,600. In view of this, it is clear that resource use planning in HRML needs to conjointly consider this trend in demography as well as the requirements of the 'floating population' of tourists and its impacts on biodiversity. In short, HRML needs to

[128]Cincotta, R.P., Wisnewski, J, Engelman, R, 200. Nature 404: 990-992

[129]Jianguo Liu, Gretchen C. Daily, Paul R. Ehrlich, 2003. Effects of household dynamics on resource consumption and biodiversity, NATURE, VOL 421, 30 JANUARY 2003

do resource planning for more people than its resident population/ households. However, this approach is currently not practiced in any of the planning frameworks of HRML.

C. BASELINE ANALYSIS

121. Different agencies, institutions, sectors and communities make significant financial, social, cultural and intellectual investments in the landscape but with varied objectives and many a times, at cross purposes. These investments are mostly confined to their own stated sectoral objectives and are generally myopic towards the objective of conservation of biodiversity. These investments form the baseline for the project. An analysis of the baseline programmes that is relevant to the project and where there is scope to align these investments along the project objectives, are outlined below. The baseline investments may be broken into five parts, based on the source of funds as described below:

Investments by the national government:

122. India's National Environment Policy (2006) seeks to achieve balance between conservation and development by mainstreaming environmental concerns in developmental activities. Considering that the mountains are important but highly fragile ecosystems, National Biodiversity Action Plan (NBAP, 2008)[130] envisages major measures for conserving the mountain ecosystems. This project will align with India's ongoing 'strategy for conservation and sustainable utilization of biodiversity that evolve mostly from various programmes formulated by the Ministry of Environment and Forests; and complement the efforts of other related Ministries/Departments and affiliated agencies dealing with Agriculture, Water Resources, Rural Development, Commerce, Power, Industry, New and Renewable Energy, Tourism, Urban Development, and Science & Technology. These flagship programmes along with other complementary programmes (both at the union and federal level) have an approximate annual financial outlay of USD 10 billion (at the national level). One striking aspect to note at this juncture is that the scope, reach, and role of these programmes in designing landscape level resource management initiatives especially in mountain landscapes are rather weak and not well-defined. The project would fill up this void by piloting a landscape approach to biodiversity conservation.

123. The Central government provides technical and financial support for the establishment and conservation of Protected Areas, Biosphere Reserves, Tiger Reserves, Elephant Reserves and Reserve Forests in the mountain areas. On an average, the Government of India spends USD 100 million per annum specifically for the conservation of mountain areas under various centrally funded schemes (out of the total outlay of), *viz. Integrated Development of Wildlife Habitats (USD 15 million), Project Tiger (USD 50 million), Intensification of Forest Protection (USD 22 million), Project Elephant (USD five million)* and *National Afforestation & Ecodevelopment Programme (USD 200 million).* Annual support from national government for protection, conservation and management of the eight PAs and five territorial Divisions in HRML amounts to USD 1.5 million. In PAs, funds are mostly directed towards strengthening protection and infrastructure, fire management etc. and to a limited extent, towards habitat improvement, ecorestoration, nature education etc. The funds for territorial divisions are mostly oriented towards consolidation, staff deployment, fortifying enforcement, reforestation through participatory forest management (PFM) and fire protection.

124. The national government also invests approximately USD 0.5 million per annum in HRML through the National Agriculture Development Programme (RKVY). Apart from direct support to agriculture through sustainable land management, improving productivity and enhancing market opportunities, RKVY also supports fisheries development, animal husbandry, popularization of temperate fruit crops, cool season vegetables, water harvesting

[130]National Biodiversity Action Plan, 2008, MoEF, New Delhi

and cardamom processing. More specifically, the National Horticulture Mission (USD two million) supports vegetable seed production, organic farming, creation of water sources, vermi-compost units, and integrated pest management. The Spices Board (USD one million) subsidizes replanting and rejuvenating small cardamom holdings, improving curing technologies, organic certification, quality control measures and market information and promotion to support the cardamom industry. The Coffee Board is marginally investing in replanting, quality upgradation, water quality management and pollution abatement, coffee processing etc. for small farmers; and the Tea Board is providing financial (USD one million) and technical assistance for tea cultivation under the Special Purpose Tea Fund Scheme for replanting and rejuvenation of old tea areas. Rubber Board invests USD 0.25 million per year for providing subsidies to new planting. Special Central Assistance (around USD 0.25 million) through Western Ghats Development Programme funds integrated development of water sheds in the landscape.

125. The Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS) has an annual outlay of around USD 17 million in the HRML and supports enhanced livelihood security by guaranteeing wage employment for unskilled laborers comprising mostly of women. Water conservation, water harvesting, renovation of traditional water bodies, land development and rural sanitation are some of the major activities undertaken under this scheme.

126. A special assistance programme from the Central government based on the Report-*Measures to Mitigate Agrarian Distress in Idukki District of Kerala* has earmarked around USD 10 million per annum for HRML for sustainable livelihoods and ecological security. The recommended activities include common infrastructure and service facilities, strengthening forest and tree cover, pisci-culture in reservoirs, promotion of rural marketing, water conservation, sustainable cardamom production, improved and community curing devices and revamping traditional farming systems. The funding for the activities outlined in the above Report are accessed from central and state agencies, commodity boards and other national programmes and missions.

Investments from the state government:

127. The state government provides an outlay of around USD 1.5 million per annum for the management of PAs in HRML. In addition, it invests USD four million annually in managing the forests lying outside the PA system and the forest production sector (e.g. planting, timber operations, protection, infrastructure development etc.). Similarly, the State Agriculture Department invests approximately USD one million in HRML on various agricultural schemes aimed at development of vegetables and spices, market stabilization, soil conservation and strengthening agricultural extension. The Tourism Department has an annual budget of USD 1million that is largely spent on planning and sprucing up tourism infrastructure in the landscape. The Scheduled Tribe Development Department has an annual outlay of about USD 0.5 million for various schemes such as housing, agriculture improvement, livestock rearing, drinking water and self employment schemes. Apart from this, Edamalakudy Tribal Panchayat has a special package of about USD 2 million mostly for housing and other infrastructure facilities. The state government also provides manpower and infrastructure for the implementation of the above-mentioned baseline projects.

Investments from Local self-governments and communities:

128. Local self-governments (*Panchayats*) have a strong presence in the landscape and carry out grass root level planning for economic development. They also implement various production sector programmes (e.g. agriculture, animal husbandry, fisheries, soil and water conservation, minor irrigation and small scale industries). The spending of local self-government that is relevant in the context of the project (on resource management) amounts to USD 4 million per annum. In addition, to enhance and strengthen the institutional capacity of local government system to deliver services and undertake basic administrative and governance functions more effectively and in a sustainable manner, the state government is

implementing a Kerala Local Government Service Delivery Project. This has an outlay of around USD one million for the PRIs in the project landscape.

129. SHGs bring in important baselines related to this project's priority areas of intervention. They are engaged in helping communities recover socially and economically by promoting micro enterprises, linking to banks through kinship based institutions to access credit at the local level, helping people restore and improve their livelihoods through training and skill development, introduction of low cost, easy to adapt technologies, introducing business model approaches (links to markets), capacity development and trainings of the community members. Some of the baseline project initiatives brought in by these agencies include: bio-gas; renewable energy; solar applications for energy efficiency; livestock based fodder systems; promoting business models for milk production; livelihood improvement through training and skill development for microenterprises based on local biodiversity (e.g. NTFPs and medicinal plants); agricultural productivity restoration; etc. *Kudumbasree*, a flagship poverty eradication mission of the State Government with its ubiquitous presence in the landscape and linkages with various central and state government projects, has an investment of about USD five million through various microenterprises. Overall, community institutions like NHGs, JFMCs etc. also bring in complementary contributions to the tune of USD one million per annum through participation in forest protection, social mobilization, community welfare etc.

Investments from the production sectors:

130. The major production sectors in the landscape are cardamom, tea and tourism. Together they have significant investment in the landscape. The annual investment in tea industry comes to USD 25 million for activities like planting, soil and water conservation, fuel plantation management, weed management, disease and pest management, plucking and processing. Cardamom farmers invest around USD 50 million on activities like weed eradication, soil working, moisture conservation, shade management, harvesting and curing. The reed based industries and forest corporations together invest around USD two million for soft wood plantation management and reed extraction. The tourism industry which is a relatively new entrant into the landscape invests around USD five million annually for services and maintenance of infrastructure.

Investments from research institutions:

131. There are a few research institutions located in HRML conducting basic and applied research. They are: a) the Indian Cardamom Research Institute (ICRI), Myladumpara under the Indian Spices Board (the Union Ministry of Commerce and Industry): b) the Cardamom Research Station (CRS), Pampadumpara under the Kerala Agricultural University; and c) Research and Development Department of the Kannan Devan Hills Plantation Company (P) Ltd. Other research institutions that have a stake in the region are Centre for Earth Science Studies (CESS) and KFRI who take up specific projects related to natural resource management. These institutions look at crop improvement, sustainability, biotechnology, weather data, soil studies etc. The investments by these institutions would come to around USD one million per year.

D. Long-term Solution and Barriers to Achieving the Solution

132. While there are several initiatives (across different sectors and actors) pertaining to resource governance in HRML, they are not sufficiently coordinated to lessen pressure on biological diversity. The operations of individual agencies are very much sector-focused and the region lacks a comprehensive planning and governance framework that specifically integrates biodiversity conservation needs in production sector planning and operations. Further, as is the case elsewhere in the country, the existing conservation framework in HRML is still 'Protected Area' centric. As PAs alone will not be able to secure the ecological

future of HRML (due to their sub-optimal coverage and existing and emerging threats), it is imperative to adopt a broader integrated approach to biodiversity conservation.

133. To repair and maintain the ecological integrity of HRML will thus require a radical shift in the governance approach that is currently being pursued. There is a need to pilot an alternate governance approach in HRML by promoting cross-sectoral coordinated planning, execution and compliance monitoring so that ecosystem integrity and life-support functions of the region are restored/ maintained for posterity. The aim is to broaden the constituency of conservation beyond the conservation sector and mainstream biodiversity considerations as central to the operations of economic production sectors. It is expected that this will enable them to minimize adverse impacts on biological diversity, manage potential trade-offs and promote win-win opportunities. The *long-term solution* proposed by the project is thus to build the know-how and put in place a collaborative governance mechanism for multiple-use management of HRML based on landscape approach that secures PAs and outlying HVBAs, mainstreams biodiversity management into production sector operations and promote conservation-compatible livelihoods. However, there are several barriers that encumber the attainment of this long-term objective:

Barrier 1: Institutional and policy framework for collaborative governance and know-how and capacities for multiple use mountain landscape management is inadequate

134. Sustainable resource use practices require robust scientific baselines supported by enabling policy framework. Such a 'science-policy-practice' interphase is currently weak in HRML. While there exists some knowledge base related to resource governance, it is largely fragmentary and scattered. Further, even when such knowledge exists, it is not readily available to policy makers, programme implementers and local communities in a user-friendly and easily retrievable manner for taking informed decisions related to land and resource use. As a result, planning and decision making (among various sectors, agencies and communities) in HRML take place based on limited/ fragmented information. This impedes effective appreciation of environmental impact assessment and management—in particular efforts to avoid impacts in the most sensitive areas and reduce and mitigate impacts in other localities. In the broader production arena, the lack of information on sustainable practices (e.g. carrying capacity assessments for sustainable tourism; energy efficient curing/ processing technology in cardamom and tea industry etc.) hamper their prospective adoption into production practices. It was further noticed that there are limited attempts to document or utilize traditional knowledge about sustainable utilization of resources.

135. While there exists fairly good knowledge base on some flagship species, information on lower life-forms are clearly lacking. Further while some PAs have been relatively well inventoried (e.g. Thattekkad), such an exercise is not yet complete in most of the PAs and almost completely absent in most of the HVBAs, particularly the interspersed areas of tea gardens. Further, the exact impact of climate change on the ecosystems of HRML is yet to be studied in detail. Similar knowledge gaps exist in key production sectors too. For instance, the long term impacts of canopy opening in CHR is still not understood and translated for local guidance for land use planning. Some of the specific knowledge barriers that limit informed decision making in the tea industry include: energy efficiency options for for thermal energy conservation; branding for premium marketing etc).

136. The existing governance framework (policy, institutional, operational and legal) is insufficient for facilitating a comprehensive and science based land use management system in the landscape. The National Capacity Self-Assessment-Thematic Report on Biodiversity has given the Western Ghats (where HRML is located) a score of only 73.3 percent based on existing capacity status/ strength of different institutions/thematic areas to handle biodiversity-related issues as articulated in CBD Articles 05 to 20. The problem starts with the planning process itself which is mostly driven by short-term sectoral considerations (maximum of five years in production sector and ten years in the conservation sector) and not coordinated across sectors. HRML has a plurality of sectoral mandates ranging from

exclusive conservation considerations (e.g. protected areas) to upfront economic production (e.g. *tourism and tea production*); all operating in an increasingly resource-scarce environment. Further, these sectoral frameworks are characterized by overlapping mandates and often mutually exclusive objectives that deepen conflicts between development goals and biodiversity concerns. For instance, the tourism sector, mandated with maximizing visitor growth, does not always take into account the impacts of unregulated tourism on biodiversity. In addition, there is a perception among development sectors and local self-governments that biodiversity conservation is more of an obstacle to development. As a result, most of the developmental activities come into conflict with conservation priorities in the landscape (e.g. road construction by PWD and GPs; distribution of goats and cows in forested areas by Tribal Welfare Department; introduction of exotic fishes in water bodies by Fisheries Department; expansion of power transmission lines by KSEB, canal construction by Water Resources Department; sand mining by LSGs etc.).

137. There also exists incongruity among various sectoral legislation and polices. While the policies and legal instruments governing the conservation sector (e.g. Forest Policy, Forest Conservation Act, Wildlife Act, etc.) have strong conservation provisions, other production sectors (e.g. Agriculture, Tourism, etc) have a weak focus on such aspects, creating conflicts over land-use. Further, policies and guidelines governing the operations of different production sectors do not provide effective guidance on minimizing adverse impacts on the ecologically sensitive environment in which they operate. Even when the production sector legislation and policies have at least some provisions for environmental safeguards (e.g. Cardamom Rules, KDH Act etc.), there are challenges like: a) weak enforcement of the existing provisions related to environmental management; b) integrating more focused biodiversity conservation principles into the production sector laws, policies and practices; c) ensuring harmony among the various sectoral laws and policies; and d) capacities to implement the same on a landscape perspective.

138. Similarly, the project landscape has several programmes that have a bearing on natural resources. While there exists some guidance in terms of pre-programme planning (albeit sectoral in nature), the institutional capacity for concurrent and post-programme monitoring and compliance monitoring is incipient. There are no formal institutions mandated to perform this at present. Sectoral capacities to gauge the gains and paybacks of 'unsustained cumulative growth' v/s 'sustained optimized growth' paradigms and also to maintain institutional memory and continuity of good practices are critically constrained. Other related institutional and policy barriers include inability to deal with 'uncertainties' such as market fluctuations (e.g. tea, cardamom), climate uncertainties etc.

139. Currently, HRML lacks a comprehensive land use plan that would have guided all land use decisions in the landscape. Similarly, barring the conservation sector, other prodcution sectors do not have the know-how and precedence of preparing and implementing biodiversity-friendly sector plans. Even when these are available, the production sector development plans do not always take into account the long-term impacts on the environmental health and integrity of the HRML. For instance, the exisitng tourism sector plan is weak in articulating a case for biodiversity mainstreaming and more-over it is a non-starter in implementaion. On similar lines, the tea garden sector plan falls short of recommending concrete prescriptions regarding biodiveristy mainstreaming.

Barrier 2: Limited application of landscape level land use planning and management that would maximize biodiversity conservation prospects

140. Lack of adequate capacity for integrated management within different institutions that have a mandate and jurisdiction over different aspects of resource governance adversely impact the HRML. For instance, production sector staff has limited technical capacity and skills to incorporate and implement biodiversity considerations in plans and activities (e.g., appreciation and consolidation of forest fragments lying outside the PA system, integrating

green development options including energy efficiency in the operations of tea, cardamom and tourism establishments etc.). Similarly, even in the conservation sector, capacities for effective management of the PAs to deal with existing and emerging threats (e.g. invasive species, visitor management and climate change) are weak in terms of technical know–how, man power and finances.

141. In the absence of an institutional mechanism for coordinated planning, action and compliance monitoring, most of the sectoral agencies/ Departments in HRML operate in deeply segregated compartments with limited interaction among each other. At a fundamental level, this inability of resource users to move out of 'sectoral comfort zones' and 'mutually exclusive growth paradigms', is one of the crucial barriers to the long term sustainable development of HRML. For instance, conservation of natural resources is almost exclusively perceived as a domain of the Forest Department whereas substantial part of the biological resources lies in areas outside their control and in production areas.

142. At present, the focus of conservaton management in the project landscape consists of PAs. However, large swathe of high value biodiversity areas are lying outside the premises of PAs where production sectors such as tea, cardamom and tourism also operate and interact significantly. As a result, the PA system alone cannot sufficiently address threats to biodiversity posed by the development in the economic production sectors– both spatially and in terms of management jurisdiction. Even in the conservation sector, a related impediment is that funding for existing conservation initiatives are inadequate to cover all management costs. There are sizeable fiscal deficits for undertaking large-scale eco-restoration programmes including invasive species management. While the situation is slightly better off in PAs, it is acute in the case of areas lying outside the PA system. In addition, several HVBAs that are outside the PA system have weak governance arrangements to secure biodiversity both within these areas and to also preserve connectivity between different PAs. There is an urgent unmet need to consolidate such key HVBAs and forest fragments to secure vital corridors and ecological niches in the landscape.

143. In the project landscape, capacities and prospects of conservation sector (anchored largely by the Forest Department) indicate a mixed scenario with strong programmatic baselines in a few areas and weak baselines in some other. On a positive note, for instance, the Forest Department has already notified several high priority conservation zones as PAs and has also endeavored community mobilization for participatory resource management (e.g. JFMCs); though with varying results. Similarly, the PAs in the landscape are managed under Management Plans (with exclusive focus on conservation) and other Forest Divisions under Forest Working Plans (with management objectives varying between commercial and conservation considerations). However, the current capacities of conservation sector are constrained by a horde of factors - limited orientation to deal with issues like community oriented resource management, human-animal conflict, climate change, invasive species, high attrition rate among the newly recruited field staff etc. Overall, the enormity and complexity of challenges confronting the project landscape surpass the existing stakeholder capacities of the conservation sector and require significant scaling up.

144. In addition to strengthening PA management, addressing threats to biodiversity in such a setting requires implementation of a landscape approach that considers among others allocation of land to different land uses according to biodiversity conservation needs and application of appropriate management practices congruent with biodiversity conservation in production areas. There is however limited practical experience with such a system of moving away from site / sector based management approach to a landscape based one. In addition there is a need to put in place monitoring and enforcement mechanisms that ensure that sector strategies are in line with the landscape level planning priorities and as agreed for each sector. Further, there is a need to integrate biodiversity conservation principles into production sector practices to reduce pressures on biodiversity. Incentives and "niche markets" also need to be designed and implemented to move production practices from currently unsustainable (harmful) practices to sustainable (biodiversity-friendly) practices. However, even when there

is appetite for green interventions, there is lack of adequate finances or where it is available, not channelized properly. Sometimes the cost of new technology is high with inadequate data on return on investment thus creating barriers for financial decision making for acquiring new technology. Further, there are also cultural barriers in adopting new technology (e.g. lemon grass distillation in tribal settlements) even when alternate and seemingly feasible technological options available. Knowledge and capacity constraints also limit production sectors from pursuing alternate ecologically benign options

145. Routine interventions/ investments from the government have been clearly unable to build sufficient capacities to develop business models based on sustainable use of natural resources. This is especially true of collection and marketing of NTFPs. Markets for commodities from the primary sector do not differentiate between produce that is sustainably harvested and produce that is not. Such markets do not send positive signals to those involved in sustainable management of natural resources (e.g. failure of organic farming models both in corporate and individual farms). This inability coupled with limited alternative livelihood options and insufficient support provided to local communities engaged in conservation and management of natural resources has led to poor implementation of conservation policies at the grassroots.

Barrier 3: Community level barriers constrain the adoption of biodiversity conservation objectives in community-level land and resource use decisions:

146. There are various barriers that encumber communities from adopting sound land-use practices and sustainable resource-based livelihoods in HRML. One of the prominent challenges is the disintegration of the traditional knowledge base and customary resource-use practices due to market forces and the changing aspirations of local communities. At present, community level land use and natural resource planning and management in HRML is undertaken mostly through a) Panchayats; and b) JFMCs. However, in view of the increasingly diminishing resource base and competing land use assertions, capacities of these institutions are insufficient to ensure sustainable utilization. For instance, communities harvest a number of wild resources—poles, lianas, NTFPs, fuel wood, reeds, medicinal plants, and wild fruits amongst others. This is critical for their subsistence (nutrition) and overall welfare. However, in many cases off-takes are higher than the amount that can be sustained, and production practices may be deleterious. For instance the practice of collecting honey by indiscriminate use of fire damages entire bee colonies and cause forest fire.

147. Community-based institutions provide a strong programmatic baseline for mobilizing communities for sustainable natural resource management. But often, limited management capacity and narrow representation hamper mobilization of broad-based support from villagers. In addition, lack of access to technology and knowledge limit their ability to take effective action. The level of participatory decision making in most communities regarding the use of natural resources is inadequate and negatively affects their ability to serve as an effective forum for community feedback on land-use issues and conflict resolution. Further, such institutions lack the economic and financial incentives to switch from short-term resource exploitation to long-term stewardship. Community-based natural resource management models are also threatened by insecure and unclear land tenure and disintegrating traditional knowledge systems. The changing perception of local communities towards human-wildlife conflict compound the problem.

148. The capacity of Panchayats, JFMCs and other community organizations to jointly plan and manage resource use to ensure sustainability are currently limited. In community level decision making, sustainable use thresholds are not always established, management measures poorly designed, compliance monitoring systems non-existent and impacts are poorly monitored. For instance, some of the activities undertaken under the MGNREGA programme are found inimical to conservation objectives and needs course corrections (e.g. clearance of vegetal cover along roads and stream banks). Moreover, more attention needs to be given to addressing conflicts between user groups, and strengthening internal

representation and governance within the management committees of these community institutions. There is a need to reorient baseline investments to support value addition and certification for sustainably produced resources at community level, and make catalytic investment in resource based livelihoods. There is a need to focus efforts in the predominantly tribal hamlets where wild resource use is crucial to the local economy (e.g. Edamalakudy). Further, the opportunity provided by the Forest Rights Act, 2006 for sustainable resource use has not made much headway in HRML.

E. Stakeholder Analysis

149. There is a multitude of stakeholders for the project ranging from central and state governments, sectoral agencies/ departments, private entrepreneurs, community organizations, and local communities. As the project is focusing on resource use over a fairly larger landscape, key stakeholders, stakeholder interests, priorities and capacities vary vastly. Broadly, stakeholder affinities in HRML revolve around aspects of exclusive conservation, participatory resource management, sustainable use, ecosystem based enterprises, resource apportions and appropriations, commercial considerations and access to markets. Climate change, decentralized planning, empowering the disadvantaged and balancing gender are cross-cutting interests.

150. In terms of government representatives, the Kerala Forest Department (KFD) is the key stakeholder (the principal anchor of the project) given its mandate for forest protection and biodiversity conservation. The main functions of KFD are to: a) conserve and expand the natural forests; b) increase the productivity of forest plantations through appropriate management interventions and modern technology; c) increase the tree cover both inside and outside the forests; d) meet the livelihood needs of tribals and other forest dependent communities; and e) sustainably manage biodiversity-rich and sensitive ecosystems such as mangroves, sacred groves, coastal areas, wetlands, homesteads, private plantations etc. that are outside the control of the Forest Department.[131] One of the main aims of the project is to capacitate KFD to deal with the existing and emerging threats in HRML.

151. Agriculture Department is another important entity as large area of the project landscape is under agriculture land use. Other government agencies that are important stakeholders include the Tourism, Revenue and Local Self Government (LSG) Departments who facilitate tourism, administration of revenue land and local bodies respectively. Animal Husbandry Department provides veterinary care and supports improving the production potential of livestock and poultry. The Fisheries Department is a stakeholder as they support inland fisheries. The Public Works Department has a role as infrastructure development have direct bearing on the landscape. Department of Science, Technology & Environment has prominent role on matters related to environment while Pollution Control and Biodiversity Boards are mandated to implement Environment Protection Act and Biological Diversity Act respectively. The Electricity Board is a major entity in the landscape and deal with dams and reservoirs.

152. At the field level, District administration is an important stakeholder and is headed by the District Collector and includes functionaries responsible for different aspects of governance. Of relevance to this project are officials responsible for administration (Revenue Divisional Officer), district planning (District Planning Officer), fisheries (Assistant Director of Fisheries), agriculture (Deputy Director, Agriculture), livestock (District Animal Husbandry Officer), tribal development (Project Officer, Integrated Tribal Development Programme), tourism (District Tourism Promotion Council). At the Divisional level, forest and wildlife units are headed by Deputy Conservator of Forests/ Assistant Conservator of Forests.

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[131] Available from http://keralaforest.gov.in/ Accessed on February 8, 2013

153. Local government institutions such as Gramsabhas and other PRIs are important stakeholders as they operate at the grassroots and decisively influence the land use in the project landscape and extensively interact with local communities. The key stakeholder group for the project is the local community who are highly vulnerable to resource depletion due to their dependency on natural resources. The primary entry-point for engaging communities in the project will be Community Based Organizations (CBOs) such as *Kudumbashree*, JFMCs, VSSs, EDCs, CRC, FDAs, BMCs and SHGs.

154. Private sector is another important stakeholder and partner for the project as they have tenuous dependence on natural resources and sustainable use is vital for their own existence in the long-run. Right at an early stage, the project will develop collaboration and promote proactive engagement with the private sector. Partnerships can be built with institutions like United Planters Association of South India (UPASI-plantation sector), Kerala Travel Mart and tour operators (tourism sector), cardamom growers and Kannan Devan Plantation Ltd. for imparting biodiversity and sustainability concerns into their production practices. Linkages can also be established with entrepreneurs willing to invest in green technologies like renewable energy, waste management, organic value added products etc.

155. Research Institutions – national, regional and local, need to be involved in the project for research, innovation, education and implementation. Wildlife Institute of India, National Centre for Biological Sciences, College of Forestry, Kerala Agriculture University, Indian Cardamom Research Institute, Kerala Forest Research Institute, School of Social Sciences, Mahatma Gandhi University, Centre for Earth Science Studies (CESS), IMG, Periyar Foundation, Institute of Management in Government (IMG) and Kerala Institute of Travel and Tourism Studies (KITTS) are institutions of excellence in research and capacity building relevant to the project. Kerala Institute of Local Administration (KILA) is an important institution for strengthening capacity of the Panchayats. The project will develop a network of these organizations for mobilizing knowledge, technology and expertise for various project activities.

156. NGOs like High Range Environment and Wildlife Preservation Association (HRWEPA), World Wide Fund for Nature (WWF), Wildlife Trust of India (WTI), Nature Conservation Foundation (NCF), Hornbill Foundation, Vattakanal Conservation Trust, Gurukula Botanical Garden etc. have important stakeholder roles in promoting awareness on conservation and sustainable resource use. Representatives from political class and audio-visual and print media are important partners in highlighting the need to mainstream biodiversity conservation and also project achievements during its implementation. .

157. Stakeholders at the national level bring requisite information, knowledge, skills and practices relevant for the project. As mentioned above, MoEF is the central Ministry for planning, promoting, coordinating and overseeing implementation of India's environmental, forestry, land degradation, climate change related policies and programmes. Other union ministries who will be important stakeholders of the project are the Ministry of Agriculture (National Agricultural Policy, 2000); Ministry of Rural Development and Land Resources (Mahatma Gandhi National Rural Employment Guarantee Act, 2005 (MGNREGA); Ministry of Tribal Affairs (Schedule Tribes and other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006*);* the Ministry of Panchayati Raj (issues related to PRIs*);* Ministry of Power, Ministry of New and Renewable Energy (issues related to energy conservation and energy efficiency), Ministry of commerce (Commodity Boards of tea, cardamom and rubber) and the Ministry of Tourism (National Tourism Policy, 2002). The project will link with the programmes of these Ministries and seek and leverage collateral support, and also promote upstream policy engagement for mainstreaming environmental considerations into their sectoral operations for deriving local/global environment benefits.

158. For over a decade, UNDP India has been leveraging funds from GEF for the national government for fortifying its biodiversity conservation programmes. The landscape approach (adopted in this project) is already being piloted in two ongoing GEF funded UNDP managed

projects (*India: Coastal and Marine Programme*) and links have been made with MoEF for facilitating actions with other Union Ministries and State Governments for allocating resources for scaling up, and solving issues around policy on replication and mainstreaming. The present project intends to upscale the reach and scope of these interventions and initiatives. Annexure 14 provides a more detailed analysis of stakeholders and their role in the project.

II: Strategy

A. Project Rationale, Policy Conformity and Design Principles

Rationale:

159. The project will conserve globally significant biological diversity in the High Ranges of the Western Ghats. It will put in place a cross-sectoral land-use management framework, compliance monitoring and enforcement system to ensure that development in production sectors such as tea, cardamom and tourism is congruent with biodiversity conservation needs. The project will seek to establish a conservation compatible mosaic of land uses, anchored in a cluster of protected areas, managed to protect wildlife refugia and corridor areas on production lands. It will catalyze a shift from the current sector-focused land use planning system, which is deficient because it does not account for the adverse cumulative direct and indirect impacts of different production activities across economic sectors on biodiversity. Unless tackled, this situation is likely to lead to the loss of globally significant biodiversity in a key biodiversity area. Furthermore, the land use management system will seek to avoid, reduce and mitigate the impacts of physical infrastructure in biodiversity rich areas. In this regard, it will ensure that the indirect impacts of development are taken into account in decision making. In parallel, the project will seek to engineer a paradigm shift towards sustainable use of wild resources by local communities, where such use is currently unsustainable or is projected to become so as a result of changes in population and consumption.

160. In taking a landscape approach to conservation—the project will work both within and outside of protected areas. It is designed to realize GEF Biodiversity Focal Area Strategic Objective One: *Improve sustainability of Protected Area (PA) systems* by seeking to expand coverage (by 11,650 ha) and strengthen the management effectiveness of a cluster of PAs (37,100 ha). The project is developing a new paradigm for the management of mountain landscapes, building on existing PAs. In doing so it will reduce pressures on PAs and establish a replicable model that will improve the security of other PAs in mountain areas. It will also improve conservation and management of forest fragments and other High Value Biodiversity Areas (HVBAs) in around 84,600 ha of adjacent production lands, thus advancing Biodiversity Strategic Objective Two: *Mainstream biodiversity, conservation and sustainable use into production landscapes, seascapes and sectors*. The foci production activities include tea and cardamom estates, forest plantations, private tree plantations, homestead agro-forestry, tourism, and urban and peri-urban development. These production lands provide habitats vital to the survival of threatened wide ranging fauna, including tiger, leopard, wild dogs and elephants amongst others.

Project conformity:

161. This project is consistent with the Convention on Biological Diversity (CBD) and its guidance from the Conference of Parties. The project is designed to support the primary objectives of the CBD - conservation of biological diversity, sustainable use of its components and the equitable sharing of the benefits arising out of the utilization of these components. By mainstreaming biodiversity conservation with production sectors and

sustainable livelihoods, the project will fulfill the requirements of Article 6: General measures for Conservation and Sustainable use. Article 8: In-situ conservation will be supported through the strengthening of park management and the targeted species and habitat management, research and monitoring programme. Article 10: Sustainable use of components of biological diversity will be furthered through development and demonstration of alternative, sustainable livelihood options that avoid or minimize adverse impacts on biological diversity. The project also supports Article 12: Research on targeted priority issues related to biodiversity of HRML and provide training in technical and managerial areas and linking exchange of information. Article 13 which stresses education and awareness will also be a key component in the project.

162. The 10th Conference of the Parties (COP) to the CBD emphasized the need for a balanced approach to the programme of work on mountain biodiversity, as contained in COP 10 Decision X/30. It invited the Governments and parties to (a) enhance the effectiveness of management in existing mountain protected areas; (b) establish effectively and appropriately managed protected areas in line with the programme of work on protected areas to safeguard the highest priority key biodiversity areas in mountain ecosystems; (c) establish, *inter alia*, conservation corridors and connectivity, where appropriate and possible and taking into account in particular, endemic species, while avoiding the spread of invasive alien species, and trans-boundary mountain protected area systems, taking into account the need to integrate protected areas into wider landscapes. Further, it invited parties and other Governments to consider the development and implementation of national and regional targets, as well as the development of the related indicators for assessing progress towards these targets, within their respective national biodiversity strategies and action plans, taking into account the Strategic Plan for Biodiversity 2011-2020, which addresses the direct drivers of biodiversity loss, including mountain biological diversity, in an effort to reduce the pressures on biodiversity from habitat change, overexploitation, pollution, invasive alien species and climate change, and to safeguard and restore mountain biological diversity and related ecosystem services, given their potential to contribute to climate change mitigation and adaptation. The project also aligns with the relevant provisions of CBD including 'Aichi targets i.e., *Strategic goal C- To improve the status of biodiversity by safeguarding ecosystem, species and genetic diversity. Target 11- Trends in the connectivity of PAs and other area based approaches integrated into landscapes and seascapes.* Over all, the project is in line with the above mentioned decisions of CBD COP and shall further strengthen the national efforts on the conservation of mountain biodiversity.

Design principles:

163. Taking into account the need to balance conservation, consumption, livelihoods and development aspirations and to utilize potential synergies and minimize negative trade-offs among baseline projects and multiple stakeholders, the project design underlines the following basic premises which is a composite of strategic planning, facilitation, regulation, market mechanisms and compliance measures.

164. Premise 1: The project adopts a **'landscape approach'** to resource governance as against the 'exclusive protected area centric approach'. As the project landscape is a complex admixture of conservation and production systems, such an approach alone can effectively address the multi-dimensional nature of resource use challenges in the project area. As a result, the landscape is taken as the basic unit of resource governance and focus of the project. The underpinning objective here is to maintain the ecological integrity of the whole of HRML and its constituent parts. In this approach, the PAs will continue to be the 'territorial core' for the conservation strategy. However, the intervening land uses between existing PAs (HVBAs and commercial production systems) will be harmonized to: a) reduce negative impacts and maximize positives on biodiversity; b) ensure continuity in the landscape for sustaining vital ecological processes such as hydrological functions, climate amelioration, provisioning of ecosystem goods, gene flow etc.

165. Premise 2: The project promotes a **cross-sectoral approach**[132] in resource planning and use-execution as against the existing sectoral approaches. The aim is to convene all relevant sectors and stakeholders for taking informed land use decisions. The finer intent here is also to push the conservation agenda beyond the frontiers of conservation sector by mainstreaming biodiversity considerations into the livelihoods and other commercial production sectors. Such an approach will help gather knowledge and experience of different sectors and actors (government departments, public and private sectors, civil society, academia, community based and non-governmental organizations etc.) to reconcile diverse and often opposite stakeholder interests and necessities. Given the need to break down barriers between sectors and disciplines, the project focuses on building a cross-sectoral institutional mechanism to: a) appreciate the consequences of the degradation of natural resources in HRML; b) share knowledge and forge partnerships across sectors; c) develop a common planning framework for the management of biological resources; d) promote the development and adoption of locally-appropriate, community-based livelihoods that accentuate positive dependence on natural resources; and e) involve the productive sectors in actions to protect natural resources. Nonetheless, the cross-sectoral approach promoted by the project does not envisage doing away with sectoral institutions or duplicating sectoral efforts. While the cross-sectoral approach aims at better coordination of land-use decisions across administrative boundaries/ sectors within the landscape, it is realistically premised that individual sectors will continue to perform their sectoral mandates - largely the production maximization goals. This project will work closely with key production sectors in HRML to factor in biodiversity considerations more explicitly that will facilitate an eventual shift towards production optimization objectives.

166. Premise 3: The project will also embrace an **'adaptive management approach'** for addressing threats to biological diversity and associated challenges. This approach is necessitated due to the dynamic nature of challenges as a result of the complex interplay of ecological, demographical, market related, technological and economic factors in the landscape. To offer 'ready-mix' solutions to address all such challenges (as many may emerge in future too) are neither feasible nor desirable at this stage. Hence, the project will encourage a culture of adaptive management (like 'building the ship while sailing') among sectoral and cross-sectoral processes to address such emerging and futuristic challenges. Towards this object, the project will also promote developing/ updating programmatic baselines on science-policy-practice interphase on resource use particularly in understanding biodiversity and ecosystem services, as well as the social, economic and political factors that contribute to their existence. This will lead to identification of appropriate technical, policy, legislative and institutional interventions required to overcome the barriers and to promote conservation and sustainable use of biodiversity. This approach will help in: (i) building a common diagnosis and shared vision; (ii) sharing information about past, on-going and planned development interventions; (iii) better coordinating and harmonizing existing interventions and investments; (iv) improving the design and alignment of future projects and programmes; and (v) identifying and addressing key barriers and bottlenecks to scale up mainstreaming approaches.

167. Premise 4: The project design supports a **'demonstration approach'** as principal entry points of engagement with stakeholders. Considering the vastness of the project landscape, varied nature of challenges and the limited resources with the project, it would be unrealistic to attempt *en masse* coverage of all individual stakeholders or activities. Hence for the rational use of scarce resources, it is envisioned to channel the project resources to select biodiversity-friendly practices as 'demonstration packages' (e.g. thermal energy efficiency interventions in tea, cardamom and lemon grass distillation; garbage disposal in Munnar town; modernization of enforcement machinery in sandal forests; invasive species management; ecosystem monitoring plots; biodiversity-friendly farming practice plots;

[132] This approach is in consistent with the other programmes employing landscape approach to conservation (e.g. India Coastal and Marine Programme)

branding and premium marketing mechanism in tea, cardamom and tourism sectors etc.). It is surmised that once such good practices are successfully demonstrated, with constant advocacy and stimulating appropriate policy and programme interventions (in the baseline projects), there will be wider uptake for such good practice packages by sectoral agencies and individuals.

168. Premise 5: The project will also facilitate a **'proactive engagement approach'** to mainstream biodiversity and create champions for biodiversity in the production sector. This is vital because getting production sectors to factor in biodiversity considerations into their operations is going to require a significant change in thinking and practice. It is partly about giving the appropriate 'push' by enshrining this thinking in the legal and policy framework, but it is equally about drawing the sectors into discussion, bringing individual actors to the table, changing mind-sets, providing training and tools, and providing technical and financial 'hand-holding' to demonstrate the new paradigm, and absorbing some of the perceived risks in changing current practices. Even this requires substantial efforts and a two-step process would be needed. Step 1 is to begin a concrete dialogue with stakeholders, and step 2 is to home in on specific changes in current practices.[133] During consultations it was felt that doing the latter without the former would antagonize the key production sector stakeholders and the project would be yet another conservation sector-led initiative that fails to obtain ownership from the production sectors. The PPG was successful in opening up lines of communication at the national and state-level and the time and resources were used to collect more background information for the project strategy, forge working relationships with key stakeholders, and get buy-in for the project strategy. This will be continued during the project implementation.

169. Premise 6: The project will promote a **'climate proofing approach'** to interventions. Climate change heightens the existing vulnerabilities (social, ecological, economic and cultural) of HRML. Climate related risks are only likely to go up in future and if not addressed, climate change can negate and hamper the developmental gains of HRML. In view of the above, the climate response strategy for HRML may include elements such as accelerating promoting sustainable development, inclusive growth, securing livelihoods and safeguarding ecosystem services. However, this strategy is not a stand-alone action; instead it is has to be integrated into the regular developmental planning (sectoral and community level). Similarly, considering the overall socio-economic and ecological contexts of HRML, adaptation options are given priority in this project design. However, most of the interventions proposed in the project will also have automatic mitigation benefits and result in GHG emission reduction (e.g. energy efficiency options in tea and cardamom sector etc.). Moreover, the project will strive to imbibe and incorporate the objectives and strategies contained in India's Green India Mission from time to time.

B. PROJECT GOAL, OBJECTIVE, OUTCOMES AND OUTPUTS/ACTIVITIES

170. The long-term goal to which the project will contribute is the sustainable governance of globally significant biological diversity of India by mainstreaming conservation considerations into production activities in the mountain landscapes, while also taking into account development imperatives, need for sustaining livelihoods and also addressing retrogressive factors including impacts of climate change. The immediate objective of the project is to conserve the biodiversity of High Ranges of the Western Ghats in peninsular India from existing and emerging threats through building an effective collaborative governance framework for multiple use management of mountain landscapes. The above-said project approach will be achieved through the following Outcomes and associated Outputs.

Outcome 1: Effective governance framework for multiple-use mountain landscape management in place.

Outcome 2: Multiple use mountain landscape management is applied securing the ecological integrity of HRML

[133] This approach is in line with the UNDP India Coastal and Marine programme

Outcome 3. Strengthened capacities for community based sustainable use and management of wild resources

Outcome 1: Effective governance framework for multiple-use mountain landscape management in place

171. This Outcome will put in place a cross-sectoral land-use management framework, compliance monitoring and enforcement system to ensure that developments in economic production sectors are congruent with biodiversity conservation needs. To begin with, it will help in improving the knowledge base and decision support systems for managing multiple-use mountain landscapes. This will be followed by the formulation of a Landscape Level Land Use Plan and other Environmental/ Biodiversity Friendly Sector Plans. These plans cumulatively shall seek to balance biodiversity needs and production objectives by: a) improving the management of existing PAs; b) identifying areas of high value biodiversity to be afforded higher protection status; and c) prescribe appropriate land uses and management practices in the adjacent production landscape. Further, this component will enable evolution of a dedicated multi-sector landscape level institutional platform for ensuring sectoral compliance with Landscape and Sector Plan prescriptions. Finally, this Outcome shall also develop a replication strategy for piloting similar governance approaches in other mountainous areas of the country including upstream policy engagements for harmonizing various legal and policy framework related to the management of mountain landscapes. The above said objectives are planned under the following Outputs:

Output 1.1: Strengthened knowledge generation and dissemination system improves decision making related to sustainable land and resource use

172. Availability and access to appropriate user-friendly knowledge base and robust scientific baseline is a pre-requisite for putting in place an improved decision support system for multiple-use mountain landscape management. This Output shall support strengthening the knowledge base on HRML particularly the 'science-policy-practice' interphase that will provide guidance for taking informed decisions related to land and resource use. The main focus would be to spawn information that empower the programme planners and implementers to meritoriously appreciate the environmental impacts of sectoral interventions (both conservation and production) with a view to analyze trade-offs while making choices about the use of natural resources and minimise adverse impacts of development in biodiversity rich areas and reduce/ mitigate impacts in other localities.

173. Primarily, this Output will provide support for several diagnostic studies that will help fill up the gaps related to knowledge base in HRML. It is envisioned that a detailed knowledge gap analysis will be carried out right at the early stages of the project involving all relevant stakeholders and sectoral agencies. This analysis will cover not only the conservation sector but would also include livelihood and other economic production sectors that have a bearing on the biodiversity of HRML. This process will help: a) collect, collate and synthesize the existing knowledge base (both formal and traditional); b) flag the knowledge gaps; and c) develop a strategy for research prioritization. Using an integrated and targeted approach, the focal areas of such diagnostic studies, would encompass biological wealth, ecological processes, sustainable use and livelihoods, innovative technological interventions, human-ecology, and economics and market mechanisms for enterprises based on natural resources.

174. A multi-pronged approach is required to conduct such diagnostic studies. This Output will provide support to undertake comprehensive and detailed assessment and inventory of biological resources of HRML. In the conservation sector, while there exists fairly adequate knowledge on flagship species (e.g. Nilgiri tahr, tiger etc.), information on less charismatic and lesser known life-forms (e.g amphibians) are clearly lacking. Further, information on larger ecological processes including ecosystem networking and functionality needs to be built up substantially. Similarly, while some PAs have been relatively well inventoried (e.g.

Thattekkad Wildlife Sanctuary for avifauna), such an exercise needs to be completed in other PAs. HRML is also known for 'discoveries and rediscoveries' of species. More detailed and in-depth efforts are required to understand and unearth the whole range of biological richness of the project landscape. Promisingly, HRML has high potential to add new species to science, if detailed and exhaustive biological investigations are undertaken.

175. It is also proposed to survey and inventorize the HVBAs under the control of Forest Department (in the territorial Divisions of Malayattoor, Kottayam, Marayur, Mankulam and Munnar) and also with Revenue Department (e.g. Manthan shola). Further, HVBAs lying in areas outside government control (particularly interspersed areas of tea gardens), needs knowledge generation 'from scratch' and the diagnostic studies may begin with documentation of HVBAs/ fragments (extent, number and location), biological richness, range of ecosystem services provided, magnitude of livelihoods supported, threat perception etc. Similarly, this Output will also support consolidating the traditional knowledge particularly the ethno-botanical knowledge and traditional ecosystem management methods available with tribal communities. Of great interest in this regard would be to understand and explore the possibilities of codifying and adapting the indigenous fire management techniques employed by Muthuvan tribes in managing the highly threatened montane grassland ecosystems of HRML.

176. Knowledge gaps need to be plugged in key production sectors too. For instance, the long-term impacts and challenges of intensive agronomic practices (e.g. excessive use of chemical fertilizers and pesticides) in tea and cardamom sectors, canopy opening in CHR, market dynamics in tea, cardamom, reed and NTFP sectors etc. need to be understood in detail and translated for local guidance for land use planning. Further, the feasibility of adopting emerging technological options for thermal energy conservation (e.g. energy efficiency options in tea curing, cardamom processing and lemon grass distillation) need to be studied with focus on its impacts on local ecology, improving the economic viability of production sectors, cultural sensitivity etc. Similarly, the tourism sector will require guidance on carrying capacity assessments for planning responsible tourism while reed industry needs a comprehensive assessement of sustianable use practices and its long term prospects including innovations at value addition and end-user markets to spur new demands and markets for reed based products. Another critical knowledge gap that needs to be plugged is the vulnerability of HRML to climate change particulalry its impacts on the proliferation of invasive species, man-animal conflicts, ecosystem alterations, resource availability and the socio-cultural fabric of the region. Diagnostic studies are also required for understanding the linkage between eucalyptus cultivation and water scarcity in the drier tracts of the landscape. This Output will suppport establishing long-term institional arrangements for the periodic monitoring of natural resources including participatory resource monitoring systems (e.g. similar to ecosystem monitoring by Kadar tribes in the neighboring Vazhachal Forest Division).

177. The PPG phase has identified several themes for conducting priority diagnostic studies (see Annexure 15 for details) and these include: 1) impacts of climate change (short, medium and long-term) on HRML – at species and ecosystem levels, on local livelihoods, production sector practices etc. 2) economic valuation of ecosystem services (e.g. hydrology, pollination services, atmospheric stability, NTFPs, etc.) and opportunity costs of externalities of deforestation and forest degradation. Two case study areas are proposed for this: a) Mankulam Division (a high biodiversity forest enclave); and b) Mathikettan National Park; 3) feasibility of adopting GIS mapping tools to inform physical development and placement of infrastructure across the landscape; 4) assessing carrying capacity of tourism sector including aspects on distribution of benefits and costs – social, economic and ecological; 5) hill area studies that throw light on the socio-cultural attributes of HRML; 6) collation and codification of existing good resource governance practices (e.g. traditional ecosystem management and ethno-botanical practices by tribal communities, reed collection etc.); 7) base line studies of lower life-forms (e.g. amphibians, balsam etc.); 8) detailed mapping and inventory of ecological resources, ecosystem types (scale and extent of fragmented *sholas*, swamps, rocky

outcrops, isolated biodiversity rich areas, corridors etc.) and resource use patterns; and 9) feasibility studies on perception management for sustainable resource use management (e.g. on ecologically sound conservation practices, dealing with human-animal conflict etc.).

178. This Output will also support developing effective knowledge dissemination system for synthesizing research knowledge into user-friendly formats for easy application by field practitioners and policy makers. The *modus operandi* for knowledge dissemination shall include online methods (e.g. expert referrals, expertise profiles and databases, electronic discussion forums, document repository, data warehousing, intranets and search engine), guidance materials, handbooks for sector staff and panchayat members, training manuals, media workshops, advocacy campaigns, and other outreach programmes. The knowledge products developed under the Output will increase awareness within the public and private sector on the economic and social values of ecosystems and on win-win opportunities for balancing conservation and economic development. Coordination across other similar projects adopting landscape approach (e.g. the GEF-UNDP: India coastal and marine programme) will help ensure a joint database, and joint outreach and communication activities (through MoEF). Research and technical institutions in both the public and private sectors will be engaged in these research efforts. Findings will be converted into various formats (such as print, audio and video documentation) and will be developed for different audiences. Materials will also be translated into vernacular languages.

179. The primary approach for knowledge generation and dissemination under this Output would be to make use of the expertise available with local research institutions such as Periyar Foundation, KFRI, UPASI, NCBS, HRWEPA, R&D wing of KDHP, KILA, IMG, School of Social Sciences, Mahatma Gandhi University, Kottayam etc and institutions of national repute such as Botanical Survey of India (BSI), Zoological Survey of India (ZSI) and Wildlife Institute of India (WII). Further, the project will support research scholars/ students from local colleges and universities for research studies of mutual interest. Apart from producing research outputs, the idea is also to build and retain capacities for knowledge generation and dissemination at the landscape level itself. This Output will also feed into necessary points of engagement with central government (MoEF) in developing replication strategies for piloting similar approaches in other regions in the country (see Output 1.5 for more on replication strategies).

Output 1.2 Landscape level land- use plan prepared and sustainable resource management systems in place

180. As already mentioned, HRML requires an integrated and cross-sectoral spatial planning process central to resource governance that balances the imperatives of conservation, economic production and livelihoods. This will provide opportunities for sectoral agencies to set common goals, engage in dialogues and manage trade-offs for resource use without engendering the efforts of other sectors and its own in the long run. Further, such a landscape-level planning in HRML will also prevent some threats to biodiversity before they actually manifest or locate them in a manner that minimizes their adversarial impact or give enough 'reaction time' to find ways and means to mitigate them appropriately.

181. To begin with, this Output will support the formulation of a Landscape Level Land Use Plan (henceforth referred to as the Landscape Plan or LP). This plan shall seek to balance the objectives of biodiversity conservation, livelihoods and economic production. The Landscape Plan will provide a broad strategic vision for mainstreaming biodiversity conservation in the various land uses of HRML. The Landscape Plan that will be developed for a longer time frame (e.g. 10 to 25 years) will look at current land use in the project area and will provide a basis for how existing practices of different sectors can be made more compatible with the conservation needs of HRML. Each major sector will form an integral part of the LP that will also give opportunity for stitching together/ aligning the multiple legal, policy and programme frameworks for the cogent use of resources of HRML. The LP

will provide a road map for streamlining land use thus avoiding, reducing and/ or mitigating impacts from physical development in major production sectors. The objective is to make the optimal allocation of natural resources to different uses based on ecological carrying capacity and socio-economic needs over the long-term. A major objective of the Landscape Plan would be to minimize the adverse impacts of production sectors on HRML including sectors that are currently having a major bearing on biodiversity (tea, cardamom), those that are a growing concern (tourism), those that have a medium impact (forest plantations, reed industry etc.), and those sectors that have a lesser impact at present but a precautionary approach is still warranted (agriculture/ horticulture, animal husbandry etc.).

182. Broadly, the Landscape Plan will give guidance on: a) improving the management effectiveness of existing PAs; b) identifying biodiversity rich areas to be accorded higher protection status; c) prescribe appropriate land uses and management practices in the adjacent production landscape; d) support interventions that require co-existence and sustainable resource use; and e) improved market opportunities for sustainable production systems and practices. For prioritizing the land use, the denominating criteria would be: 1) ecological priorities (e.g. ecosystem goods and services); b) economic imperatives; c) cultural attributes; d) trajectory of development; e) threats and limiting factors (waste, water, other resources, climate change); f) market dynamics; g) inclusion of marginalized communities; and h) sustainable use etc.

183. Landscape Plan would also enshrine a mix of approaches such as re-alignment of existing government budgetary resources, instituting/ re-allocating/ recycling user fees generated within the conservation (e.g. entry fees to PAs) and production (promoting Corporate Social/ Environmental Responsibility) sectors to augment the conservation prospects of the resource base on which these sectors depend. Besides, the Landscape Plan will explore opportunities for mobilizing new resources (e.g. Panchayats collecting service cess from tourists visiting the landscape) to mainstream biodiversity conservation considerations in the region. The Landscape Plan would also strategically align (incorporating elements/ influencing these) with other development plans like Idukki (M.S. Swaminathan) Package, Working Plans, Tourism Plan, Panchayat Plans, District Development Plans, Private Sector Plans etc.

184. The Landscape Plan will be a dynamic document that needs to be updated periodically in tune with the changes occurring in the landscape. The LP will also draw heavily from the outcomes of diagnostic studies and will incorporate lessons from national and international "best management practices" on environmental mainstreaming for minimizing adverse impacts of production practices on biodiversity. Towards this end, this Output will support the preparation of a "Compendium of best practices (national and international) in mainstreaming mountain biodiversity in production sectors". Based on this analysis, the most ecologically feasible, economically viable and socially acceptable measures will be identified. A time line for implementation of these measures as well as a financial strategy will also be indicated in the LP. The financial strategy could clearly include harmonizing/ re-directing of existing sectoral budgetary resources, and/ or mobilizing new resources.

185. The preparation of the LP will be anchored within the proposed High Range Sustainable Development Society (HRSDS) (to be established as part of Output 1.4). The technical backstopping for the preparation of the Plan will be through a multi-disciplinary team of experts on land-use, geology, GIS, conservation biology, forestry, social sciences, economics, developmental studies, governance issues, urban and country planning, legal issues etc. Landscape Plan will be prepared based on extensive consultations with government, research institutions and local communities so that a pragmatic and effective conservation strategy is prepared. Particular emphasis will be placed on strategies that do not compromise local livelihoods and economic production but rather support the rights of traditional communities and other sustainable production and consumption practices in the region. The Landscape Plan will be more 'enabling' rather than 'restrictive' in nature with

clear short and long-term goals for the landscape. After obtaining the concurrence of the HRSDS, the Plan shall finally be placed before the State Government for its approval.

Output 1.3 Biodiversity considerations are mainstreamed into sector plans and practices

186. Under the umbrella of the Landscape Plan, conservation sector and key production sectors (e.g. tea, cardamom, tourism etc.) will develop/ revise Sector Plans (SPs) that outline sector-specific biodiversity-friendly practices for integration into respective sectoral operations. The SPs individually as well as collectively shall contribute towards the overarching principles entailed in the Landscape Plan. Identification of economically viable, cost effective, technologically feasible and pragmatic solutions shall be the key to the success of the Sector Plans.

187. Conservation sector will adopt the following strategies towards this: 1) Management Plans for PAs will be revisited for addressing new and emerging threats in the landscape (e.g. invasive species, climate change, regional developmental issues etc.); 2) Working Plans for territorial Forest Divisions will dovetail/ strengthen biodiversity-friendly practices (including in commercial forestry) on a landscape perspective; and 3) Biodiversity Conservation Plans (BCPs) shall be prepared for HVBAs and if these are already in existence shall be strengthened on the lines of Management/ Working Plans as mentioned above. The commercial forestry operations (both government and private) on the landscape need to incorporate guidance on good practices - an activity to be supported under this Output.

188. Though all the PAs in HRML have operational Management Plans, in the context of new and emerging challenges to PAs management, these plans need to be revisited from a landscape perspective. Towards this objective, this Output will invest in strengthening the PA management planning process. In order to capture the specificities of HRML which is a highly dynamic system, it is important to integrate more rigorous technical inputs into these plans. Besides, preparation of these plans needs to be made more participatory involving all stakeholders in the landscape. Interventions that need to be included in the revised Management Plans *inter alia* include eco-restoration options with focus on grassland management; invasive species removal; establishing long-term protocols for species and ecosystem monitoring; adaptive fire management strategies; prioritization of conservation zones within PAs; species specific conservation programmes; technological options in monitoring and enforcement; strengthening of capacities of PA staff etc. The Working Plans and Biodiversity Conservation Plans will also need updation on similar lines.

189. This Output will support the preparation of Sector Plans for economic production sectors based on the premise of "avoid-offset-mitigate- compensate" strategies (in the descending order of priority for planning investment decisions). It is to reiterate that the intention of SPs is not to curtail sectoral growth and development mandates but the focus is rather on aligning sectoral operations with ecological imperatives that have minimal adverse impacts on ecosystems. Proactive response towards conservation considerations will be a highly desirable objective of the SPs (e.g. energy efficient options in tea and cardamom that have less reliance on biomass; MGNREGA activities congruent with conservation priorities like removal of exotics like wattle; promotion of wild tree growth and diversity in cardamom gardens; identification and consolidation of HVBAs in tea growing areas; market linkages for realization of better price for environmentally valued products; reduced pesticide use; Revenue Department recognizes and appreciates biodiversity rich habitats etc.). Sector plans for Panchayats could promote the idea of 'Green Development Cess' from economic production sectors that have ecological footprints in the area (e.g. tourists visiting HRML).Tourism Sector Plan (TSP) will need to assess the carrying capacity and promote 'responsible tourism' and may also indicate establishing and /or upgrading existing waste management/ effluent treatment mechanism and certification standards for tourism operations. Sector Plans shall promote Corporate Environment Responsibility (CER) and would also explore the involvement of Electricity Board (a major beneficiary of hydrological services) in upland ecosystem management/ eco-restoration. Green concepts would be built

into the Sector Plans of infrastructure development agencies too (e.g. PWD) as most of them only absorb resources from the landscape and seldom release positives for conservation. This Output shall also support "greening the rural development" investments that is routed through sectoral agencies and Panchayats. During the project preparatory phase a lot of suggestions were received regarding the activities that need to form part of the Sector Plans from an environmental perspective that is summarized in Annexure 16.

190. Under this Output, SPs will be prepared by technical experts after extensive consultations with respective stakeholders. Preparation of Sector Plans would follow a rigorous scientific process anchored strongly in participatory approaches. The HRSDS in close association with the respective sectors shall spearhead the preparation of the SPs. After obtaining the concurrence of the HRSDS, the SPs shall finally be placed before the concerned Sectoral Department for approval. Technical assistance shall be extended to other sectors that may have own resources and are interested in developing similar biodiversity- friendly plans.

Output 1.4 A dedicated cross - sectoral landscape level institutional platform ensures sectoral compliance with management prescriptions of Landscape and Sector Plans

191. Contrary to the existing sectoral growth paradigm, the project identifies landscape as the basic unit of management. While administrative boundaries are inevitable in the current governance framework in India, this also means that resource management happens in a fractured manner across ecologically contiguous landscapes. In the process, even for identical natural resources, management decisions vary significantly between administrative units that may not sync well with the overall ecological continuum. This brings in the need for harmonizing the resource management decisions transcending administrative boundaries. However, this transition from sector based to landscape based resource management has to be a highly nuanced and pragmatic exercise as there are multiplicity of actors and sectors accustomed to the current sectoral management approaches. The success of the project, to a large extent will depend on the active involvement of all sectors and actors in this process. The project proposes to establish an institutional mechanism in the form of High Range Sustainable Development Society (HRSDS) to convene all stakeholders on one platform to exchange information, discuss issues, plan and monitor activities on agreed principles (LPs and SPs) that ensure minimal adverse impact on the biodiversity of HRML.

192. The proposed HRSDS will have representation from relevant government agencies (Department of Forests, Revenue, Tourism, Agriculture, Industries, Electricity Board etc.); Local Self Governments; private sector (representatives of key production sectors – tea, cardamom etc.); communities (functionaries of traditional community institutions, *Kudumbasree*, EDCs, JFMCs, CRC, BMCs, agriculture associations, commerce and trade organizations); research institutions (e.g. KFRI, Periyar Foundation, Cardamom Research Station etc.) and representatives of NGOs (e.g. HRWEPA, WWF, WTI etc.). The primary mandate of HRSDS will be to provide for a formal institutional platform by which government policies, programs and resources, as well as non-government activities can be better mobilized/ channeled/ harmonized to ensure the long-term sustainable use of resources in HRML, even while individual sectors continue to pursue own sector objectives. The scope and representation of HRSDS is not the conservation sector alone but all actors and agencies in HRML that have a bearing on biodiversity. One model for this institutional mechanism to consider may be that of a Government owned Public Trust that combines the authority of the Government and flexibility of a good NGO.[134] It is not intended to replace, duplicate, suspend or supersede existing sectoral institutions, but will act as a supporting/ coordinating institution. The HRSDS is expected to take up a variety of functions requiring professional inputs and expertise. To that end, HRSDS will have a strong complement of technical subject specialists. A senior level officer (at least the rank of Chief Conservator of Forests/ Secretary to state government) may head this institution.

[134] The precise structure, composition and authority of the Foundation will be determined after extensive stakeholder consultations.

193. As a preparatory process to the formation of HRSDS, an assessment will be conducted of existing international and national experience with such institutional mechanisms to articulate issues such as mandate, operating principles, bye-laws, and rules. There are examples of similar functional institutional arrangements in the country (e.g. Periyar Foundation in one of the Tiger Reserves in southern India set up under another GEF funded – India Ecodevelopment Project; Gulf of Mannar Biosphere Reserve Trust established under the GEF-UNDP-Gulf of Mannar Project etc.). The lessons from these projects show that multi-stakeholder participation brought-in through such institutions can go a long way in supporting existing institutions in addressing current and new challenges facing the conservation sector. Similar approach is currently being pursued under another two GEF funded and UNDP supported Coastal and Marine Projects (Godavari and Sindhudurg).

194. The assessment will be followed by extensive consultations at various levels involving stakeholders (government, community, academia, civil society etc.) and the Society will be established through a Government Order within the 1st year of the project. HRSDS will be a cross-sectoral platform with enough convening power representing various stakeholders in the landscape. It should also give representation to hitherto not so well represented groups in decision making related to resource use (e.g. tribal communities). The Society will also have the mandate of compliance monitoring of sectoral operations that have a bearing on biodiversity. Towards this, HRSDS shall be vested with appropriate powers under the Environment Protection Act, 1986. Further, the Society will also develop a financial sustainability strategy for post-project functioning.

Output 1.5: Replication strategy developed for multiple use management of mountain landscapes

195. Facilitating replication of similar landscape approaches for resource governance in other mountainous areas of the country is an important intent of the project. This Output will support evolving a replication strategy towards this objective. First, it will earmark resources for identification of viable meso-level mountain landscapes for piloting similar approaches across the Himalayas, the Western and Eastern Ghats, Vindhyas, Aravallis, Central Indian High lands, and North-East. Under the aegis of the project and anchored within the National Project Management Unit (within MoEF), this exercise will be supported by technical agencies like Wildlife Institute of India, Periyar Foundation, GB Pant Institute etc.

196. This Output will also support developing HRML as a 'learning centre' for further replication of similar approaches in other areas and states (through technical backstopping), exposure visits and training to stakeholders from other regions. It is envisioned that by the project end this Output shall result in well-informed replication strategies and hand holding support for incorporating biodiversity and ecosystem values into land use planning and management in at least 3,000,000 ha of mountain landscapes in the country.

Output 1.6: Policies and legal framework reviewed and harmonized for ensuring sustainable management of mountain landscapes

197. The existing policies, legislation and guidelines of key economic sectors (both at national and state level) will be reviewed to determine how they can be made more explicit on the special requirements of biologically rich mountain areas. Methodological recommendations/ strategies/ guidelines will be developed for each sector on the minimum standards that should be observed by different economic activities in order to maintain the integrity of mountain regions. To build on the existing national environmental regulatory framework that includes mandatory Environmental Impact Assessment (EIAs), the project will develop strategies on how to include a thorough assessment of biodiversity impacts in the context of developmental imperatives in mountain landscapes. Equally important is developing mechanisms for concurrent and post project compliance monitoring of developmental interventions. Sector policies and guidelines to be considered for this review

shall be determined during the early stages of the project. The review of sectoral policies will be undertaken in close collaboration with line Ministries/ Departments, technical experts, and other stakeholders. International best practices will also be reviewed towards this end. The analytical review shall also include consultative dialogue involving government, non-government, communities and research institutions, in order to facilitate policy engagement and catalytic change. The outcomes of these reviews and strategies for harmonizing the policy and legal framework for the sustainable management of mountain landscapes shall be placed before the government for further policy processes.

Outcome 2 Multiple-use mountain landscape management is applied securing the ecological security of HRML

198. This Outcome will focus on translating/ implementing the provisions of the Landscape and Sector Plans into implementable actions on the ground by developing institutional capacities among respective sectoral institutions. Building these capacities will require a combination of methodological guidance, training, consultation, demonstration and implementation support. As the landscape is vast and sectoral activities are diverse, it is premised that the project will support select number of "demonstration programmes" as models (through Annual Work Plans) as identified in the LPs and SPs. Such demonstration models will later become replicable references for incorporation into the regular resource use programming in the region. The Outputs to be realized under this Outcome are described below.

Output 2.1: Capacities developed among conservation and production sector staff for applying landscape approaches to biodiversity conservation into sectoral operations

199. Capacity building envisioned in this Output is a cross-cutting activity that is applicable to conservation and production sector staff on equal measure. However, capacity issues related to communities have been dealt separately under Outcome 3 as they require a separate set of focus. Capacity assessment of sectoral institutions/ functions carried out as part of the PPG exercise has identified several key areas for capacity scaling up in HRML. Conservation sector requires capacity augmentation in: (a) PA/ HVBA management planning; (b) understanding the provisions of relevant sectoral legislation especially environmental laws and Rules; (c) specific habitat improvement techniques on mountain biodiversity (e.g. management of montane *shola*-grasslands, fire management, appreciation of lower life-forms, invasive species management, managing human-wildlife conflict, climate change response measures, innovative eco-restoration options, improved plantation technology etc.); (d) participatory resource governance; (e) multi-sectoral engagement and conflict resolution; (f) development of viable business models based on natural resources; (g) monitoring and evaluation (including species and ecosystem processes, day to day reporting etc.); (h) adaptive management skills; (i) incorporation of community knowledge in resource governance etc.

200. Identified capacity needs in the economic production sector include: (a) appreciation of significance of biodiversity including the negative impacts of biodiversity loss on production sectors in the long-run (e.g. tea, cardamom and tourism); (b) specific know-how on applying simple and effective conservation practices into production operations (e.g. rational use of chemical inputs in tea and cardamom); (c) exposure to new and state-of-the-art technological innovations that will have positive impacts on biodiversity (e.g. use of renewable energy sources for curing in tea and cardamom); (d) knowledge about technical and financial options that maximize biodiversity gains without compromising on profits; (e) exposure to engage with market dynamics (e.g. market fluctuations in cardamom); (f) managing trade-offs in land use decisions; (g) marketing biodiversity friendly products etc.

201. This Output will earmark resources for undertaking detailed capacity needs assessments of the conservation and economic productions sector institutions/ staff right at

the start of the project. The needs assessment will also include identification of all target groups that must form part of the capacity building/ training programmes. As a follow up, based on the identified requirements, and drawing extensively from the knowledge management and dissemination system (developed under Output 1.1), detailed training programmes will be chalked out by preparing customized technical materials / manuals and resource persons identified for effective delivery. Research institutions, universities, and other educational and training institutes and NGOs will be mobilized towards this. Training template will also include exposure to national and international best practices on related themes and practices. Further, in order to ensure that training support continues post-project, efforts will be made to locate the training curriculum and resource persons with relevant training institutions (KFRI, WII, Forest Academies, HRSDS, Periyar Foundation, KILA, KITTS, IMG etc.).

Output 2.2: Management effectiveness of PA system strengthened to address existing and emerging threats to PA systems

202. As mentioned in the Baseline Analysis, at individual level, the existing PAs in the landscape have performed an impressive role in conserving diversity. However, at the landscape level their effectiveness remains critically sub-optimal due to a) prevailing and emerging threats; b) small size; c) incomplete representation of biota; and d) connectivity issues. This Output will aim to improve the management effectiveness of the PA system by addressing the issues around the prevailing and emerging threats, issues of size, representation and connectivity. A four-pronged strategy is identified for strengthening the management effectiveness of existing PAs under this Output: 1) revisiting the Management Plans of PAs; 2) capacity building of PA managers and staff; 3) implementation support to select activities identified in the Management Plans; and 4) expansion of PA system. Since the former two are already covered under Output 1.3 and 2.1 respectively, this Output deals with the latter two aspects.

203. Under this Output, technical and financial support will be provided for implementing the activities identified through the Management Planning process. These may *inter alia* include eco-restoration (e.g. wattle and other invasive species, fire management); strengthening enforcement by deploying technology and manpower; participatory resource management arrangements; wildlife research; nature awareness and outreach; monitoring ecological parameters; wildlife veterinary care; staff welfare activities (providing field infrastructure and incentives for exemplary work); eco-development and community oriented activities; fostering eco-tourism, visitor management, settlement of rights; consolidation of PA boundaries (e.g. Kurinjimala, Anaimudishola and Chinnar) etc. Collateral financing leveraged from national and state governments will be used for implementation of the Management Plans. Eco-restoration of grasslands is a key priority for HRML and a focus of the project. The possibility of undertaking the removal of exotic species from the high altitude grasslands through the MGNREGA programme is a possibility that will yield considerable conservation and livelihood dividends on equal measure. Further, the prospects of utilizing the wattle and *Eucalyptus* (eradicated from the grasslands) for fuel wood in cardamom curing and lemon grass distillation would also need to be explored. An indicative list of activities to be supported under this component is given in Annexure 16.

204. With an average size of only 4,600 ha and covering less than 12 percent of the project landscape, the PAs are unable to encompass and sustain the representative biodiversity of the region. Large tracts of high conservation significance are still located outside the premises of PAs. HVBAs (mostly under territorial Forest Divisions and partly with the Revenue Department) and also the forest fragments in tea estates are examples of this. Most of these areas are not accorded enough conservation priorities – neither legal nor operational (e.g. Pettimudi, Kathumala, Idlimotta, Manthan shola) and with increasing pressure from alternate land uses, these areas are under threat of further fractioning.

205. The Project Preparatory Team has assessed the extent and location of areas requiring augmented conservation status based on ecological considerations, socio-economic feasibility and administrative suitability. There is good scope for expanding the PA system in the project landscape by around 30 percent by upgrading the conservation status of some of the identified HVBAs (see Annexure 17). This is largely an administrative action as most of these areas are already under government control (with Forest and Revenue Departments) and bereft of any active commercial operations or subsistence reliance by local communities. This Output will earmark technical and financial resources for the identification and consolidation of such areas into the PA system (e.g. survey, demarcation, basic infrastructure development, staff deployment etc.).

Output 2.3: HVBAs secured through improved conservation focus and interventions

206. Improving the management effectiveness and expansion of PA system will need to be complemented by according enhanced conservation focus to the remaining HVBAs of HRML. As discussed earlier, extending over 84,600 ha, HVBAs currently cover about 27 percent of the project landscape. In terms of ecological attributes, they are equally important and crucial as that of PAs. HVBAs of HRML fall under two kinds of tenurial arrangements: a) under government control (e.g. the whole of Mankulam Division, areas resumed from tea estates, areas adjoining PAs and portions of natural forests of Munnar, Malayattoor and Marayur Forest Divisions and the *sholas* and grasslands under the control of the Revenue Department (e.g. Manthanshola)); b) under corporate control (e.g. interspersed forests, grasslands and swamps within tea plantations of KDH). Since such areas are increasingly threatened by alternate land use aspirations, it is important to put in place a focused conservation strategy, sustainable use and stronger governance framework for these areas. While a part of HVBAs will be upgraded to PA system (through Output 2.2 above), still an estimated extent of around 73,000 ha of HVBAs shall remain outside the PA network. However, in view of various practical considerations, it would not be feasible to convert most of these into PAs particularly where commercial operations are going on or where there is significant livelihood dependence by local communities.

207. In view of this, in order to magnify the conservation focus to HVBAs falling in tea gardens, this Output will support: a) inventorying, demarcating and consolidating such HVBAs (extent, number and location); b) rehabilitation/ eco-restoration of critically degraded areas; and c) incorporating HVBA management into the Sector Plan of tea industry. In the case of HVBAs under government control, the strategy would involve: a) identifying and inventorying such areas especially in terms of their ecological, corridor and dispersal values; b) preparing/ strengthening Biodiversity Conservation Plans (BCPs) for the management of such HVBAs (Output 1.3); and c) incorporation of HVBA management into the Working Plans of territorial Divisions (Output 1.3).

208. Capacity development of conservation sector staff manning the HVBAs has been detailed under Output 2.1. This Output will support the implementation of improved biodiversity management in HVBAs as identified in the Sector Plans (tea, Territorial Forest Divisions etc). These may include eco-restoration options (e.g. wattle and other invasive species removal, fire management); strengthening enforcement by deploying technology and manpower (e.g. Marayur); participatory resource management arrangements; nature awareness and outreach; monitoring biological parameters; staff welfare activities (providing field infrastructure and incentives for exemplary work); visitor management, settlement of rights; consolidation of boundaries etc. An indicative list of activities to be supported under this Output is given in Annexure 16. Further, the commercial forestry operations happening in proximity to such HVBAs will also need to be rationalized. By the year second of the project, a comprehensive proposal will be prepared under this Output for leveraging collateral financing for HVBAs of HRML under the national wildlife programme – *Integrated Development of Wildlife Habitats*.

Output 2.4: Biodiversity mainstreaming demonstrated in key production sectors

209. Under this Output, key economic production sectors will be supported to mainstream biodiversity into commercial operations. This requires a composite strategy involving a) demonstration of appropriate technology; b) incentivizing sustainable resource use through promoting branding/ certification for environmentally sustainable production operations (e.g. 'carbon neutral-tea', 'shade cardamom' and 'responsible mountain tourism') and other market mechanisms (e.g. premium sale of organic products); and c) continued and focused skill upliftment. In furtherance of this, this Output shall provide implementation support to select activities identified in the Landscape Plan and and Sector Plans concerning these sectors (e.g. regeneration of forest fragments, planting of native species as canopy trees in cardamom plantations, promotion of innovative technology (e.g. gasifiers, renewables etc.) for energy use in tea and cardamom plantations, etc). This Output will stress on reduction in pressure (both direct and indirect) from production sectors (e.g. tea, cardamom, tourism) as evidenced by a) no net loss of natural forest blocks/ fragments/ HVBAs in critical corridors; b) reduction in usage of chemical pesticides in tea and cardamom sectors; c) number of energy efficient processing/ curing units adopted by tea and cardamom sectors etc.

210. With regard to tea industry, environmental mainstreaming would entail the following approaches. First, conservation of HVBAs/ forest fragments within interspersed tea gardens (an activity already covered under Output 2.3). Second, energy efficiency options in tea industry that can bring down dependence on mono culture plantations of *Eucalyptus*. Key interventions in this regard would be on: a) housekeeping and demand side management; b) energy conservation in electrical systems; and c) fuel conservation (firewood) on thermal side. This Output will also leverage experiences and technology towards this including from a recently concluded GEF funded UNDP supported project in Tamil Nadu that can be customized and packaged for the specific requirements of tea industry.

211. Assessments made during the PPG phase show that the tea industry in HRML has the potential to bring energy efficiency (both electrical & thermal energy) improvements to the tune of 8–10 percent. Adapting the results from a recently concluded GEF funded and UNDP supported project - *Energy Conservation in small sector tea processing units in South India* (in the adjoining landscape of Nilgiris), it is estimated that energy efficiency in tea industry of HRML will have a CO_2 mitigation potential of 0.12 kg CO_2 / kg of made tea. The additional investment needed to mitigate 1 ton of CO_2 from the tea processing comes to around USD 30 only. Interestingly the investment for bringing in energy efficiency is not much too (≈ Rs 0.20 / kg of made tea). However, the tea industry require a large bouquet of technical solutions, continued availability of high quality technical support, strengthened supply chain of energy efficient equipment suppliers etc. to factor in such innovations.

212. Reduction in fuel wood use in tea industry can innovatively be channeled for better biodiversity gains in two ways – a) such saved fuel wood could be used for supplying to other energy intensive economic production activities in the landscapes that have heavy reliance on biomass and a cause of forest and tree cover depletion (e.g. cardamom curing and lemon grass distillation), and b) areas vacated by eucalyptus plantations could be allowed to grow into wilderness adding to the vegetal cover of the region. The project will facilitate bringing in necessary policy changes to achieve this. Further, energy efficiency improvements can conserve around 8–10 percent of both electrical & thermal energy with consequent mitigation of CO_2 emission. Besides, this Output will also look at energy efficiency options in the labour dwelling areas of tea estates to reduce their biomass dependency on *shola* forests and other natural vegetation. In addition, this Output will also facilitate the transfer of technical know-how on fuelling some of the tea curing units from the garbage (a chronic problem in the landscape) collected from the Munnar town.

213. In the cardamom sector, primary interventions would be the following. First, most of the cardamom curing units is also operating at below par efficiency in terms of energy consumption. Improvements in technology could bring in significant reduction in firewood use that will have a big influence in retaining the tree growth and the canopy which is fast opening up. Even a modest 10 percent reduction in fire wood consumption in cardamom

curing units will save around 8,000 MT of firewood annually with a corresponding CO_2 emission reduction to the tune of 14 million kg. This Output will support cardamom sector by: a) providing financial and technical support to pilot energy efficiency options; b) providing alternate sources of firewood (e.g. wattle removed from the high elevation grasslands of HRML); c) providing at least three years of support to select farmers who are volunteering to shift to more sustainable production practices; and d) revival of the Cardamom for Rainforest Conservation (a participatory resource governance institution established by the government).

214. Another critical area of intervention would be to work on the market risks (price fluctuations, presence of unsavory intermediaries, poor economic returns to farmers and pervasive and unfavourable trade regulations). In tandem with Output 1.6, this Output will develop opportunities of upstream policy engagements with Ministry of Commerce through MoEF at the national level. This Output will also promote interventions to remove the ambiguity regarding land use rules/ regulations; promotion of rational use of pesticides; better awareness among farmers and Panchayats about benefits of sustainable farming etc. Sectoral Plans for more sectors can be supported conditional to the successful definition and implementation of the Sectoral Plans that need to be taken up on priority as mentioned above. This Output will also establish linkages and partnership with respective commodity boards (Tea and Spices Board) for furthering the mainstreaming objectives envisaged.

Outcome 3: Strengthened capacities for community based sustainable use and management of wild resources

215. The most prominent stakeholder capacity existing in the project landscape is the presence of functioning local self-government institutions (PRIs) that if appropriately capacitated and effectively empowered, could become an effective vehicle for sustainable resource management. There are 34 PRIs in the project landscape that play a crucial role in land-use and development planning and implementation at the grass roots level. In addition, 118 Joint Forest Management Committees (JFMCs) involving local communities (mostly tribals) and with varying degrees of functional presence have been established by the Forest Department. The culture of women Self Help Groups (SHGs) are also strong in the project area (e.g. *Kudumbasree*). This Outcome intends to strengthen these institutions on sustainable resource management.

216. PRIs, JFMCs, SHGs, BMCs, Gramasabha (in the context of FRA) and other CBOs, are the key conduits for reaching out to the grassroots on account of their local presence, reach, flexibility of operations and rapport. A three pronged strategy is adopted towards this: a) community based organizations (PRIs, JFMCs, Gramasabhas and SHGs) will be capacitated on sustainable resource use; b) support to resource use practices that accentuate positive resource dependency; and c) demonstration of a holistic community-based natural resource governance model for the unique tribal local self-government at Edamalakudy. This Outcome will provide technical and financial assistance to tribal communities, Panchayats (with focus on 11 targeted GPs) and community institutions as relevant to adopt land use practices in consonance with sustainability principles and increase income from resource based enterprises. The effectiveness of these interventions will be evidenced by: a) reduction on pressure on biodiversity (e.g. illicit felling of sandal trees); b) population of key harvested species (e.g. reeds, medicinal plants etc.) remain stable or increase through-out project period; and c) 15–20 percent increase in the income of local communities attributed to biodiversity-friendly enterprises. This will be realized through the following Outputs. The lessons learnt from the implementation of Small Grants Programme across the country will also be utilized while designing such community level interventions.

Output 3.1 Community based organizations (Panchayats, JFMCs, Self Help Groups (SHGs)) have adequate capacities to plan sustainable resource use

217. There is a need to scale up opportunities for providing higher incentives for conservation initiatives among local communities. The first building block for community engagement as stewards of the local ecosystem must necessarily be about securing the traditional, resource based livelihoods. This Output will provide technical and financial support to Panchayats to develop Panchayat level resource use plans for greening the land-use investments. It is envisioned that through this, the investments at Panchayat level will reinforce low-impact land use practices and manage their development efforts in tune with Landscape Plan developed under Output 1.2. The focal areas of intervention in Panchayat level plans would be code of conduct for green development; increased income generating opportunities through green options (e.g. tourism cess, leveraging CSR/ CER commitments from production sector); waste management etc. The preparation of these plans will take into account gender-segregated data as well. These plans will be founded on extensive interactions among the community through existing institutions such as Panchayats, *Kudumbasree*, SHGs, JFMCs, Self Help Groups and tribal groups. Strategies will be discussed and vetted among the communities, and channels of communication will also be maintained with community, cultural/ religious and political leaders, so as to ensure the acceptance and efficient implementation of livelihood strategies.

218. This Output will also earmark resources for revitalizing the functioning of existing JFMCs/ BMCs by building their capacities to enter into co-management agreements with Forest Department and other institutions as relevant for the management and use of forest resources and NTFPs. The existing micro plans of JFMCs/BMCs will be revised to specify clear roles and responsibilities of each party and define mechanisms for sustainable use. These micro plans shall prescribe: i) resource off-take limits; ii) zones where harvesting can take place; iii) mechanisms for monitoring and enforcement including community sanctions against defaulters; iv) marketing mechanism; and v) internal democratic and equitable benefit sharing mechanism.

219. Necessary follow up data collection, analysis and comprehensive feasibility studies will be undertaken, as required, for selecting the appropriate activities (ecosystem based) to be supported. Women shall comprise more than 50 percent of the target beneficiaries. The women's self-help groups with good micro-credit system and micro enterprises are very strong in HRML and there is substantial social capital built up among women already. The project will target both men and women in defining and implementing livelihood-generation activities. The project will expend efforts in carrying out wherever possible gender analysis for the design and analysis of such interventions, and shall take steps to ensure that perceptions of both women and men are taken into consideration. Training, technical and financial support will be provided to Panchayats, JFMCs, SHGs and tribal associations (with a particular focus on women and youth). *Quid pro quo* commitments shall be dove-tailed into the plans regarding livelihood support provided under the project and improved biodiversity conservation practices to be followed by the communities.

220. The Panchayats, JFMCs, BMCs SHGs and other CBOs of HRML will be trained in conservation management practices so that they become effective partners in conservation actions. Training and financial support will be provided for field-level data collection on biodiversity impacts of land use decisions. Monitoring groups will be formed among the local communities and participants will be trained in collecting data on change realized as a result of project interventions. Communities will also be trained on habitat restoration techniques, participatory resource appraisal, NTFP based enterprises, value addition on artisanal operations (e.g. reeds) etc. This Output will establish institutional partnership with KILA (a key state level institution for training local self-governments) to develop training modules on sustainable resource use for Panchayat members. Customized training programmes will also be developed for tribals on resource use based on natural resources and on the effective implementation of the Forest Rights Act.

Output 3.2 Support to sustainable resource use practices accentuate positive resource dependency

221. This Output will support biodiversity-friendly businesses as identified in the micro-plans of JFMCs and Resource Plans of Panchayats/ Gramasabhas which will include artisanal enterprises (e.g. reed mat weaving), community based tourism, NTFP based enterprises etc. To ensure that these enterprises remain viable, the project will strengthen technical, financial, administrative and marketing capacities. In addition, to ensure that businesses with negative impacts on biodiversity are not promoted inadvertently, the project will put in place safeguards for financial and business management support. The project will support adoption of innovative technology for bringing in use efficiency (e.g. lemon grass distillation) and better value realization of products (e.g. NTFPs, artisanal reed products etc.). Support under this Output will be based on the principles of "demonstration approach". It is anticipated that the catalytic investments from the project will provide economic and financial incentives to switch over from short-term resource exploitation to long-term stewardship. It is to reiterate that this Output is intended to support only natural resource based livelihoods while developmental assistance for non-ecosystem based livelihoods need to be mobilized from other baseline projects. During the project preparation phase, an initial list of potential income-generating opportunities has been identified (Annexure 16). External expertise and best practices will also be tapped towards this. Government co-financing that has been leveraged for the livelihoods sector (e.g. MGNREGA) will be directed to putting in place alternative livelihood and social welfare programs.

222. Currently, not much attention has been given to various aspects of reed management such as regeneration, weed control, biodiversity and livelihood issues. In many parts of the country, under the Schedule Tribes and other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, the right to extract bamboo is being handed over to tribal communities as part of Community Forest Rights. This Output will explore options for creating new institutional mechanisms for the extraction and management of reeds through tribal communities under the Forest Rights Act.

Output 3.3 Community-based natural resource management governance model for the unique tribal local self-government (Edamalakudy Panchayat)

223. Edamalakudy Panchayat is a remotely located, biodiversity rich and exclusively tribal settlement (600 families and 3000 members) located deep inside the thick evergreen forests of the project landscape. The eastern portion of Edamalakudy envelops the richest areas of Eravikulam National Park and is very important in ensuring connectivity between Malayattoor and Mankulam Forest Divisions and Anamalai Tiger Reserve. It is an ideal habitat of the endangered Lion tailed macaque. Recently, Edamalakkudy was declared as a tribal Panchayat , the first of its kind in the Western Ghats. As already mentioned, the hamlet is inhabited by highly marginalized, less mainstreamed, and highly resource dependent tribal communities. They are less dependent on market interventions but are highly prone to intermediary exploitations. They have heightened vulnerabilities but also have and extreme potential for demonstrating resource based sustainable livelihoods on a settlement level. Considering these special circumstances, and the extremely rich biodiversity they are dependent on, this Output proposes to give a separate and focused resource governance approach for this Panchayat. Particular focus would be given to holistic development interventions based on natural resources such as the effective implementation of the Community Forest Rights under the Forest Rights Act, developing resource models of scale such as NTFP based, reed based etc. It is anticipated that such a model will also serve as learning references for replication among other exclusive tribal Panchayats across the country in the context of implementation of the Forest Rights Act, 2006.

C. RISKS AND ASSUMPTIONS

Risk/ Assumption	Risk Ratings	Mitigation Strategy
Limited support from production sector due to apprehension that their economic interests would be jeopardized due to participation in the planned conservation interventions	M	The production sectors operating in the HRML (tea, cardamom and tourism) are critically dependent on natural resources. Depletion of natural resources shall inevitably act against the sustainability of these sectors in the long run; a fact that will be used as a spring board for engaging with enterprises. Necessary measures (including both technical and market based instruments) shall be undertaken by the project (under Outcome 2) to influence their production practices and choices. Further, production sector representatives will be key participants in the cross-sectoral institutional platform to be established by the project (under Outcome 1). Knowledge products will be developed highlighting the benefits of a well-governed mountain landscape. In addition, the project will identify appropriate technological options/ incentives that would be beneficial to these sectors and form part of the Landscape Level Land Use Plan (Outcome 1).
Policy amendments and regulations for addressing biodiversity conservation in sector practices may not receive government and political support	M	In amending policies and the regulatory framework, a highly consultative approach will be used drawing on reviews and inputs from various stakeholders (government, private sector, communities, local bodies and academicians) to ensure the feasibility and acceptability of the proposed changes. The proposed cross-sectoral multi-stakeholder institutional platform (HRSDS) to be set under the project shall lead this process in consultation with key ministries. Similarly, the knowledge products generated under the project shall be disseminated widely for lobbying for upstream policy uptakes of the project concepts.
Local communities may not be willing to participate in the project unless the project addresses their livelihood needs	L	The project will work closely with the local communities by providing technical and financial support for engendering sustainable use of natural wild resources. Planned interventions include skills upliftment, value addition to on-farm and forest produce shall result in income augmentation of communities. The project will also recognize the traditional knowledge of local communities and fully integrate this in designing management interventions. These interventions will be developed with the full participation of communities.
The benefits generated by the project may be offset by the impacts of climate change	M	Climate proofing is an important element in the project design. To start with, the project proposes to address this risk by building a better understanding on the impacts of climate change on HRML (Output 1.1). The findings of this study will give inputs into the process of landscape-level planning – a key focus being on maintaining functional connectivity across the landscape, and maintaining functional diversity (both key to enhancing the resilience of ecosystems to climate changes induced fire, drought and other perturbations). By reducing existing anthropogenic stressors to ecosystems, the project will enhance the capacity of ecosystems to recover following such climate changed induced perturbation.
Stakeholders may perceive the project as restrictive rather than enabling due to its focus on biodiversity.	M	The project aims to mainstream biodiversity as enabling element rather that counter pose it against development. The project approach is to balance conservation, development and livelihoods. Right at the beginning of the project this fact shall be disseminated widely among diverse stakeholder groups. Further, the capacity strengthening programmes and the demonstration approach envisaged in the project will lead to better appreciation of the benefits of sustainable development and biodiversity conservation. Project is also expected to unleash the potentials of new technology and marketing strategies that are anchored in biodiversity friendliness.
The history of the landscape is replete with efforts to establish rights over land and the idea of a landscape level	M	Project stresses on evolving clarity on land tenure and harmonization of Acts and policies which would, in fact, dispel the vagueness associated with the present compartmentalized way of dealing with land and resource related issues. The project will support efforts towards settling land rights and untangle the complex land related issues in the landscape. Further, one of the main thrust areas of the project is securing the rights of tribal communities as

plan may appear to be pitted against existing tenurial interests.		the Forest Rights Act.
Resources of the project are insufficient for meeting the objectives over the large area of landscape	M	The project design adopts the principles of incremental reasoning over the baseline investments. More emphasis is given to develop soft skills, institution building, policy enabling and shift in development trajectory rather than focusing on building physical infrastructure. It is presumed that the catalytic investments from the project will enable channelizing/ realigning the baseline investments in congruence with the needs of biodiversity conservation. Moreover, the demonstration approach adopted by the project will help rationalizing the utilization of project resources.

D. Incremental Reasoning and Expected Global, National and Local Benefits

224. As already mentioned, India's mountain regions cover an area close to 1.00 million ha (around 30 percent of India's landmass) that constitutes more than 90 percent of the 'biodiversity hotspots' in the country. HRML, nestled in the Western Ghats Mountains of peninsular India is significant due to the following reasons: a) high levels of endemism and repository of presumably several new species; b) richest biome in the entire Western Ghats; c) presence of globally threatened species of fauna, flora and ecosystems; d) part of the World Heritage Site under UNESCO; e) an Important Bird Area; f) catchment of three major river systems in the southern Western Ghats; g) one of the five viable breeding centres of tiger in the entire country and form part of the largest habitat for elephants in the southern Western Ghats; h) harbor the largest global population of the highly threatened Nilgiri tahr and a significant population of Grizzled Giant Squirrel; i) strong eco-cultural affinities and presence of ethnic groups that depend heavily on natural resources for livelihoods; j) support important economic sectors like cardamom, tea and tourism; k) vegetal cover in the region acts as a shield against the impacts of climate change; l) high carbon sequestration potential; m) there has been no major project in this region for mainstreaming biodiversity. Further, HRML is a peep into the future for other mountain areas in the country in terms of the trajectory of development where there is complex interplay of ecological and anthropogenic factors.

225. Recognizing the biodiversity significance of HRML, the government has established eight PAs in the region. However, given the escalating development pressures and need for sustaining livelihoods, it is unlikely that the current approach of conserving biodiversity in "exclusive PAs" alone is going to be effective in safeguarding the biological opulence of HRML. The baseline investments in the project landscape comprise of diverse interventions undertaken by different sectors to further sectoral development objectives, but these interventions do not always integrate biodiversity conservation considerations. Further, these are not coordinated at the landscape level to provide a cross-sectoral strategic vision for balancing conservation, livelihood and production sector objectives. For instance, of the departmental budgets allocated to different sectors, some resources are set aside for conducting research, monitoring, training of sector staff, development of alternate livelihood opportunities and enhancement of existing opportunities to reduce the dependence on natural resources etc. while bulk of sectoral department budgets (agriculture, horticulture, animal husbandry, forests, and tourism) are allocated to pursuing sectoral objectives through activities at the village/ settlement level. These activities are largely for development of assets, but the development of institutional and individual capacities for balancing biodiversity conservation objectives with sector development objectives are not be addressed.

226. Under the baseline (business-as-usual) scenario, the trajectory of production activities in the project landscape and associated degradation trends are likely to continue as there remain persistent barriers to addressing the direct and indirect drivers of degradation. The existing planning and policy framework, as well as institutional arrangements in HRML are inadequate for addressing biodiversity conservation issues from a landscape perspective. In

terms of making community resource use and livelihoods more sustainable, there is lack of robust community-based resource governance systems and alternatives. It is evident that far greater emphasis needs to be placed on mainstreaming biodiversity considerations into economic and livelihood activities in tandem with strengthening the management effectiveness of the existing PA system.

227. GEF support will be catalytic in mobilizing action by production sectors and other stakeholders to overcome existing barriers and introduce new strategies and technologies that will improve the condition of natural resources and increase the stability, integrity and productivity of HRML. More importantly, building on the opportunities for community-based or stakeholder based resource management, it will promote a participatory natural resource planning and management strategy, involving large scale stakeholders such as production sectors, strengthening of village level institutions, and development of capacity to enable stakeholders to undertake micro level planning and management of natural resources. It will enhance the capacity of functionaries of different sectors, private agencies, and CBOs to promote sustainable resource management.

228. Even in the absence of this GEF project, there are certain baseline investments/ interventions that would take place in HRML in the next five years. These projects/ investments form the programmatic baselines for this project in the "business-as-usual" scenario. Most of the baseline investments will continue to be driven by the existing template (sectoral) of resource planning and implementation. Some of these investments will have some positive impacts on biodiversity conservation in the region. However, in the context of the complex inter-related challenges confronting the project landscape, the baseline projects alone are unlikely to reduce the major barriers identified above unless some key alterations are made in the governance approach. That is the space where GEF investment is trying to lock in. Nonetheless, the existing baseline projects provide a strong platform/ collateral funding/ support structures on which this project can anchor to influence the trajectory of development in the project landscape.

229. The GEF Alternative aims at making a change in natural resource management in the target project area. The aim is to engage and coordinate different sectors at the landscape level to promote sustainable resource management that balances ecological and livelihood needs as an integral part of the operation of these sectors. This mainstreaming approach would enhance the resource base and generate local as well as global benefits. The Departments of Forests, Agriculture, Tourism, Rural Development and many large scale production agencies will mobilize their resources in the target landscape for mainstreaming biodiversity conservation in sector development strategies. The IC matrix details the baseline expenditures, and the incremental cost of realizing each outcome, as well as how the incremental costs are to be shared by the GEF and different government departments. (Incremental Cost Matrix is in Annex 18).

230. The baseline projects comprise mostly of programmes of government agencies, private entrepreneurs, local self-government institutions, CBOs and research institutions in HRML relevant to biodiversity, poverty reduction and natural resource use. These programs form the bulk of this project's co-financing and GEF investment is designed to complement these baseline projects for creating a strategic shift in the development paradigm that is currently being pursued in HRML. GEF resources will enable baseline projects to more effectively focus upon and address key challenges to biodiversity governance and multiple use management in HRML.

231. GEF funding will incrementally leverage new skills, practices and technologies through building capacities and demonstration of environment-friendly production practices across identified stakeholders. GEF resources will also be channeled for creating an enabling governance environment for the sustainable management of biodiversity of HRML through upstream policy and legal engagement both national and state level. The GEF finance will be aligned in such a manner that the co-financing through baseline projects will be utilized in

sectoral operations in a more biodiversity-friendly manner. GEF financing will provide additional assistance for cross-cutting capacity development and knowledge management that will fill a critical gap in the existing baseline project to enable the replication and scaling up of integrated approaches for biodiversity conservation. The baselines would help identify potential partners particularly the innovators, champions, early receptors, dissidents, early majority, late majority and the laggards in the projects and therefore help focus on developing clear strategies for project implementation. It will also identify areas where the GEF financing does not need to focus with a view to avoid duplication of efforts and resources.

232. In short, the project seeks to put in place collaborative governance and know-how for multiple-use management of mountain landscapes to conserve biological diversity. This will have wider replication potential for other mountainous regions across India. The project will engineer a paradigm shift from current sector based and unsustainable practices to integrated multiple use management of mountain landscapes to deliver global environmental benefits as described in Table below:

Current Practices	Alternatives to be put in place by the project	Expected Additional Benefits
Inadequate management effectiveness of the PA system: a) PAs are too small and do not adequately cover representative biodiversity; and b) management measures in PAs are sub-optimal in terms of addressing the emerging threats.	1. Coverage of PAs in the project landscape expanded by approximately 11,600 ha over the baseline. 2. PA functions improved to account for existing and emerging threats including human-animal conflicts (covering 50,00 ha). 3. Wildlife populations ranging into PA's adjacent landscape (> 400,000 ha) secured—thus indirectly sustaining their ecological integrity.	1. PA systems cover more representative areas of global biodiveristy significance (e.g. *shola*-grasslands). 2. Population status of several globally significant species maintained or increased – e.g. *1. Nilgiri tahr; 2. Grizzled giant squirrel; 3. Tiger;4: Leopard 5: Nilgiri marten 6: Clawless otter 7: Asian elephant;8:Gaur* 3. The prospects of discovering species new to science particularly from lesser known life forms. 4. Production of knowledge about multiple use management of biodiversity rich areas. 5. Expansion of PA network and coverage of more globally significant biodiversity under PA systems. 6. Reduced forest degradation and improved vegetal cover contribute to significant carbon sequestration and improving ecosystem functions.
Limited protection accorded to biological diversity outside the PA systems: Extensive areas of HVBAs and forest fragments face growing threats from unsustainable use and land use change—threatening vital animal movement corridors, habitat loss and degradation.	1. Landscape Level Land-Use and Sectoral Plans developed and a functional cross-sectoral institutional mechanism established for the sustainable management of HRML. 2. Key HVBAs and forest fragments in the project landscape identified, mapped, conservation/ eco-restoration plan prepared and implementation support provided by reorienting baseline investments. 3. Conservation sector staff capacitated on improved conservation practices, collaborative governance, stakeholder engagement, eco-restoration, etc (applicable to PA staff too).	1. Extensive areas of HVBAs and forest fragments (totaling 84,600 hectares) brought under improved conservation management and function as stepping stone corridors/ 'escape routes' ensuring species and genetic flow across the whole of southern Western Ghats. This is particularly important to ensure the survival of high altitude species threatened by climate change (e.g. Black and rufous flycatcher). It is also critical to ensure the survival of species such as tiger and elephant which need large home ranges. 2. Restored HVBAs and forest fragments act the foci for the revival of lost habitats of several threatened and globally significant species (e.g. Great Indian hornbill, *Impatiens* spp). 3. Avoided forest cover loss and augmented ecorestoration contribute to significant carbon sequestration and improving ecosystem functions. 4. The prospects of discovering species new to science particularly from lesser known life-forms.
Production sectors do not adopt	1. Formulation of biodiversity-friendly Sector	1. Production sectors develop capacities for

sustainable practices: a) economic production activities have limited focus, capacities and technologies that are less detrimental to ecology, b) production sectors have limited market opportunities for adopting ecologically sustainable activities.	Plans for mainstreaming biodiversity considerations into production sector practices. 2. Production sector stakeholders capacitated on biodiversity mainstreaming concepts and approaches. 3. Focused implementation support and transfer of knowhow (e.g.energy efficiency options in curing operations) to key production sectors as in designing and implementing biodiversity-friendly production practices. 4. Business models, market mechanisms and branding developed to incentivize sustainable resource use.	mainstreaming biodiversity considerations into their operations and practices across 200,000 ha area—reducing the negative ecological foot print on biodiversity and sustaining critical wildlife blocks. 2. Production sector operations have adverse minimal impacts on the regional ecology and functionality of key ecosystems improves. 3. Adoption of environmentally sound production practices (e.g. energy efficiency options, waste management etc.) leads to reduction in GHG emission. 4. Production of ecologically benign goods and services (e.g. tea, cardamom and tourism) for the consumption of global communities.
Community institutions fail to sustainably govern land and resource use: Community capacities for effective management of natural resources are weakening and livelihoods shrinking.	1. Local self governments and community institutions incorporate improved practices for managing wild resource use to ensure sustainability. 2. Market mechanisms developed (certification for sustainably produced farm products and NTFPs) for sustainable use of natural resources. 3. A holistic governance model based on natural resources developed for the tribal Panchayat at Edamalakkudy.	1. Community incomes augmented, socio-economic situation improved – providing a utilitarian incentive for conservation and improving conservation status and security. 2. Uptake, replication and mainstreaming of community models on improved resource management into legal, policy and programme framework. 3. Improved conservation status of heavily utilized species (i.e. medicinal plants) and conservation of local varieties. 4. Increasing the adaptive capacity and resilience and women and other marginalized communities.

E. COST-EFFECTIVENESS

233. In tune with the GEF Council's guidance on assessing project cost-effectiveness (Cost Effectiveness Analysis in GEF Projects, GEF/C.25/11, April 29, 2005), the PPG team has taken a qualitative approach to identify the most cost-effective strategy for achieving the project objective. Several scenarios for improving the long-term sustainable management of natural resources of HRML's unique biodiversity heritage have been considered, and the prominent three among these are described below.

234. One option would be to continue with the business as usual scenario of pursuing conservation objectives through the existing PA network. However, the current paradigm of resource management in HRML is complex with diverse baselines, disparate issues, multi-faceted challenges, divergent governance models, and varied stakeholder interests; most of which are emanating from outside the PA network. Notwithstanding several initiatives undertaken so far, mostly by the government, the natural resource governance in the region remains weak due to limited inter-sectoral coordination on developmental decisions, knowledge and capacity gaps, institutional barriers, limited technology support, poor realization of economic potential of natural resources, limited integration of policies and actions across line agencies on resource management, unclear mandate of community institutions on sustainable resource management, etc. Further, a major challenge in this regard is supporting/ mobilizing community institutions to take up effective resource management. This has been found to be a tough proposition in the conventional approach. In the business-as-usual scenario, this trend is likely to remain the same or may even worsen especially in the context of fast developments taking place in the landscape. Furthermore, even if this approach were to succeed, given the escalating threats from anthropogenic activities in the wider landscape, irreparable losses of existing values, option values and future use values could still result.

235. Moreover, the existing PA network provides only sub-optimal coverage of representative biodiversity in the region and does not encompass the entire range of ecological and biological values of HRML. Large chunks of biodiversity rich areas lie outside the purview of the PA system and often are embedded in economic production systems. As a result, efforts to strengthen the management effectiveness of existing PAs alone are unlikely to yield significant conservation dividends. Hence, to continue with the single-sector approach, wherein the conservation sector focuses solely on the existing PAs is considered less likely to succeed and critical biodiversity and ecosystem values will continue to erode.

236. A second option would be to expand the territorial extent of the PAs, which might provide greater security for biodiversity values. This approach surely has some potential, but may not be a complete solution in itself given the development pressures and competing economic and livelihood interests. It may be feasible to expand HRML's PA network to some extent, but a large extension of the PA system is unlikely to gain the necessary community and political support to succeed. Keeping this in mind, the project design proposes to expand the PA network to the extent possible in a pragmatic way. However, this approach needs a strong compliment of engaging with economic production sectors on mainstreaming biodiversity into sectoral practices. The conventional approach to resource governance in HRML does not factor-in this aspect which is a critical lacuna.

237. It is in this context that a third option – 'the landscape approach' was considered and found most appropriate, feasible and cost effective. This approach will focus on a cogent and integrated planning framework for natural resource governance departing from the current sector based planning so that baseline policies and practices of economic production sectors related to resource use are influenced and aligned in tune with the ecological imperatives of HRML. This will demonstrate the possibilities for integrating biodiversity conservation into land use planning and decision making in production sectors located in HRML. *Inter alia*, these include adopting a landscape-level, biodiversity-friendly mainstreaming approach that will cover PAs, HVBAs, tea, cardamom, tourism, commercial forestry, subsistence and other livelihood activities, as well as a more detailed sector-by-sector biodiversity-friendly planning approach for each of these sectors. Improved management effectiveness of the PA system (including expansion of PA system) will be embedded within the Landscape Plan in a manner that conservation, livelihoods, and production sectors are engaged on an equal footing and are co-partners of the process. Further, by adopting a demonstration approach, the project design promotes rational use of project resources and gives emphasis on influencing baseline investments in the landscape. Special care has been taken to identify the gaps in the baseline investments and project will try to support these deficient areas to further the project objectives. Besides, it is presumed that the project results will act as replicable reference points for adopting similar approaches in other parts of the country.

238. This third option is considered to be the most cost-effective deployment of GEF resources because it will ensure that investments in the conservation sector are not compromised by threats emanating outside. Furthermore, the cross-sectoral approach is considered more likely to succeed in bringing competing interests to the table and beginning the dialogue necessary to conserve the biodiversity values of HRML. In line with the precautionary principle, this option will avoid further degradation of ecosystem values and services, which once lost could be prohibitively costly to restore. Finally, in developing the project, lessons learned from similar initiatives (as noted earlier in the document) have been considered and incorporated into project design to ensure that GEF resources are efficiently deployed.

239. Since 1992, GEF has supported similar catalytic investments in India to improve its cost-effectiveness in generating global environmental benefits (GEB). This project will expand India's previous grant portfolio, leading to improved cost-effectiveness. This project will build upon cost-effective implementation and management practices and baselines already set in the country. The project will seek new efficiencies in the conservation sector's

proven capacity to deliver positive environmental results in a cost-effective manner. This will be done in terms of grant review, disbursement and evaluation/monitoring.

F. Country Ownership: Country Eligibility and Country Drivenness

240. The project is directly relevant to, supportive of, and consistent with India's national priorities and policies related to global environmental issues and development priorities. To promote conservation and sustainable use of biodiversity and natural resources, India has an extensive body of constitutional provisions, laws and policies. India is signatory to various international conventions and treaties related to environmental protection and has also taken numerous initiatives towards implementation. India ratified the Convention on Biological Diversity on 18 February 1994. India is a recipient of UNDP technical assistance and notified its participation in the GEF on 12 May 1994. It is thus eligible according to Article 9 (b) of the GEF instrument to receive GEF funding.

241. The key elements of India's National Biodiversity Action Plan (2008) include: strengthening and integration of in situ and on-farm conservation; augmentation of natural resource base and its sustainable utilization; improved regulation of invasive species; assessment of vulnerability and adaptation to climate change and desertification; integration of biodiversity concerns in economic and social development; development of biodiversity databases; strengthening implementation of policy, legislative and administrative measures for biodiversity conservation and management; building of national capacities for biodiversity conservation and appropriate use of new technologies; valuation of goods and services provided by biodiversity and use of economic instruments in decision making processes.

242. Similarly, the National Action Plan on Climate Change (2008) comprising of eight National Missions (National Solar Mission, National Mission on Enhanced Energy Efficiency, National Mission on Sustainable Habitat, National Water Mission, National Mission for Sustaining Himalayan Eco-System, National Mission for Green India, National Mission for Sustainable Agriculture and National Mission on Strategic Knowledge for Climate Change) provides multi-pronged, long-term and integrated strategies for addressing climate change.

243. Other relevant national policies, legislation and guidelines relevant to this project are: the Biological Diversity Act of 2002, National Environmental Policy, 2006 National Forest Policy of 1988, Indian Forest Act of 1927 and related state legislation, Forest (Conservation) Act of 1980, Wildlife (Protection) Act of 1972, Environmental Act of 1986, The Environment Impact Assessment Notification of 2006, National Wildlife Action Plan (2002-16), National Water Policy (2002), National Conservation Strategy and Policy Statement on Environment and Development (1992), Policy Statement on Abatement of Pollution (1992), National Tourism Policy (1998), National Agricultural Policy (2000), The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, National and State Joint Forest Management orders and rules etc.

244. The project is in conformity with the national policy and legal framework and shall further support the implementation of these in the national and sub-national context. India is a signatory to the UN Convention on Biological Diversity (UNCBD), UN Framework Convention on Climate Change (UNFCCC) and also the UN Convention to Combat Desertification (UNCCD).

G. Sustainability and Replicability

245. The project is envisioning a radical shift in the biodiversity governance of HRML that has significant potential for influencing the natural resource paradigm across the country.

Hence, great stress has been given to sustaining the project initiatives and outcomes and this is reflected in the project design as an integral element.

246. Ecological sustainability: The project initiatives will provide long-term security for the globally significant biodiversity of HRML by reinforcing the management effectiveness of PA system and other HVBAs, mainstreaming biodiversity considerations into the operations of economic production sector and supporting sustainable livelihoods in the subsistence sector. The project ensure ecological sustainability in HRML through the following key measures: (i) production of knowledge base on the biodiversity values of HRML that will provide guidance to policy and programme managers for taking informed decisions on resource use; (ii) facilitate the development of a landscape-level land use plan that will look at current land use in the project area and will then provide a road map for how land uses/ production practices by the different sectors can be made more compatible with the conservation needs of HRML; (iii) helping individual sectors to develop biodiversity-friendly sector plans to factor in biodiversity concern in sectoral operations; (iv) putting in place a cross-sectoral institutional mechanism to promote cross-sectoral dialogue and joint actions by different sectors that operate in the landscape for pre-programme planning and concurrent and post project monitoring; (v) develop capacities of conservation and key production sector institutions (tea, cardamom and tourism) to implement biodiversity-friendly sector plans; (vi) improve the management effectiveness of existing PA system; (vii) expansion of the PA system by 30 percent over the baseline; (viii) develop community based micro plans for sustainable natural resource use along with capacity building and other technical assistance to implement these plans, (ix) develop markets and branding for produce from conservation-friendly production systems; (x) strengthen the management planning process in HRML and devise strategies for addressing new generation threats to biodiversity such as climate change, invasive species etc.

247. Financial sustainability: HRML has significant baseline investments related to the objectives of the project. One of the main aims of the project is to influence these investments and investment decisions so as to make them more conservation-friendly. This will be an 'inbuilt' financial sustainability strategy for the project. Further, in order to ensure that biodiversity mainstreaming approaches identified under the project can be financially sustained post project, financial sustainability strategy will be made part of the landscape-level land use plan. The financial strategy will look at a mix of approaches such as re-alignment of existing government budgetary resources, generation/ re-allocation of user fees generated within the conservation and production sectors, and/ or mobilizing new resources. In terms of the livelihoods/ subsistence sector, the project will promote sustainable resource use based on economic feasibility assessments to ensure that such livelihoods are sustained over the long-term.

248. Institutional sustainability: To ensure that prevailing structures and processes set in motion by the project have the capacity to continue to perform their functions over the long term, the project will devote significant resources to capacity development. Capacity development will be based on comprehensive needs assessments targeting all key stakeholders that directly or indirectly impact the biodiversity of HRML. To ensure that training support can continue post-project, efforts will be made to associate the training curriculum and resource persons with existing training institutions. Further, the project promotes developing Trainers at the local level so that capacities are retained at the landscape itself and will be available post project. For instance, training content related to the conservation sector could be integrated with the KFRI, School of Social Sciences, Periyar Foundation etc. Local NGOs and research institutions will also be included in project activities based on their comparative advantages and this will help build a broader constituency for conservation. Further, the most crucial factor for the institutional sustainability would be the formation of HRSDS (the multi-sectoral institutional platform) which will be capacitated adequately during the course of project implementation, to steer the processes initiated by the project even after the project comes to a close.

249. Social sustainability: The project gives maximum emphasis to building social capital among women and tribal groups. To ensure that social exclusion is minimized and social equity maximized, project activities targeting the livelihoods/ subsistence sector will be founded on extensive stakeholder participation. Existing networks of community organizations will be targeted towards this. The stress will be given to revitalize existing institutions rather than establishing new ones. The project will target the institutions operating at the community level to enable them to actively participate in developing and implementing activities to ensure continuity and replicability once the project is completed. A horizontal method of capacity building called Community to Community Training (CTCT) will be adopted to disseminate the lessons learnt during the project implementation. This involves organization and conduct of training programmes by the Task Teams of one village for other village communities. Further, the project shall promote community based economic enterprises of scale based on sustainable resource use that will augment the social security of marginalized communities. Of particular relevance in this regard is a separate Output (3.3) that aims at developing a holistic resource governance model for one of the remote and backward tribal Panchayat in the project landscape.

Replicability

250. There are various aspects of project design that facilitate replication. First, facilitating replication of similar landscape approaches for resource governance in other mountainous areas of the country is an important intent of the project. The project has a separate Output (1.5) towards realizing this. This Output will support identification of viable meso-level mountain landscapes for piloting similar approaches across the Himalayas, the Western and Eastern Ghats, Vindhyas, Aravallis, Central Indian High lands, and North-East. It is also proposed to develop HRML as a 'learning centre' for further replication of similar approaches in other areas and states (through technical backstopping), exposure visits and training to stakeholders from other regions. It is envisioned that by the project end, there will be well-informed replication strategies for incorporating biodiversity and ecosystem values into land use planning and management in at least 3,000,000 ha of mountain landscapes in the country.

251. Second, the project will strengthen the enabling environment for biodiversity mainstreaming into production sectors by proposing amendments and methodological guidelines to complement existing policies so that they are more explicit on mainstreaming of biodiversity conservation considerations (Output 1.6). Third, the project will undertake research studies to address key knowledge gaps that impede mainstreaming of biodiversity conservation considerations in the activities of production sectors (Outputs 1.1). These studies as well as the lessons learned will be widely disseminated. Fourth, the project's capacity building efforts (under Outputs 2.1 and 3.1) will be internalized with identified training institutions so that this can become an accessible resource to other mountain areas where there is interest in replicating the project approach. Training programs will be accompanied by handbooks/ manuals/ compendiums. Towards the latter phase of the project, efforts will be made to replicate good practices in India's other mountainous areas by training stakeholders on various aspects of mainstreaming biodiversity conservation.

III: Strategic Results Framework

This project will contribute to achieving the following Country Programme Outcome as defined in the CPAP for India (2008-2012): Outcome 4.3 Progress towards meeting national commitments under multilateral environmental agreements; and Output 4.3.2 National efforts supported towards conservation and management of natural resources

Country Programme Outcome Indicators: Output 4.3.2 Indicator: Number of new joint initiatives undertaken for integrated biodiversity conservation

Primary applicable Key Environment and Sustainable Development Key Result Area: 1. Mainstreaming environment and energy

Applicable GEF Strategic Objective and Program: Strategic Objective 2 – To mainstream biodiversity in production landscapes/ seascapes and sectors; Strategic Priority 4 – Strengthening the policy and regulatory frameworks for mainstreaming biodiversity

Applicable GEF Expected Outcomes:

Applicable GEF Outcome Indicators:

Project Strategy	Indicator	Baseline	Targets[135]	Means of verification	Risks and Assumptions
The long-term goal to which the project will contribute is the sustainable management of the globally significant mountain biodiversity of India by mainstreaming biodiversity conservation considerations into production sectors, while also taking into account development imperatives, need for sustaining livelihoods and also addressing retrogressive factors including the anticipated impacts of climate change.					
Immediate Objective: To protect biodiversity of the High Range Mountain Landscape of the southern Western Ghats in peninsular India from existing and emergent threats through building an effective collaborative governance framework for multiple use management.	Extent brought under multiple use management planning framework	0 ha	300,000 ha	Mid-term and Final Technical Evaluation	Limited support from production sector due to apprehension that their economic interests would be jeopardized due to participation in the planned conservation interventions The population dynamics of flora and fauna may depend on various extraneous factors over which project may have little control.
	Population status of following critical species remain stable or increases: Nilgiri tahr Grizzled giant squirrel Tiger	 944 195 34	Remain stable or increases by project end	Monitoring reports, Population estimation reports, Publications of National Tiger Conservation Authority	
	Percentage increase in habitats categorized as high conservation value over the baseline.[136]	PA: 207.5 km^2 Non-PAs: 846 km^2	10% increase by mid-term and 20 % by project end. 10 % increase by mid-term and 15% by project end	Mid-term and Final Technical Evaluation	
	Improvements in water quality in the water bodies of the landscape	BOD -1.5 mg/l at Neriamangala	10% improvement by project end.	Monitoring reports, Administrative reports of Pollution	

[135] The time frame for realizing project targets is project end (2018), unless otherwise specified.
[136] Baseline values of conservation zones are given in Table 14 of the Project Document.

		mand 1.4 mg/l at Bhoothathankett		Control Board, Kerala State Council for Science and Environment	
Outcome 1: Effective governance framework for multiple-use mountain landscape management in place	Landscape Level Land use Plan (LLLUP) developed adhering to multiple use management decisions	0	1	Approved Plan document	Policy amendments and regulations for addressing biodiversity conservation in sector practices may not receive government and political support
	Sector-specific biodiversity-plans compatible with LLLUP developed leading to effective integration of biodiversity considerations into production practices	0	At least six Sector Plans (Forestry, Tourism, Tea, Cardamom, Agriculture and Tribal Development) and Biodiversity Conservation Plans (5) in place	Approved Sector Plan documents Approved Biodiversity Conservation Plans	Stakeholders may perceive the project as restrictive rather than enabling due to its focus on biodiversity and a cautious approach towards normal development
	Effective and functioning cross-sectoral, multi-stakeholder institution (including conservation, livelihood and production) established.	0	1	Government Orders or notifications, meeting records	Non PA forest Divisions will have work on conservation plans outside the regular Working Plan system, for which a process is laid down. However this aspect is latent or non- existent
	Number of key policy and management framework/ decisions adopted at local and state level related to sustainable mountain landscape management	0	7 (Wildlife Protection Act, Forest Conservation Act, Environment Protection Act, Forest Rights Act, Cardamom Rules, KDH Act, Land Assignment Act, Commodities Act), National Working Plan Code and other Management decisions	Policy briefs Relevant GOs & notifications	Local policies, processes and management decisions related to forest and production sectors may not lead to land/ resource-use change in favour of biodiversity conservation

<table>
<tr>
<td></td>
<td>Improvement in Systemic Level Indicators of <u>Capacity Development Scorecard</u> (Annex 19)</td>
<td colspan="2">
<table>
<tr><td>SYSTEMIC LEVEL</td><td>B/L</td><td>Tgt.</td></tr>
<tr><td>1. Capacity to conceptualize and formulate policies, legislations, strategies, programme</td><td>40%</td><td>80%</td></tr>
<tr><td>2. Capacity to implement policies, legislation, strategies and programmes</td><td>33%</td><td>80%</td></tr>
<tr><td>3. Capacity to engage and build consensus among all stakeholders</td><td>15%</td><td>80%</td></tr>
<tr><td>4. Capacity to mobilize information and knowledge</td><td>35%</td><td>80%</td></tr>
<tr><td>5. Capacity to monitor, evaluate and report and learn at the sector and project levels.</td><td>30%</td><td>80%</td></tr>
</table>
</td>
<td>Mid-term and Final Evaluation</td>
<td></td>
</tr>
<tr>
<td rowspan="2">Outcome 2:
Multiple use mountain landscape management is applied securing the ecological integrity of HRML</td>
<td>Improved management effectiveness PAs as measured and recorded by Management Effectiveness Tracking Tool (METT)</td>
<td>168 out of 300</td>
<td>Increase in METT scores by 10 percent by year 3
By 20 percent by year 5</td>
<td>METT scorecard prepared annually. Independent mid-term and final evaluations</td>
<td rowspan="2">The benefits generated by the project may be offset by the impacts of climate change

Resources of the project are insufficient for meeting the objectives over the large area of landscape</td>
</tr>
<tr>
<td>Increase in area under PA system</td>
<td>37,100 ha</td>
<td>Increase by 11,500 ha</td>
<td>Project Reports; Independent mid-term and final evaluations</td>
</tr>
<tr>
<td colspan="6">Project Outputs</td>
</tr>
</table>

Output 1.1	Strengthened knowledge generation and dissemination system improves decision making related to sustainable land and resource use
Output 1.2	Landscape level land- use plan prepared and sustainable resource management systems in place
Output 1.3	Biodiversity considerations are mainstreamed into sector plans and practices
Output 1.4	A dedicated cross sectoral landscape level institutional platform ensures sectoral compliance with management prescriptions of Landscape and Sector Plans
Output 1.5	Replication strategy developed for multiple use management of mountain landscapes
Output 1.6	Policies and legal framework reviewed and harmonized for ensuring sustainable management of mountain landscapes
Output 2.1	Capacities developed among conservation and production sector staff for applying landscape approaches to biodiversity conservation into sectoral operations
Output 2.2	Management effectiveness of PA system strengthened to address existing and emerging threats to PA systems
Output 2.3	HVBAs secured through improved conservation focus and interventions
Output 2.4	Biodiversity mainstreaming demonstrated in key production sectors
Output 3.1	Community based organizations (Panchayats, JFMCs, Self Help Groups (SHGs)) have adequate capacities to plan sustainable resource use
Output 3.2	Support to sustainable resource use practices accentuate positive resource dependency
Output 3.3	Community-based natural resource management governance model for the unique tribal local self-government (Edamalakudy Panchayat)

IV: TOTAL BUDGET* AND WORK PLAN

Award ID:							Project ID:				4651	
Award Title:												
Business Unit:					**IND10**							
Project Title:					**India High Range Landscape Project - Developing an effective multiple-use management framework for conserving biodiversity in the mountain landscapes of the High Ranges, Western Ghats, India.**							
PIMS no.:												
Implementing Partner (Executing Agency)/ Responsible partner					Ministry of Environment & Forests (MoEF), Government of India / Department of Forest and Wildlife, Government of Kerala.							
GEF Outcome/Atlas Activity	**Responsible Party/ Implementing Agent**	**Fund ID**	**Donor Name**	**Atlas Budgetary Account Code**	**Atlas Budget Description**	**Total**	**Amount Year 1 (USD)**	**Amount Year 2 (USD)**	**Amount Year 3 (USD)**	**Amount Year 4 (USD)**	**Amount Year 5 (USD)**	**Budget Note**
Outcome 1 Effective	MoEF	62000	GEF	71300	Local consultants	517,100	51,710	108,591	113,762	118,933	124,104	1
				71200	International Consultants	35,000	3,500	7,350	7,700	8,050	8,400	2

governance framework for multiple-use mountain landscape management in place				72100	Contractual Services-Companies	7,000	700	1,470	1,540	1,610	1,680	3
				71600	Travel	78,000	7,800	16,380	17,160	17,940	18,720	4
				74500	Meetings and Consultations	44,000	4,400	9,240	9,680	10,120	10,560	5
				72200	Material and goods	5,000	500	1,050	1,100	1,150	1,200	6
				74200	Audio-visual and printing production costs	59,000	5,900	12,390	12,980	13,570	14,160	7
				72200	Equipments	5,000	500	1,050	1,100	1,150	1,200	8
TOTAL OUTCOME 1						750,100	75,010	157,521	165,022	172,523	180,024	
Outcome 2 Multiple-use mountain landscape management is applied securing the ecological integrity of HRML	MoEF	62000	GEF	71300	Local consultants	13,000	1,300	2,730	2,860	2,990	3,120	9
				71200	International Consultants	0	0	0	0	0	0	
				72100	Contractual Services-Companies	3,277,600	327,760	688,296	721,072	753,848	786,624	10
				71600	Travel	105,000	10,500	22,050	23,100	24,150	25,200	11
				74500	Meetings and Consultations	50,000	5,000	10,500	11,000	11,500	12,000	12
				74200	Audio-visual and printing production costs	55,000	5,500	11,550	12,100	12,650	13,200	13
TOTAL OUTCOME 2						3,500,600	350,060	735,126	770,132	805,138	840,144	
Outcome 3 Strengthened capacities for community based sustainable use and management of wild resources	MoEF	62000	GEF	71300	Local consultants	138,000	13,800	28,980	30,360	31,740	33,120	14
				72100	Contractual Services-Companies	1,340,700	134,070	281,547	294,954	308,361	321,768	15
				71600	Travel	100,000	10,000	21,000	22,000	23,000	24,000	16
				74500	Meetings and Consultations	50,000	5,000	10,500	11,000	11,500	12,000	17
				74200	Audio-visual and printing production costs	50,000	5,000	10,500	11,000	11,500	12,000	18
TOTAL OUTCOME 3						1,678,700	167,870	352,527	369,314	386,101	402,888	
Project Management	MoEF	62000	GEF	71400	Project Manager (NPMU)	98,000	9,800	20,580	21,560	22,540	23,520	19
				71400	Project Coordinator (SPMU)	98,000	9,800	20,580	21,560	22,540	23,520	20
				71400	Financial cum Admin Assistant (SPMU)	39,700	3,970	8,337	8,734	9,131	9,528	21
				71400	Office Assistants (SPMU)	32,400	3,240	6,804	7,128	7,452	7,776	22
				72400	Office facilities, equipment and communications (NPMU)	5,000	500	1,050	1,100	1,150	1,200	23
				72400	Office facilities, equipment and communications (SPMU)	10,000	1,000	2,100	2,200	2,300	2,400	24
				71600	Travel (SPMU)	6,887	689	1,446	1,515	1,584	1,653	25
				74599	Direct Project Costs (DPC)	55,613	6,359	15,273	12,027	11,504	10,451	26
TOTAL PROJECT MANAGEMENT						345,600	34,560	72,576	76,032	79,488	82,944	
TOTAL GEF ALLOCATION						6,275,000	627,500	1,317,750	1,380,500	1,443,250	1,506,000	
Budget Note	Explanation											

1**	This include the cost of technical consultants (national) for undertaking research gap analysis (4 weeks @ USD 700 per week), carrying out various research programmes (430 weeks @ USD 700 per week), preparation of Landscape Plan (50 weeks @ USD 700 per week), preparation of Compendium on Best Practices in Mainstreaming (2 weeks @ USD 700 per week), various Sectoral Plans (30 weeks @ USD 700 per week), legal expert for drafting the constitution of HRSDS (5 weeks @ USD 700 per week), mid-term evaluation (6 weeks @USD 700 per week), final evaluation (6 weeks @ 700 per week) replication strategy (5 weeks @ USD 700 per week), legal expert for harmonizing various legal and policy framework (15 weeks @ USD 700 per week) and the engaging the Conservation Biologist (7 months @ USD 1000 per month), Socio-economic and Livelihood Specialist (7 months @ USD 1000 per month) and Communication and Outreach Expert (8 months @ USD 1000 per month) for undertaking various research programmes and activities through Output 1.1 to 1.6. , one Technical Coordinator at the national level to supervise the preparation and generation of knowledge products and guide the cross-sectoral planning process (54 months @approx. USD 2000 per month)
2	This include the cost of international technical consultants for undertaking mid-term evaluation (4 weeks @USD 3500 per week) and final evaluation (6 week @ USD 3500 per week), under Output 1.4.
3	This includes subcontracts to host the inception workshop (USD 7,000) under the Output 1.4.
4	This include the travel cost of technical consultants (national) for undertaking research gap analysis (2 trips @ USD 500 per trip), carrying out various research programmes (90 trips @ USD 500 per trip), preparation of Landscape Plan (8 trips @ USD 500 per trip), various Sectoral Plans (20 trips @ USD 500 per trip), legal expert for drafting the constitution of HRSDS (3 trips @ USD 500 per trip), mid-term evaluation (2 trips @ USD 3000 per trip), final evaluation (2 trips @ USD 3500 per trip), replication strategy (2 trips @ USD 500 per trip), legal expert for harmonizing various legal and policy framework (5 trips @ USD 500 per trip) under Output 1.1 to 1.6.
5**	This include the cost of conducting various meetings and consultations related to undertaking research gap analysis (4 meetings @ USD 500 per meeting), carrying out various research programmes (30 meetings @ USD 500 per meeting), preparation of Landscape Plan (8 meetings @ USD 500 per meeting), various Sectoral Plans (30 meetings @ USD 500 per meeting), legal expert for drafting the constitution of HRSDS (5 meetings @ USD 500 per meeting), replication strategy (1 meeting @ USD 500 per meeting), legal expert for harmonizing various legal and policy framework (10 meetings @ USD 500 per meeting) under Output 1.1 to 1.6.
6	This includes the cost of procuring necessary material and goods for the functioning of the HRSDS Office for five years under Output 1.4.
7	This include the cost of procuring audio-visual reproduction production and printing of the materials such as the research gap analysis (USD 1000), research Outcomes (USD 16300), preparation of knowledge products (USD 25,000), Landscape Plan and Compendium of Best Practices on Mainstreaming (USD 2000), various Sectoral Plans (USD 13,200), replication strategy (USD 500), harmonizing various legal and policy framework (USD 1000) under Output 1.1 to 1.6.
8	This includes the cost of procuring computers, printers and other accessories for the functioning of HRSDS for five years under Output 1.4.
9	This includes the cost of technical consultants (national) for mapping of HVBAs (USD 10,000) engaging the Conservation Biologist (1 month @ USD 1000 per month), Socio-economic and Livelihood Specialist (1 month @ USD 1000 per month) and Communication and Outreach Expert (1 month @ USD 1000 per month) for undertaking various activities under Output 2.1 to 2.4.
10**	This includes the cost of sub-contracting technical agencies for support to capacity building of conservation and production sector staff (100 programmes @ USD 1000 per programme), support to conservation sector for expansion of PA system (USD 200,000), support to conservation sector for improving PA Management Effectiveness (11,70,000), support to conservation sector for implementation support to HVBAs (USD 767,600), and implementation support to production sector activities (USD 1040,000) under Outputs 2.1 to 2.4. The details of the activities are given in project Output descriptions and also in Annexure 16.
11	This include the travel cost for sub-contracting technical agencies for support to capacity building of conservation and production sector staff (100 travel @ USD 1000 per trip) and for mapping of HVBAS (10 travel @ USD 500 per trip) under Outputs 2.1 and 2.3.
12	This includes the cost of conducting meetings and workshops as part of the capacity building of conservation and production sector staff (100 consultations @ USD 500 per meeting) under Outputs 2.1.

13	This includes the audio-visual and printing costs related to capacity building of conservation and production sector staff (USD 50,000) and for mapping of HVBAS (USD 5000) under Outputs 2.1 and 2.3.
14**	This include the cost of engaging Conservation Biologist (46 months @ USD 1000 per month), Socio-economic and Livelihood Specialist (46 months @ USD 1000 per month) and Communication and Outreach Expert (46 months @ USD 1000 per month) for undertaking capacity building of communities, support to sustainable resource use practices and support to Edamalakudy Panchayat on sustainable resource governance model through Output 3.1 to 3.3.
15	This include the cost of implementation support to community institutions for undertaking various activities identified through the micro-planning process, engaging expert agencies for impacting specific skills as part of undertaking capacity building of communities (100 programmes @ USD 500), implementation support to sustainable resource use practices (USD 912,000) and implementation support to Edamalakudy Panchayat on sustainable resource governance model (USD 378,700) through Output 3.1 to 3.3.
16	This includes the travel costs related to capacity building communities (100 travel @ USD 1000) under Output 3.1.
17	This includes the cost of organizing meetings and consultations related to capacity building communities (100 meetings @ USD 500) under Output 3.1.
18	This includes the costs of printing training materials and knowledge products related to capacity building communities (USD 50000) under Output 3.1.
19	Annex C provides details on total weeks, weekly rate and terms of reference for this consultant.
20	Annex C provides details on total weeks, weekly rate and terms of reference for this consultant.
21	Annex C provides details on total weeks, weekly rate and terms of reference for this consultant.
22	Annex C provides details on total weeks, weekly rate and terms of reference for this consultant.
23	Facilities and communications (internet, landlines, cell phone service) for management purposes (estimated at approximately $80/ month)
24	Facilities and communications (internet, landlines, cell phone service) for management purposes (estimated at approximately $160/ month)
25	Management-related travel to project site for staff in the SPMU
26	Direct project cost as applicable

Note: * The exchange rate at the time of submission of the proposal to GEF has fluctuated considerably. The budget may require a revision under different heads if it changes further.

** This project is undertaking pioneering work. A significant part of the project aims at extending technical assistance to implement the main components of the project that would requires high quality professional service. The amounts mentioned in the budget are mere estimates. These figures may require upward revision to enable procurement of services at higher rates that will be commensurate with qualifications and experience. However, the overall budget of the project will remain same.

OUTCOME	OUTPUT NUMBER	OUTPUT	BUDGET (GEF resources, USD)
Outcome 1: Effective governance framework for multiple-use mountain landscape management in	Output 1.1	Strengthened knowledge generation and dissemination system improves decision making related to sustainable land and resource use	517,100
	Output 1.2	Landscape level land- use plan prepared and sustainable resource management systems in place	52,400

place	Output 1.3	Biodiversity considerations are mainstreamed into sector plans and practices	65,200
	Output 1.4	A dedicated cross sectoral landscape level institutional platform ensures sectoral compliance with management prescriptions of Landscape and Sector Plans	83,900
	Output 1.5	Replication strategy developed for multiple use management of mountain landscapes	9,500
	Output 1.6	Policies and legal framework reviewed and harmonized for ensuring sustainable management of mountain landscapes	22,000
Sub-total Outcome 1			**750,100**
Outcome 2: Multiple-use mountain landscape management is applied securing the ecological integrity of HRML	Output 2.1	Capacities developed among conservation and production sector staff for applying landscape approaches to biodiversity conservation into sectoral operations	303,000
	Output 2.2	Management effectiveness of PA system strengthened to address existing and emerging threats to PA systems	1,370,000
	Output 2.3	HVBAs secured through improved conservation focus and interventions	787,600
	Output 2.4	Biodiversity mainstreaming demonstrated in key production sectors	1,040,000
Sub-total Outcome 2			**3,500,600**
Outcome 3: Strengthened capacities for community based sustainable use and management of wild resources	Output 3.1	Community based organizations (Panchayats, JFMCs, Self Help Groups (SHGs)) have adequate capacities to plan sustainable resource use	310,000
	Output 3.2	Support to sustainable resource use practices accentuate positive resource dependency	972,000
	Output 3.3	Community-based natural resource management governance model for the unique tribal local self-government (Edamalakudy Panchayat)	396,700
Sub-total Outcome 3			**1,678,700**
Sub Total NPMU			103,000
Sub Total SPMU			186,987
DPC			55,613
Sub Total Project Management			**345,600**
GRAND TOTAL			**6,275,000**

V: Management Arrangements

Project Implementation Arrangements

252. The project will be executed under Direct Implementation Modality (DIM), according to the Standard Basic Assistance Agreement between UNDP and the Government of India, and the Country Programme Action Plan (CPAP). The project is financed with funding from the GEF co-financed by the Ministry of Environment and Forests and the Kerala State Government. UNDP acts as the GEF Executing Agency.

253. **Implementing Partner (IP):** The project will be directly implemented by UNDP in close cooperation with Ministry of Environment and Forests (MoEF). UNDP and the Ministry of Environment and Forests will be responsible for the effective use of resources and the achievement of the project outcomes and outputs as set forth in the document. The Ministry of Environment and Forests will designate a nodal officer for the project. UNDP will be responsible for all financial management, reporting, procurement and recruitment services. UNDP recruitment and procurement rules will apply.

254. **Project Steering Committees:** Oversight of project level activities will be provided by the Project Steering Committees (PSC). There will be two Steering Committees - one, at the national level and the other, at the State level.

255. **National Project Steering Committee (NPSC)** will be jointly chaired by a senior official from UNDP and the Additional Director General of Forests (Wildlife), Ministry of Environment and Forests. The NPSC will comprise the Inspector General of Forests (Wildlife), Operational Focal Point of Global Environment Facility (GEF – OFP), Joint Secretary (in charge of Biodiversity), Joint Secretary (in charge of Mountains), representatives from Ministry of Agriculture, Ministry of Commerce, Tourism, Ministry of Rural Development, Ministry of Tribal Affairs, Ministry of Panchayati Raj, Ministry of New and Renewable Energy, Chairman, National Biodiversity Authority, the Chief Wildlife Warden, Kerala; two representatives of UNDP; and two non-government representatives (including one from private sector/ industries) nominated jointly by the MoEF and UNDP. The Chairmen can also invite other officials and experts to the NPSC meetings on as-needed basis. The NPSC will be responsible for overall programme effectiveness and relevance for policy. The NPSC will also be responsible for approving the budgeted AWPs forwarded by the State and providing overall guidance and oversight on policy matters. NPSC meeting will be convened at least once a year. But efforts will be made to organise quarterly/half yearly meetings to ensure regular follow up.

256. **State Project Steering Committee (SPSC)** will be established in the state with representation from key state Departments/ Agencies to direct and oversee project implementation and management at the state level. SPSC will be jointly chaired by the Chief Secretary, Kerala and a senior official from UNDP. The Chief Wildlife Warden, Kerala shall be the ex-officio Secretary. Other members will include representatives of the relevant State Departments, Finance (Expenditure), Planning Board, Agencies, representatives of MOEF which include the GEF OFP and the JS-Mountains and other stakeholders including private sector/ industries nominated by the State Government. The SPSC shall meet at least twice a year to review the progress of project implementation and take corrective measures where required for the smooth implementation of the project. The SPSC shall ensure that key officials involved in the project will have sufficient tenure for effective functioning. Further, SPSC may also constitute a Working Committee under the chairmanship of Secretary; Forests take necessary administrative decisions on a regular basis. The SPSC should recommend to line departments specific actions in the form of administrative decisions and resource allocation which will compliment project activities to meet the broader developmental outcomes. The SPSC should monitor the co-financing commitments and should make efforts to ensure that developmental and scheme commitments of the state towards the project are meet.In addition, both the PSCs will be responsible for regular project reviews to ensure that the agreed deliverables are produced satisfactorily according to plans and timelines; assess and decide to proceed

on project changes through appropriate revisions and arbitrate on any conflicts within the project or negotiate a solution to emerging problems.

257. In order to ensure UNDP's ultimate accountability, PSC decisions will be made in accordance with standards that shall ensure management for development results, best value for money, fairness, integrity, transparency and effective international competition. In addition, the PSC plays a critical role in project evaluations are of a high quality and using evaluations for performance improvement. The developmental outcomes that the project seeks to achieve requires supportive action by related Ministries and Departments, so both the Project Steering Committees will be expected to advocate for these developmental initiatives.

258. **National Project Management Unit (NPMU)** will be the administrative hub for the project will be supported with one full-time Project Manager (PM). PM shall report to the MoEF Nodal Officer and UNDP Country Office on all matters related to project implementation. The Project Manager will assist in coordinating with the State Government of Kerala, UNDP, State Nodal Officer, LLPMU and other agencies and Stakeholders. The NPMU shall also coordinate exchange of information and also open channels of communication with other similar programmes/ projects in the country for ensuring synergy and initiating upstream policy engagements. The NPMU will also include a Technical Coordinator and a Financial cum Admin Assistant. See Annexure for Terms of Reference of local project management staff, as well as local and international consultants that will provide technical services.

259. **State Nodal Officer:** Government of Kerala will designate an appropriate officer above the rank of Chief Conservator of Forests (preferably who is in charge of the project landscape) as the State nodal officer. The State Nodal Officer will be responsible for overall implementation of the project at the State level, including adherence to the AWP and achievement of planned results as outlined in the Project Document, and for the use of project funds through effective management and well established project review and oversight mechanisms. The State Nodal officer will head the Landscape Level Project Management Unit (LLPMU) and ensure coordination with UNDP, MoEF, various Departments and Agencies; provide guidance to the project team; review reports and look after other administrative and financial arrangements related to the project.

260. **Landscape Level Project Management Unit (LLPMU):** The implementation of the project at the landscape level will be carried out through LLPMU. The LLPMU will initially be located in the State Forest Department. Once the High Range Sustainable Development Society (HRSDS) is setup by the project as visualized in output 1.4 of the project document, the LLPMU will be hosted by this society. The HRSDS is envisaged as a cross-sectoral institutional platform and will be a registered body represented by all key stakeholders in the High Range Mountain Landscape (HRML) (including private sector/ industries) and may have a Governing Board, General Body and Advisory Committee. The HRSDS could be registered under the relevant State Act meant for the purpose. Apart from implementing the project, LLPMU may also: 1) develop general policy and overall programmes for the HRML, 2) receive, control, invest and disburse all funds provided for the project, 3) promote research into the scientific, sociological and economic aspects of landscape and integrate into landscape and sector plans, 4) coordinate with different production sectors and other agencies to develop an environmentally sustainable strategic plan for HRML, 5) promote programs for the sustainable livelihood options of the communities dependent on the HRML, and 6) provide a long-term institutional sustainability strategy for the project beyond project period, etc.

261. The LLPMU will engage Subject Specialists (SSs) to extend technical assistance to the project. The LLPMU will comprise of a State Project Coordinator (SPC), Conservation Biologist (1), Socio-Economic and Livelihood Specialist (1), Communication and Outreach specialist (1), and a Financial – cum - Administrative Assistant (FA). Under the direct supervision of State Nodal Officer, the SPC will lead the project team and ensure that the project activities are proceeding as per schedule and facilitate effective implementation of the project. The key responsibilities for the LLPMU will include: 1) coordinating project implementation with all stakeholders, State Government and central government agencies and UNDP-GEF; 2) organizing the project evaluations; 3) ensuring that there is adequate documentation by all implementing partners at all stages and in collating this

documentation; and 4) facilitating the publication of project outputs. LLMPU will also have a Stakeholder Advisory Committee (SAC) comprising of elected representatives and other local stakeholders who shall provide regular guidance and feedback to the project activities.

262. SSs will provide technical leadership and support for the project implementation, monitoring & evaluation, and adaptive management. In addition, there will be support staff for performing the day to day administrative and financial functions of the LLPMU. The key responsibilities of the SSs will include: 1) provide strong technical leadership and strategically important inputs to the project during its implementation 2) provide advice and guidance in the implementation of the project, 3) to ensure that the project achieves its overall objective and outcomes as identified in the project document, 4) provide high levels of coordination during project inception and implementation at landscape and sector levels, 5) ensure sharing and flow of information in a transparent manner among all project stakeholders as appropriate, 6) support the LLPMU in the overall management of the project and to ensure coherence between all components of the project and implementing partners, 7) provide advice and assistance to organize and conduct various consultations, workshops and trainings, 8) provide advice related to the AWPs, 9) participate in the recruitment of subcontractors and consultants, 10) ensure strong quality control and provide advisory support as required, 11) contribute to resource mobilization and development of partnerships to further the objectives of the project, and 12) contribute to the establishment of a monitoring and evaluation plan and system for the project.

263. The National Project Management Unit (NPMU) and Landscape level Project Management Unit (LLPMU) will prepare a budgeted Work Plan on an annual basis, as per UNDP rules and regulations, which will be shared with the Ministry of Environment and Forests for comments and inputs. Approved copy of the AWP will be provided to GEF – OFP India office as well. The AWP will programme both GEF grants and project co-finance approved by GEF CEO.

264. The project results will be reviewed at the Country Programme Management Board (CPMB) comprising DEA and UNDP. The oversight will consist, at a minimum, of a six monthly review (at the end of the second quarter) and an annual strategic review (in the last quarter of the year) between DEA and UNDP. The recommendations from the annual review will be used to update and adjust the annual work plan and budgets for the coming year, if required. UNDP will enter into agreement(s) with other organizations or entities for providing goods and services to the project, carry out project activities and produce project outputs. UNDP will designate an official from UNDP who will work in close consultation with nodal officers designated by the Ministry of Environment and Forests and the State Government. NPMU and LLPMU details are provided in a separate section below. The PM and the SPC will be responsible for the day-to-day management of the programme. They will coordinate the Project activities including the preparation of Annual and Quarterly Work Plans, Budget, Financial Reports, etc. and will interface on project management issues. The PM/ SPC will be responsible for:

- Managing the overall conduct of the project;
- Implementing activities by mobilizing goods and services;
- Checking on progress and watch for plan deviations;
- Regular progress reporting to the PSC;
- Ensuring that changes are controlled and problems addressed;
- Monitoring progress and risks;
- Reporting on progress including measures to address challenges and opportunities.
- Coordinate the Project activities including the preparation of Annual and Quarterly Work Plans, Budget, Financial Reports, etc;
- Capture lessons learnt during project implementation
- Prepare the annual review report, and submit the report to the PSC.

265. **Project Assurance** will be the responsibility of UNDP. The Assurance role will support the NPSC by carrying out objective and independent project oversight and monitoring functions. During the implementation of the project, this role ensures (through periodic monitoring, assessment and evaluations) that appropriate project management milestones are managed and completed. The assurance will:

- Ensure that funds are made available to the project;
- Ensure the project is making progress towards intended outputs;
- Perform regular monitoring activities, such as periodic monitoring visits and spot checks;
- Ensure that resources entrusted to UNDP are utilized appropriately;
- Ensure that critical project information is monitored and updated
- Ensure that financial reports are submitted to UNDP on time, and that combined delivery reports are prepared and submitted to the NPSC and SPSC;
- Ensure that risks are properly identified, managed, and monitored on regular basis.

266. An independent external review may be conducted through resource persons/groups to feed into this process. The UNDP official responsible for the Project Assurance and the PM will meet on a quarterly basis to assess progress of the decisions taken in the PSC.

267. **Agreement on the intellectual property rights and use of logo on the project's deliverables:** In order to accord proper acknowledgement to MoEF, GEF and UNDP for providing funding, logos should appear on all relevant project publications as applicable and adhere to the branding guidelines of the aforementioned agencies.

Funds Flow Arrangements and Financial Management:

268. The project follows DIM (Direct Implementation) modality and UNDP takes on the role of implementing partner.

a. The project will be directly implemented by UNDP in close cooperation and consultation of Ministry of Environment and Forests (MoEF).
b. In this case, UNDP assumes the responsibility for mobilizing and applying effectively the required inputs in order to reach the expected outputs. UNDP assumes overall management responsibility and accountability for project implementation. Accordingly UNDP would follow all policies and procedures established for its own operations and will be responsible for all financial management, reporting, procurement and recruitment services.
c. UNDP and MoEF will jointly prepare a budgeted Annual Work Plan on an Annual basis, as per UNDP rules and regulations.
d. UNDP may identify Responsible Parties to carry out activities within a DIM project. A Responsible Party is defined as an entity that has been selected to act on behalf of the UNDP on the basis of a written agreement or contract to purchase goods or provide services using the project budget. All Responsible Parties are directly accountable to UNDP in accordance with the terms of their agreement or contract with UNDP. The Responsible Party may follow its own procedures only to the extent that they do not contravene the principles of the Financial Regulations and Rules of UNDP. Where the financial governance of the responsible party, does not provide the required guidance to ensure best value for money, fairness, integrity, transparency, and effective international competition that of UNDP shall apply.

269. **Audit:** The audit will be governed as per UNDP norms.

270. **Project Closure:** Project will be operationally completed when the last UNDP-financed inputs have been provided and the related activities completed. Through the PSC, the implementing partner (UNDP in its implementation role) notifies the UNDP (in its project assurance role) when this has been done. When a project is operationally complete, the parties must agree on the disposal of any equipment and complete the transfer of assets under the project. Projects will be financially completed when the Implementing Partner has reported all financial transactions to UNDP so that the project accounts can be closed. UNDP and the Implementing Partner will certify a final Combined Delivery Report. Projects will be financially completed not more than 12 months after being operationally completed. Between operational and financial closure, the Implementing Partner will be required to identify and settle all financial obligations and prepare a final expenditure report. No adjustments can be made to a financially completed project.

Coordination with related initiatives

271. India has implemented several programmes, over the past two decades that specifically sought to strengthen institutional structures at different levels (national and sub-national) to create an enabling environment for biodiversity conservation. An earlier GEF aided project – India Ecodevelopment Project (1996-2004) – has shown that providing sustainable livelihoods to communities is central to the success of conservation in India, and lessons from this project have resulted in upstream policy changes (e.g. amendment of the national wildlife legislation in 2006). The proposed GEF project shall add another layer to the existing framework of conservation in India by engaging production sectors and promoting integrated landscape management approaches to safeguard biodiversity in mountain landscapes.

272. The GEF-UNDP-Gulf of Mannar Biosphere Reserve project (currently nearing completion), wherein an integrated, multi-sectoral approach was adopted to secure the critical linkage between improved coastal and marine resources and the local livelihoods, is particularly relevant. UNDP is also currently implementing two projects under the *India: GEF-UNDP- Coastal and Marine Programme* that aims at mainstreaming biodiversity conservation into production sector operations in the critically vulnerable coastal and marine zones of Godavari, Andhra Pradesh (east-coast) and Sindhudurg, Maharashtra (west-coast). The project will establish necessary communication and coordination mechanisms (through the Ministry of Environment and Forests) with this programme. Further, a GEF-UNDP Project- *Energy Conservation in Small Sector Tea processing Units in Southern India* has demonstrated that by adopting energy efficient options in tea curing units, there could be 20 percent savings in electrical and thermal energy. This learning would be dove-tailed into the proposed project in the tea and cardamom sector. Similarly, a couple of other initiatives – *Community Based Natural Resource Management* and the GEF- *Small Grants Programme* – have developed models of viable and ecologically sustainable "community owned ecosystem based enterprises" with high replication potential. The proposed project shall build on the lessons learned and experiences gained from these projects as well as the lessons learnt from the project shall be up-scaled, mainstreamed and replicated into relevant national programmes and policies. In addition, the project will coordinate actions with other government and non-government initiatives where similarities in the strategy of the proposed project open up an opportunity for cross fertilizing good practices.

VI. *MONITORING FRAMEWORK AND EVALUATION*

273. In accordance with the programming policies and procedures outlined in the UNDP User Guide and GEF M & E Policy (2010), the project will be monitored through the following:

A. MONTHLY PROGRESS REPORT: The Implementing Partner, in consultation with the project teams, will provide brief monthly updates on progress against planned activities and budgets. These monthly reports will be provided in the format provided at Annex1. These monthly reports will be consolidated, as required, by UNDP's quality assurance team for progress review meetings.

B. ONE TIME RISK LOG: Based on the initial risk analysis, a risk log shall be activated in Atlas and regularly updated by reviewing the external environment that may affect the project implementation. This will be completed by UNDP project assurance team in consultation with the Implementing partner.

C. A terminal evaluation will be conducted to capture the progress, the results and the lernings. It is aimed to commission the study at least 4 to 6 months prior to the project closure. It is commissioned as per UNDP guidelines.

D. ANNUAL REVIEW REPORT: An Annual Review Report shall be prepared by the PMU and shared with the Project Board and the Outcome Board. The reporting format at Annex 2 will used to provide brief description of results achieved in the year against pre-defined annual targets.

E. ANNUAL PROJECT REVIEW/ PROJECT IMPLEMENTATION REPORT. Based on the above report, an annual project review shall be conducted during the fourth quarter of the year or soon after, to assess the performance of the project and appraise the Annual Work Plan (AWP) for the following year. In the last year, this review will be a final assessment. This review is driven by the Project Board and may

involve other stakeholders as required. It shall focus on the extent to which progress is being made towards outputs, and that these remain aligned to appropriate outcomes. The first draft of the PIR will be prepared for the previous reporting period (30 June to 1 July) by the LLPMU and the NPMU and submitted to UNDP and MoEF. The PIR will be shared with the GEF OFP India also on an annual basis.

Use of institutional logos on project deliverables

274. In order to accord proper acknowledgement to GEF for providing funding, a GEF logo should appear on all relevant GEF project publications, including among others, project hardware and vehicles purchased with GEF funds. Any citation on publications regarding projects funded by GEF should also accord proper acknowledgment to GEF. Alongside GEF, UNDP logo, GOI and State Government of Kerala logos along with that of the Implementing Partner of the proposed project will also be featured.

PROJECT START

275. A Project Inception Workshop will be held within the first three months of project start-up involving those with assigned roles in the project organization structure, UNDP country office, and, where appropriate/ feasible, regional technical policy and programme advisors, as well as other stakeholders. The Inception Workshop is crucial to building ownership for the project results and to plan the first year's AWP. The Inception Workshop report will be a key reference document and will be prepared and shared with participants to formalize various agreements and plans decided during the meeting. The Inception Workshop will address a number of key issues including:

- Assist all partners to fully understand and take ownership of the project. Detail the roles, support services and complementary responsibilities of UNDP CO and RCU staff vis-à-vis the project team. Discuss the roles, functions, and responsibilities within the project's decision-making structures, including reporting and communication lines, and conflict resolution mechanisms. The Terms of Reference for project staff will be discussed again as needed.
- Based on the project results framework and the GEF SO-2 Tracking Tool, finalize the first AWP. Review and agree on the indicators, targets and their means of verification, and re-check assumptions and risks.
- Provide a detailed overview of reporting, monitoring and evaluation (M&E) requirements. The Monitoring and Evaluation work plan and budget should be agreed and scheduled.
- Discuss financial reporting procedures and obligations, and arrangements for annual audit.
- Plan and schedule Project Steering Committee meetings. Roles and responsibilities of all project organization structures should be clarified and meetings planned. The first PSC meeting should be held within the first six months following the Inception Workshop.

QUARTERLY MONITORING

- Progress made shall be monitored in the UNDP Enhanced Results Based Management Platform.
- Based on the initial risk analysis submitted, the risk log shall be regularly updated in ATLAS.
- Based on the information recorded in Atlas, a Project Progress Reports (PPR) can be generated in the Executive Snapshot.
- Other ATLAS logs can be used to monitor issues, lessons learned etc. The use of these functions will be a key indicator in the UNDP Executive Balanced Scorecard.

ANNUAL MONITORING

276. Annual Project Review/ Project Implementation Reports (APR/PIR): This key report will be prepared to monitor progress made since project start and in particular for the previous reporting period (30 June to 1 July). The APR/PIR combines both UNDP and GEF reporting requirements. The APR/PIR includes, but is not limited to, reporting on the following:

- Progress made toward project objective and project outcomes - each with indicators, baseline data and end-of-project targets (cumulative)

- Project outputs delivered per project outcome (annual)
- Lessons learned/good practice.
- AWP and other expenditure reports
- Risk and adaptive management
- ATLAS QPR
- Portfolio level indicators (i.e. SO-2 Tracking Tool)

PERIODIC MONITORING THROUGH SITE VISITS

277. UNDP CO and the UNDP RCU will conduct visits to project sites based on the agreed schedule in the project's Inception Report/ Annual Work Plan to assess first hand project progress. Other members of the Project Steering Committee may also join these visits. A Field Visit Report/ BTOR will be prepared by the CO and UNDP RCU and will be circulated no less than one month after the visit to the project team and Project Steering Committee members.

MID-TERM OF PROJECT CYCLE

278. The project will undergo an independent Mid-Term Evaluation at the mid-point of project implementation. The Mid-Term Evaluation will determine progress being made toward the achievement of outcomes and will identify course correction if needed. It will focus on the effectiveness, efficiency and timeliness of project implementation; highlight issues requiring decisions and actions; and present initial lessons learned about project design, implementation and management. Findings of this review will be incorporated as recommendations for enhanced implementation during the final half of the project's term. The MTE will also be an opportune time to review and fine tune indicators based on the sector plans and micro plans that would have by then been developed and under implementation. The organization, terms of reference and timing of the mid-term evaluation will be decided after consultation between the parties to the project document. The Terms of Reference for this Mid-term evaluation will be prepared by the UNDP CO based on guidance from the Regional Coordinating Unit and UNDP-GEF. The management response and the evaluation will be uploaded to UNDP corporate systems, in particular the UNDP Evaluation Office Evaluation Resource Center (ERC). The GEF SO-2 Tracking Tool will also be completed during the mid-term evaluation cycle.

END OF PROJECT

279. An independent Final Evaluation will take place three months prior to the final Project Steering Committee meeting and will be undertaken in accordance with UNDP and GEF guidance. The final evaluation will focus on the delivery of the project's results as initially planned (and as corrected after the mid-term evaluation, if any such correction took place). The final evaluation will look at impact and sustainability of results, including the contribution to capacity development and the achievement of global environmental benefits/ goals. The Terms of Reference for this evaluation will be prepared by the UNDP CO based on guidance from the Regional Coordinating Unit and UNDP-GEF. The Terminal Evaluation should also provide recommendations for follow-up activities and requires a management response which should be uploaded to UNDP-GEF's Project Information Management System (PIMS) and to the UNDP Evaluation Office Evaluation Resource Center (ERC). The GEF SO-2 Tracking Tool will also be completed during the final evaluation.

280. During the last three months, the project team will prepare the Project Terminal Report. This comprehensive report will summarize the results achieved (objectives, outcomes, outputs), lessons learned, problems met and areas where results may not have been achieved. It will also lay out recommendations for any further steps that may need to be taken to ensure sustainability and replicability of the project's results.

LEARNING AND KNOWLEDGE SHARING

281. Results from the project will be disseminated within and beyond the project intervention zone through existing information sharing networks and forums. The project will identify and participate, as relevant and appropriate, in scientific, policy-based and/ or any other networks, which may be of

benefit to project implementation though lessons learned. The project will identify, analyze, and share lessons learned that might be beneficial in the design and implementation of similar future projects. Finally, there will be a two-way flow of information between this project and other projects of a similar focus.

Table 1. Project Monitoring and Evaluation Plan and Budget

Type of M&E activity	Responsible Parties	Budget US$	Time frame
Inception Workshop (IW)	National Nodal Officer, State Nodal Officer, Project team, UNDP, UNDP GEF	7,000	Within first three months of project start up
Inception Report	Project Team PSC, UNDP CO	None	Immediately following IW
Measurement of Means of Verification for Project Purpose Indicators	Project Manager will oversee the hiring of specific studies and institutions, and delegate responsibilities to relevant team members	To be finalized in Inception Phase and Workshop. Cost to be covered by targeted survey funds.	Start, mid and end of project
Measurement of Means of Verification for Project Progress and Performance (measured on an annual basis)	Oversight by Project GEF Technical Advisor and Programme Officer, UNDP Measurements by regional field officers and local IAs	TBD as part of the Annual Work Plan's preparation. Cost to be covered by field survey budget.	Annually prior to APR/PIR and to the definition of annual work plans
PIR	Project Team PSC UNDP-GEF	None	Annually
Project Steering Committee meetings	National Nodal Officer and State Nodal Officer	None	Following IW and annually thereafter.
Technical and periodic status reports	Project team Hired consultants as needed	6,000	TBD by Project team and UNDP-CO
Mid-term External Evaluation	Project team PSC UNDP-GEF RCU External Consultants (evaluation team)	24,200	At the mid-point of project implementation.
Final External Evaluation	Project team, PSC, UNDP-GEF RCU External Consultants (evaluation team)	32,200	At the end of project implementation
Terminal Report	Project team PSC External Consultant	None	At least one month before the end of the project
Audit	UNDP-CO Project team	10,000	Yearly
Visits to field sites (UNDP staff travel costs to be charged to IA fees)	UNDP-CO, UNDP-GEF RCU Government representatives	None	Yearly average one visit per year
TOTAL indicative COST Excluding project and UNDP staff time costs		79,400	

VII. Legal Context

282. This document together with the CPAP signed by the Government and UNDP which is incorporated by reference constitute together a Project Document as referred to in the SBAA and all CPAP provisions apply to this document.Consistent with the Article III of the Standard Basic Assistance Agreement, the responsibility for the safety and security of the implementing partner and

its personnel and property, and of UNDP's property in the implementing partner's custody, rests with the implementing partner. The implementing partner shall:

- put in place an appropriate security plan and maintain the security plan, taking into account the security situation in the country where the project is being carried;
- assume all risks and liabilities related to the implementing partner's security, and the full implementation of the security plan.

283. UNDP reserves the right to verify whether such a plan is in place, and to suggest modifications to the plan when necessary. Failure to maintain and implement an appropriate security plan as required hereunder shall be deemed a breach of this agreement.

284. The implementing partner agrees to undertake all reasonable efforts to ensure that none of the UNDP funds received pursuant to the Project Document are used to provide support to individuals or entities associated with terrorism and that the recipients of any amounts provided by UNDP hereunder do not appear on the list maintained by the Security Council Committee established pursuant to resolution 1267 (1999). The list can be accessed via http://www.un.org/Docs/sc/committees/1267/1267ListEng.htm. This provision will be included in all sub-contracts or sub-agreements entered into under this Project Document.

COMMUNICATIONS AND VISIBILITY REQUIREMENTS

285. Full compliance is required with UNDP's Branding Guidelines and guidance on the use of the UNDP logo. These can be accessed at http://web.undp.org/comtoolkit/reaching-the-outside-world/outside-world-core-concepts-visual.shtml. Full compliance is also required with the GEF Branding Guidelines and guidance on the use of the GEF logo. These can be accessed at http://www.thegef.org/gef/GEF_logo. The UNDP and GEF logos should be the same size. When both logs appear on a publication, the UNDP logo should be on the left top corner and the GEF logo on the right top corner. Further details are available from the UNDP-GEF team based in the region.

286. Full compliance is also required with the GEF's Communication and Visibility Guidelines (the "GEF Guidelines").[137] Amongst other things, the GEF Guidelines describe when and how the GEF logo needs to be used in project publications, vehicles, supplies and other project equipment. The GEF Guidelines also describe other GEF promotional requirements regarding press releases, press conferences, press visits, visits by Government officials, productions and other promotional items.

287. Where other agencies and project partners have provided support through co-financing, their branding policies and requirements should be similarly applied.

AUDIT CLAUSE

288. The Government will provide the Resident Representative with certified periodic financial statements, and with an annual audit of the financial statements relating to the status of UNDP (including GEF) funds according to the established procedures set out in the Programming and Finance manuals. The Audit will be conducted according to UNDP financial regulations, rules and audit policies by the legally recognized auditor of the Government, or by a commercial auditor engaged by the Government.

[137] The GEF Guidelines can be accessed at http://www.thegef.org/gef/sites/thegef.org/files/documents/C.40.08_Branding_the_GEF%20final_0.pdf

VIII: ANNEXURES

Annexure 1

Checklist of flowering plants in the HMRL

(A total of 281 species of flowering plants are recorded from the project area. Name given in **bold** are confined to the HMRL)

RANUNCULACEAE

1. *Anemone rivularis* Buch.-Ham. Ex DC.,
2. *Clematis gouriana* Roxb. ex DC
3. ***Clematis munroiana*** Wight. Southern Western Ghats, endemic
4. *Clematis smilacifolia* Wall. Southern Western Ghats, endemic
5. *Clematis theobromiana* Dunn. Southern Western Ghats, endemic
6. *Clematis wightiana* Wall. Southern Western Ghats, endemic
7. *Naravelia zeylanica* (L.) DC
8. *Ranunculus muricatus* Linn.
9. *Ranunculus reniformis* Wall. Ex Wight & Arn.,
10. *Ranunculus suboinnatus* Wt. and Arn. Southern Western Ghats, endemic
11. ***Ranunculus wallichianus*** Wight & Arn. Southern Western Ghats, endemic
12. *Thalictrum javanicum* Blume

DILLENIACEAE

13. *Acrotrema arnottiana* Wight. Southern Western Ghats, endemic
14. *Dillenia pentagyna* Roxb
15. *Tetracera akara* (Burm. f.) Merr

MAGNOLIACEAE

16. *Michelia nilagirica* Zenk. Southern Western Ghats, endemic

ANNONACEAE

17. *Alphonsea sclerocarpa* Thw., Enum
18. *Artabotrys zeylanicus* Hook. f. & Thoms
19. *Desmos lawii* (Hook. f. & Thoms.) Safford. Southern Western Ghats, endemic
20. *Desmos viridiflorus* (Bedd.) Safford. Southern Western Ghats, endemic
21. *Goniothalamus rhynchantherus* Dunn. Southern Western Ghats, endemic
22. *Goniothalamus wightii* Hook. f. & Thoms. Southern Western Ghats, endemic
23. *Meiogyne pannosa* (Dalz.) Sinclair.Southern Western Ghats, endemic
24. *Meiogyne ramarowii* (Dunn) Gandhi. Southern Western Ghats, endemic
25. *Miliusa indica* Lesch. ex A. DC. Southern Western Ghats, endemic
26. *Miliusa eriocarpa* Dunn in Gamble. Endemic to Peninsular India
27. *Miliusa tomentosa* (Roxb.) Sinclair
28. *Mitrephora heyneana* (Hook. F. & Thoms.) Thw
29. *Orophea erythrocarpa* Bedd. Southern Western Ghats, endemic
30. *Orophea uniflora* Hook. f. & Thoms. Southern Western Ghats, endemic
31. *Phaeanthus malabaricus* Bedd. Southern Western Ghats, endemic
32. *Polyalthia coffeoides* (Thw. ex Hook. f. & Thoms.) Hook. f. & Thoms.
33. *Polyalthia fragrans* (Dalz.) Bedd. Southern Western Ghats, endemic

34. *Sageraea grandiflora* Dunn. Southern Western Ghats, endemic
35. *Uvaria hookeri* King. Southern Western Ghats, endemic
36. *Uvaria narum* (Dunal) Wall. Ex Wight & Arn.,

MENISPERMACEAE

37. *Anamirta cocculus* (L.) Wight & Arn.
38. *Cissampelos pareira* L.
39. *Cocculus laurifolius* DC.
40. *Cyclea arnottii* Miers. Southern Western Ghats, endemic
41. *Cyclea fissicalyx* Dunn
42. *Cyclea peltata* (Poir.) Hook. f. & Thoms.
43. *Diploclisia glaucescens* (Bl.) Diels
44. *Pachygone ovata* (Poir.) Miers ex Hook. f. & Thoms.,
45. *Stephania japonica* (Thunb.) Miers
46. *Stephania wightii* (Arn.) Dunn. Southern Western Ghats, endemic
47. *Tinospora sinensis* (Lour.) Merr.

PAPAVERACEAE

48. *Argemone mexicana* L.,

BERBERIDACEAE

49. *Mahonia leschenaultii* Takeda

BRASSICACEAE

50. *Brassica juncea* (L.) Czern. & Cosson,
51. *Cardamine africana* L.
52. *Cardamine trichocarpa* Hochst. ex A. Rich.
53. *Coronopus didymus* (L.) Smith
54. *Lepidium sativum* L.

CAPPARACEAE

55. *Cadaba fruticosa* (L.) Druce
56. *Capparis brevispina* DC.
57. *Capparis divaricata* Lam.,
58. *Capparis grandis* L. f.,
59. *Capparis roxburghii* DC.,
60. *Capparis sepiaria* L.,
61. *Capparis zeylanica* L.,
62. *Cleome aspera* Koen. ex DC.,
63. *Cleome gynandra* L.,
64. *Capparis fusifera* Dunn
65. *Capparis moonii* Wight. Southern Western Ghats, endemic
66. *Capparis shevaroyensis* Sund.-Ragh. Southern Western Ghats, endemic
67. *Cleome monophylla* L.
68. *Cleome rutidosperma* DC.
69. *Cleome viscosa* L.
70. *Crataeva adansonii* DC. ssp. odora (Buch.-Ham.) Jacobs.
71. *Crateva magna* (Lour.) DC.

VIOLACEAE

72. *Hybanthus enneaspermus* (L.) F. Muell.

73. *Viola hamiltoniana* D. Don. Southern Western Ghats, endemic
74. *Viola pilosa* Blume
75. *Viola betonicifolia* J.E. Smith

COCHLOSPERMACEAE

76. *Cochlospermum religiosum* (L.) Alston

FLACOURTIACEAE

77. *Casearia championii* Thw.
78. *Casearia coriacea*
79. *Casearia rubescens* Dalz. var. ***gamblei*** Mukherj. Southern Western Ghats, endemic
80. *Casearia thwaitesii* Briq. Southern Western Ghats, endemic
81. *Casearia zeylanica* (Gaertn.) Thw.
82. *Flacourtia montana* Grah.
83. *Flacourtia ramontchi* L'Herit., Strip
84. *Homalium ceylanicum* (Gard.) Benth.
85. *Hydnocarpus alpina* Wight
86. *Hydnocarpus macrocarpa (Bedd.) Warb.* Southern Western Ghats (Kerala), endangered
87. *Hydnocarpus pentandra* (Buch.-Ham.) Oken
88. *Scolopia crenata* (Wight & Arn.) Clos

PITTOSPORACEAE

89. *Pittosporum napaulense* (DC) Rehder & Wilson
90. *Pittosporum neelgherrense* Wight & Arn. Southern Western Ghats, endemic
91. *Pittosporum tetraspermum* Wight & Arn. Southern Western Ghats, endemic
92. *Pittosporum wightii* Mukh. Southern Western Ghats, endemic

POLYGALACEAE

93. *Polygala arillata* Buch.-Ham. ex D. Don
94. *Polygala arvensis* Willd.
95. *Polygala bolbothrix* Dunn var. *bulbothrix.* Southern Western Ghats, endemic
96. ***Polygala bolbothrix*** Dunn var. ***devikolamensis*** (Mukherj.) Banerjee, S.Western Ghats (Kerala), endemic
97. *Polygala chinensis* L.
98. *Polygala elongata* Klein ex Willd
99. *Polygala jacobii* Chandrab. Southern Western Ghats, endemic
100. *Polygala persicariifolia* DC. Southern Western Ghats, endemic
101. *Polygala rosmarinifolia* Wight & Arn. Southern Western Ghats, endemic
102. *Polygala sibirica* L.
103. *Salomonia ciliate* (L.) DC.

XANTHOPHYLLACEAE

104. *Xanthophyllum arnottianum* Wight. Southern Western Ghats, endemic

CARYOPHYLLACEAE

105. *Cerastium indicum* Wight & Arn.
106. *Drymaria cordata* (L.) Roem. ex Schult
107. *Polycarpon prostratum* (Forsk.) Asch. & Schweinf
108. *Polycarpaea corymbosa* (L.) Lam.,
109. *Sagina saginoides* (L.) Karsten
110. *Spergula arvensis* L.
111. *Stellaria media* (L.) Vill

PORTULACACEAE

112. *Portulaca oleracea* L.
113. *Portulaca pilosa* L
114. *Portulaca quadrifida* L.,
115. *Portulaca suffruticosa* Wight ex Wight & Arn.,
116. *Portucala tuberosa* Roxb.,
117. *Portulaca wightiana* Wall. ex Wight & Arn.,
118. *Talinum portulacifolium* (Forsk.) Asch. & Schweinf.

HYPERICACEAE

119. *Hypericum humifusum* L.
120. *Hypericum japonicum* Thunb. ex Murr.
121. *Hypericum mysorense* Heyne ex Wight & Arn. Southern Western Ghats, endemic
122. *Hypericum wightianum* Wall. ex Wight & Arn. Southern Western Ghats, endemic

CLUSIACEAE

123. *Calophyllum calaba* L.
124. *Calophyllum polyanthum* Wall. ex. Choisy. Southern Western Ghats, endemic
125. *Garcinia cowa* Roxb. ex DC. Southern Western Ghats, endemic
126. Garcinia gummi-gutta (L.) Robs.
127. *Garcinia morella* (Gaertn.) Desv. Southern Western Ghats, endemic
128. *Garcinia spicata* (Wight & Arn.) Hook. f. Southern Western Ghats, endemic
129. *Garcinia wightii* Anders. Southern Western Ghats, endemic
130. *Mesua ferrea* L. var. *ferrea.* Southern Western Ghats, endemic
131. ***Mesua ferrea*** L. var. **coromandeliana** (Wight) Singh. Southern Western Ghats (Kerala), endemic
132. *Mesua thwaitesii* Planch. & Triana Southern Western Ghats, endemic

BONNETIACEAE

133. *Poeciloneuron indicum* Bedd. Southern Western Ghats, endemic

THEACEAE (TERNSTROEMIACEAE)

134. *Camellia sinensis* (L.) O. Ktze
135. *Eurya nitida* Korth
136. *Gordonia obtusa* Wall. ex Wight & Arn., Southern Western Ghats, endemic
137. *Ternstroemia gymnanthera* (Wight & Arn.) Beddome,

DIPTEROCARPACEAE

138. *Dipterocarpus bourdillonii* Brandis, Southern Western Ghats, **Critically Endangered.**
139. *Dipterocarpus indicus* Bedd., Southern Western Ghats, **Critically endangered**
140. *Hopea parviflora* Bedd., Southern Western Ghats, endemic
141. *Hopea ponga* (Dennst.) Mabber., Southern Western Ghats, Endangered
142. *Shorea roxburghii* G. Don, Endemic to Peninsular India
143. *Vateria indica* L., Southern Western Ghats, endemic

ANCISTROCLADACEAE

144. *Ancistrocladus heyneanus* Wall. ex Graham,

MALVACEAE

145. *Abelmoschus angulosus* Wall. ex Wight & Arn. var. angulosus
146. *Abelmoschus angulosus* Wall. ex Wight & Arn. var. purpureus Thw.
147. *Abelmoschus angulosus* Wall. ex Wight & Arn. var. grandiflorus Thw.
148. *Abelmoschus manihot* (L.) Medik.

149. *Abelmoschus moschatus* Medik.
150. *Abutilon hirtum* (Lam.) Sweet
151. *Abutilon indicum* (L.). Sweet,
152. ***Abutilon neilgherrense*** Munro ex Wight. Endemic to Peninsula India (Kerala)
153. *Abutilon persicum* (Burm.f.) Merr.
154. *Abutilon ramosum* (Cav.) Guill. & Perr.
155. *Fioria vitifolia* (L.) Mattei
156. *Herissantia crispa* (L.) Briz.,
157. *Hibiscus canascens* Heyne ex Wight & Arn.,
158. *Hibiscus micranthus* L. f.,
159. *Hibiscus hispidissimus* Griff.
160. *Hibiscus lobatus* (Murr.) O. Ktze.
161. *Hibiscus lunariifolius* Willd.
162. *Hibiscus platanifolius* Sweet
163. *Hibiscus surattensis* L.
164. *Hibiscus tiliaceus* L.
165. *Julostylis angustifolia* (Arn.) Thw.
166. *Malvastrum coromandelianum* (L.) Garcke
167. *Pavonia burchellii* (DC.) Dyer.
168. *Pavonia odorata* Willd.
169. *Pavonia zeylanica* (L.) Cav
170. *Sida acuta* Burm. f.
171. *Sida alnifolia* L.
172. *Sida cordata* (Burm. f.) Borss.
173. *Sida cordifolia* L.
174. *Sida fryxellii* Sivar. & Pradeep
175. *Sida mysorensis* Wight & Arn.
176. *Sida rhombifolia* L.
177. *Sida rhomboidea* Roxb. ex Fleming
178. *Sida scabrida* Wight & Arn.
179. *Thespesia lampas* (Cav.) Dalz. & Gibs.
180. *Urena lobata* L.
181. *Urena sinuata* L.

BOMBACACEAE

182. *Bombax ceiba* L.
183. *Bombax scopulorum* Dunn
184. *Cullenia exarillata* Robyns

STERCULIACEAE

185. ***Byttneria herbacea*** Roxb.,
186. *Eriolaena hookeriana* Wight & Arn
187. ***Eriolaena lushingtonii*** Dunn. Endemic to Southern Western Ghats, Vulnerable
188. *Eriolaena quinqueloculari*s (Wight & Arn.) Wight
189. *Firmiana colorata* (Roxb.) R. Br.
190. *Helicteres isora* L.
191. *Heritiera papilio* Bedd. Southern Western Ghats, endemic

192. *Melhania incana* Heyne ex Wight & Arn
193. *Melochia corchorifolia* L.
194. *Pterospermum diversifolium* Blume Southern Western Ghats, endemic
195. *Pterospermum reticulatum* Wight & Arn. Southern Western Ghats, vulnerable
196. *Pterospermum rubiginosum* Heyne ex Wight & Arn. Southern Western Ghats, endemic
197. *Pterygota alata* (Roxb.) R. Br.
198. *Sterculia foetida* L.
199. *Sterculia guttata* Roxb. ex DC
200. *Sterculia urens* Roxb
201. *Sterculia villosa* Roxb. ex DC.
202. *Waltheria indica* L.

TILIACEAE

203. *Corchorus aestuans* L.,
204. *Corchorus tridens* L.,
205. *Grewia abutilifolia* Vent. ex Juss.
206. *Grewia barberi* Drumm. Southern Western Ghats, endemic
207. *Grewia damine* Gaertn.
208. *Grewia flavescens* Juss.
209. ***Grewia gamblei*** Drumm.
210. *Grewia glabra* Bl. Southern Western Ghats, endemic
211. ***Grewia heterotricha*** Mast.
212. *Grewia hirsuta* Vahl
213. *Grewia laevigata* Vahl
214. *Grewia lanceaefolia* Roxb.
215. *Grewia nervosa* (Lour.) Panigrahi
216. *Grewia obtusa* Wall. ex Dunn
217. *Grewia oppositifolia* Buch.- Ham. ex Roxb
218. *Grewia orbiculata* Rottl
219. *Grewia tiliifolia* Vahl
220. *Grewia umbellifera* Bedd.
221. *Grewia villosa* Willd
222. *Triumfetta annua* L.
223. *Triumfetta pilosa* Roth
224. *Triumfetta rhomboidea* Jacq.

ELAEOCARPACEAE

225. *Elaeocarpus glandulosus* Wall. ex Merr.
226. *Elaeocarpus munronii* (Wight) Mast. Southern Western Ghats, endemic
227. *Elaeocarpus recurvatus* Corner. endemic to Peninsula India
228. *Elaeocarpus serratus* L.
229. *Elaeocarpus tuberculatus* Roxb. Southern Western Ghats, endemic

LINACEAE

230. *Linum mysorense* Heyne ex Benth. Southern Western Ghats, endemic

ERYTHROXYLACEAE

231. *Erythroxylum monogynum* Roxb. Southern Western Ghats, endemic

MALPIGHIACEAE

232. *Aspidopterys canarensis* Dalz. Southern Western Ghats, endemic, vulnerable
233. *Hiptage acuminata* Wall. ex A., Juss.
234. *Hiptage benghalensis* (L.) Kurz,

ZYGOPHYLLACEAE

235. *Tribulus terrestris* L.,

GERANIACEAE

236. *Geranium nepalense* Sweet

TROPAEOLACEAE

237. *Tropaeolaum majus* L.

OXALIDACEAE

238. *Biophytum candolleanum* (Wight) Edgew.
239. ***Biophytum congestiflorum*** Govind, Southern Western Ghats (Kerala), endemic
240. *Biophytum intermedium* Wight
241. *Biophytum reinwardtii* (Zucc.) Klotzsch var *reinwardtii*
242. *Biophytum reinwardtii*(Zucc.) Klotzsch var. *keralanum* Santosh et al, S.Western GhatsGhats (Kerala),endemic.
243. *Biophytum sensitivum* (L.) DC.
244. *Oxalis corniculata* L.
245. *Oxalis corymbosa* DC.
246. *Oxalis dehradunensis* Raiz.
247. *Oxalis latifolia* HBK

BALSAMINACEAE

248. *Impatiens acaulis* Arn. Southern Western Ghats, endemic, threatened
249. *Impatiens aliciae* Fischer, Southern Western Ghats, endemic
250. *Impatiens anaimudica* Fischer, Southern Western Ghats, endemic. Endngered
251. *Impatiens balsamina* L.
252. *Impatiens campanulata* Wight Southern Western Ghats, endemic
253. *Impatiens chandrasekharanii* Chandrab., Southern Western Ghats, endemic
254. *Impatiens chinensis* L.
255. ***Impatiens coelotropis*** Fischer, Southern Western Ghats (Kerala), Vulnerable
256. ***Impatiens concinna*** Hook.f., Southern Western Ghats (Kerala), Endengered
257. *Impatiens cordata* Wight Southern Western Ghats, endemic
258. *Impatiens crenata* Bedd., Southern Western Ghats (Kerala), threatened
259. ***Impatiens cuspidata*** Wight & Arn. Southern Western Ghats, endemic
260. *Impatiens dasysperma* Wight Southern Western Ghats, rare and threatened
261. *Impatiens denisonii* Bedd., Southern Western Ghats (Kerala), threatened
262. ***Impatiens elegans*** Bedd., Southern Western Ghats (Kerala), threatened
263. *Impatiens flaccida* Arn. Southern Western Ghats, endemic
264. *Impatiens fruticosa Lesch. Ex DC.*, Southern Western Ghats, threatened
265. *Impatiens goughii* Wight Southern Western Ghats, endemic
266. ***Impatiens grandis*** Heyne ex Wall. Southern Western Ghats, endemic
267. *Impatiens hensloviana* Arn. Southern Western Ghats, endemic
268. *Impatiens herbicola* Hook. f. Southern Western Ghats, endemic
269. *Impatiens inconspicua* Benth. ex Wight & Arn. Southern Western Ghats, endemic
270. *Impatiens jerdoniae Wight.* Southern Western Ghats, endemic
271. ***Impatiens johnii*** Barnes. Southern Western Ghats (Kerala), endangered

272. ***Impatiens kulamavuensis*** Pand. & Nair Southern Western Ghats (Kerala).
273. ***Impatiens laticornis*** *Fischer*. Southern Western Ghats, endemic
274. *Impatiens latifolia* L.
275. *Impatiens leptura* Hook. f. Southern Western Ghats, endemic
276. *Impatiens levingei* Gamble ex Hook. f Southern Western Ghats, endemic
277. *Impatiens lucida* Heyne ex Hook. f. Southern Western Ghats, threatened
278. ***Impatiens macrocarpa*** Hook.f., S. Western Ghats (Kerala), **Critically Endangered**
279. *Impatiens maculata* Wight Southern Western Ghats, endemic
280. *Impatiens minor* (DC.) Benn.
281. *Impatiens modesta* Wight Southern Western Ghats, endemic
282. ***Impatiens munnarensis*** Barnes S. Western Ghats (Kerala), **Critically Endangered**
283. ***Impatiens nilgirica*** Fischer Southern Western Ghats (Kerala), **Critically Endangered**
284. ***Impatiens pallidiflora*** Hook.f., Southern Western Ghats (Kerala), endangered
285. ***Impatiens pandata*** Barnes Southern Western Ghats (Kerala), endangered
286. *Impatiens parasitica* Bedd. Southern Western Ghats, endemic
287. ***Impatiens parvifolia*** Bedd., Southern Western Ghats (Kerala), endangered
288. ***Impatiens pendula*** Heyne ex Wight & Arn., S. Western Ghats, endangered
289. ***Impatiens phoenicea*** Bedd., Southern Western Ghats, endangered
290. ***Impatiens platyadenia*** Fischer S. Western Ghats (Kerala), **Critically Endangered**
291. *Impatiens pulcherrima* Dalz. Southern Western Ghats, endemic
292. ***Impatiens rupicola*** Hook. f. Southern Western Ghats, endandered
293. *Impatiens scapiflora* Heyne ex Roxb. Southern Western Ghats, endemic
294. ***Impatiens tangachee*** Bedd. endemic to Peninsular India
295. *Impatiens tomentosa* Heyne ex Wight & Arn., endemic to Peninsular India
296. ***Impatiens trichocarpa*** Hook. f. Southern Western Ghats, endemic
297. *Impatiens umbellata* Heyne ex Roxb. Southern Western Ghats, endemic, vulnerable
298. *Impatiens uncinnata* Wight, Southern Western Ghats, endemic
299. ***Impatiens verecunda*** Hook. f. Southern Western Ghats (Kerala), **Critically Endangered**
300. *Impatiens verticillata* Wight Southern Western Ghats (Kerala), endemic
301. ***Impatiens violacea*** Muktesh & Stephan, Southern Western Ghats, endemic
302. *Impatiens viridiflora* Wight Southern Western Ghats, endemic. Threatened
303. *Impatiens viscosa* Bedd. Southern Western Ghats, endemic
304. *Impatiens wightiana* Bedd., Southern Western Ghats (Kerala), rare. Endangered.

RUTACEAE

305. *Acronychia pedunculata* (L.) Miq.
306. *Aegle marmèlos* (L.) Correa
307. *Atalantia monophylla* (L.) DC.
308. *Atalantia racemosa* Wight & Arn. Southern Western Ghats, endemic
309. *Atalantia wightii* Tanaka. Southern Western Ghats, endemic
310. *Chloroxylon swietenia* DC.,
311. *Citrus limon* (L.) Burm. f.
312. *Clausena anisata* (Willd.) Hook.f. ex Benth. Southern Western Ghats, endemic
313. *Clausena austroindica* Stone & Nair
314. *Clausena indica* (Dalz.) Oliver.
315. *Glycosmis angustifolia* Lindl. ex Wight & Arn.

316. *Glycosmis macrocarpa* Wight. Southern Western Ghats, endemic
317. *Glycosmis mauritiana* (Lam.) Tanaka
318. *Glycosmis pentaphylla* (Retz.) DC.
319. *Luvunga eleutherandra* Dalz. in Hook. f.
320. *Melicope lunu-ankenda* (Gaertn.) T. Hartley
321. *Murraya paniculata* (L.) Jack.
322. *Naringi crenulata* (Roxb.) Nicolson
323. *Pamburus missionis* (Wall. ex Wight) Sw. Southern Western Ghats, endemic
324. *Pleiospermium alatum* (Wall. ex Wight & Arn.) Swingle
325. *Toddalia asiatica* (L.) Lam.
326. *Vepris bilocularis* (Wight & Arn.) Engl. Southern Western Ghats, endemic
327. *Zanthoxylum ovalifolium* Wight. Southern Western Ghats, endemic
328. *Zanthoxylum rhetsa* (Roxb.) DC.
329. *Zanthoxylum tetraspermum* Wight & Arn. Southern Western Ghats, endemic

SIMAROUBACEAE

330. *Ailanthus excelsa* Roxb.,
331. *Ailanthes triphysa* (Dennst.) Alston

OCHNACEAE

332. *Ochna obtusa* DC.

BURSERACEAE

333. *Boswellia serrata* Roxb. ex Coleb
334. *Canarium strictum* Roxb. Southern Western Ghats, endemic
335. ***Commiphora berryi*** (Arn.) Engl.
336. *Commiphora caudata* (Wight & Arn.) Engl.
337. ***Commiphora pubescens*** (Wight & Arn.) Engl.
338. *Garuga floribunda* Decne.,

MELIACEAE

339. ***Aglaia apiocarpa*** (Thw.) Hiern. Southern Western Ghats, endemic. Vulnerable
340. *Aglaia barberi* Gamble. Southern Western Ghats, endemic
341. *Aglaia elaeagnoidea* (Juss.) Benth., endemic to Peninsular India
342. *Aglaia lawii* (Wight) Sald. Southern Western Ghats, endemic
343. *Aglaia perviridis* Hiern, vulnerable
344. *Aglaia simplicifolia* (Bedd.) Harms. Near threatened
345. *Aglaia tomentosa* Teijsm. & Binn.
346. *Aphanamixis polystachya* (Wall.) Parker. Southern Western Ghats, endemic
347. *Azadirachta indica* A. Juss
348. *Chukrasia tabularis* A. Juss.
349. *Cipadessa baccifera* (Roth) Miq.
350. *Dysoxylum beddomei* Hiern. Southern Western Ghats, endangered
351. *Dysoxylum binectariferum* (Roxb.) Hook. f., ex Bedd. Southern Western Ghats, endemic
352. *Dysoxylum ficiforme* (Wight) Gamble. Southern Western Ghats, endemic
353. *Dysoxylum malabaricum* Bedd. ex Hiern. Southern Western Ghats, endemic
354. *Melia azedarach* L.
355. *Melia dubia* Cav.
356. *Munronia pinnata* (Wall.) Harms

357. *Naregamia alata* Wight & Arn. Southern Western Ghats, endemic
358. *Toona ciliata* Roem.
359. *Trichilia connaroides* (Wight & Arn.). Bentvelzen Southern Western Ghats, endemic
360. *Turraea villosa* Benn. Southern Western Ghats, endemic
361. *Walsura trifoliata* (A. Juss.) Harms

DICHAPETALACEAE

362. *Dichapetalum gelonioides* (Roxb.) Engl.

OLACACEAE

363. *Anacolosa densiflora* Bedd. Southern Western Ghats, endemic
364. *Erythropalum scandens* Bl.
365. *Olax imbricata* Roxb.
366. *Strombosia ceylanica* Gard.

ICACINACEAE

367. *Apodytes dimidiata* E. Meyer ex Arn. Southern Western Ghats, endemic
368. *Gomphandra coriacea* Wight. Southern Western Ghats, endemic
369. *Gomphandra tetrandra* (Wall.) Sleumer. Southern Western Ghats, endemic
370. *Miquelia dentata* Bedd. Southern Western Ghats, endemic
371. *Nothapodytes nimmoniana* (Grah.) Mabber.
372. *Sarcostigma kleinii* Wight & Arn. Southern Western Ghats, endemic

OPILIACEAE

373. *Cansjera rheedii* Gmel.
374. *Opilia amentacea* Roxb.,

AQUIFOLIACEAE

375. ***Ilex denticulata*** Wall. ex Wight. Southern Western Ghats, endemic
376. *Ilex gardneriana* Wight. Southern Western Ghats, endemic
377. ***Ilex malabarica*** Bedd. Southern Western Ghats, endemic
378. *Ilex walkerii* Wight & Gard. Ex Thw.,
379. *Ilex wightiana* Wall. Ex Wight
380. ***Ilex wightiana*** Wall. ex Wight var. ***peninsularis*** Hook.f., S. Western Ghats, endemic

CELASTRACEAE

381. *Bhesa indica* (Bedd.) Ding Hou. Southern Western Ghats, endemic
382. *Cassine albens* (Retz.) Kosterm.,
383. *Cassine paniculata* (Wight & Arn.) Lobr.-Callen. Southern Western Ghats, endemic
384. *Celastrus paniculatus* Willd. Southern Western Ghats, endemic
385. *Euonymus angulatus* Wight, Southern Western Ghats, Vulnerable
386. *Euonymus crenulatus* Wall. ex Wight & Arn. Southern Western Ghats, endemic
387. *Euonymus dichotomus* Hyene wx Roxb.,
388. *Euonymus indicus* Heyne ex Roxb. Southern Western Ghats, endemic
389. *Euonymus paniculatus* Wight ex Lawson. Southern Western Ghats, endemic
390. *Euonymus serratifolius* Bedd. Southern Western Ghats, endemic
391. *Lophopetalum wightianum* Arn.. Southern Western Ghats, endemic
392. *Maytenus ovatus* (Wall.ex Wight & Arn.) Loes. Southern Western Ghats, endemic
393. *Microtropis ramiflora* Wight,
394. *Microtropis stocksii* Gamble. Southern Western Ghats, endemic
395. *Microtropis wallichiana* Wight ex Thw.

396. *Pleurostylia opposita* (Wall.) Alston

HIPPOCRATEACEAE

397. *Loeseneriella arnottiana* (Wight) A.C. Smith
398. *Loeseneriella bourdillonii* (Gamble) Ramam. Southern Western Ghats, endemic
399. *Loeseneriella obtusifolia* (Roxb.) A. C. Smith
400. *Reissantia indica* (Willd.) Halle
401. *Salacia beddomei* Gamble. Southern Western Ghats, endemic, rare
402. *Salacia fruticosa* Heyne ex Laws. Western Ghats, endemic
403. *Salacia macrosperma* Wight. Southern Western Ghats, endemic, rare
404. *Salacia malabarica* Gamble. Southern Western Ghats, endemic, rare
405. *Salacia oblonga* Wall. ex Wight & Arn.

RHAMNACEAE

406. *Gouania microcarpa* DC.
407. *Rhamnus wightii* Wight & Arn.,
408. *Sageretia hamosa* Brongn.
409. *Ventilago bombaiensis* Dalz.
410. *Ventilago madraspatana* Gaertn.
411. *Zizyphus glabrata* Hyene ex Roth.
412. *Ziziphus mauritiana* Lam.
413. *Ziziphus oenoplia* (L.) Mill.
414. *Ziziphus rugosa* Lam.
415. *Ziziphus xylopyrus* (Retz.) Willd.,

VITACEAE

416. *Ampelocissus tomentosa* (Heyne ex Roth) Planch
417. *Cayratia mollissima* (Wall.) Gagnep.
418. *Cayratia pedata* (Lam.) Juss. ex Gagnep.
419. *Cayratia pedata* (Lam.) Juss. ex Gagnep. var. *glabra* Gamble Southern Western Ghats, endemic, vulnerable.
420. *Cayratia pedata* (Lam.) Juss. ex Gagnep. var. pedata.
421. *Cayratia trifolia* (L.) Domin Cissus discolor Bl.
422. *Cissus arnottiana* Shetty and Singh
423. *Cissus discolor* Blume
424. *Cissus glyptocarpa* (Thw.) Planch.
425. *Cissus heyneana* (Wall. ex Lawson) Planch
426. *Cissus latifolia* Lam.
427. *Cissus quadrangularis* L.,
428. *Cissus repens* Lam.
429. *Cissus vitiginea* L.,
430. *Parthenocissus neilgherriensis* (Wight) Planch. Southern Western Ghats, endemic
431. *Tetrastigma leucostaphylum* (Dennst.) Alston. Endemic to Peninsular India
432. *Tetrastigma nilagiricum* (Miq.) Shetty Southern Western Ghats, endemic
433. *Tetrastigma sulcatum* (Lawson) Gamble

LEEACEAE

434. *Leea guineensis* G. Don
435. *Leea indica* (Burm. f.) Merr.
436. *Leea robusta* Roxb. Southern Western Ghats, endemic

SAPINDACEAE

437. *Allophylus cobbe* (L.) Raeusch. Southern Western Ghats, endemic
438. *Allophylus concanicus* Radlk. Southern Western Ghats, endemic
439. *Allophylus rheedii* (Wight) Radlk. Southern Western Ghats, endemic
440. *Allophylus serratus* (Roxb.) Kurz Southern Western Ghats, endemic
441. *Allophyllus serrulatus* Radlk. Western Ghats, endemic
442. *Cardiospermum canescens* Wall.,
443. *Cardiospermum halicacabum* L.
444. *Dimocarpus longan* Lour.
445. *Dodonaea angustifolia* L.f.
446. *Filicium decipiens* (Wight & Arn.) Thw.
447. *Harpullia arborea* (Blanco) Radlk. Southern Western Ghats, endemic
448. *Lepisanthes erecta* (Thw.) Leenh. Southern Western Ghats, endemic
449. *Lepisanthes senegalensis* (Juss. ex Poir.) Leenh
450. *Lepisanthes tetraphylla* (Vahl) Radlk. Southern Western Ghats, endemic
451. *Otonephelium stipulaceum* (Bedd.) Radlk. Southern Western Ghats, endemic
452. *Sapindus emarginatus* Vahl
453. *Sapindus laurifolius* Vahl
454. *Schleichera oleosa* (Lour.) Oken

STAPHYLEACEAE

455. *Turpinia malabarica* Gamble Southern Western Ghats, endemic
456. *Turpinia nepalensis* Wall. ex Wight & Arn.

SABIACEAE

457. *Meliosma pinnata* (Roxb.) Maxim. Southern Western Ghats, endemic
458. *Meliosma simplicifolia* (Roxb.) Walp. Southern Western Ghats, endemic
459. *Meliosma simplicifolia* (Roxb.) Walp. Var. *pungens* Beus.,

ANACARDIACEAE

460. *Buchanania lanzan* Spreng.
461. *Holigarna arnottiana* Hook. f. Southern Western Ghats, endemic
462. *Holigarna ferruginea* Marchand. Western Ghats, endemic
463. *Holigarna grahamii* (Wight) Kurz., Western Ghats, endemic
464. *Holigarna nigra* Bourd., Southern Western Ghats, endemic
465. *Lannea coromandelica* (Houtt.) Merr.
466. Mangifera indica L.
467. *Nothopegia beddomei* Gamble. Southern Western Ghats, endangered
468. *Nothopegia colebrookeana* (Wight) Bl. Southern Western Ghats, endemic
469. *Nothopegia heyneana* (Hook. f.) Gamble. Southern Western Ghats, Endangered
470. *Nothopegia racemosa* (Dalz.) Ramam. Southern Western Ghats, endemic
471. *Nothopegia travancorica* Bedd. ex Hook. f. Southern Western Ghats, endemic
472. *Rhus mysorensis* G. Don
473. *Semecarpus auriculata* Bedd. Southern Western Ghats, near threatened
474. *Semecarpus travancorica* Bedd. Southern Western Ghats, Rare
475. *Solenocarpus indica* Wight & Arn. Southern Western Ghats, Rare
476. *Spondias pinnata* (L. f.) Kurz

MORINGACEAE

477. *Moringa pterygosperma* Gaertn.,

CONNARACEAE

478. *Connarus monocarpus* L. Southern Western Ghats, endemic
479. ***Connarus parameswaranii*** *Ramam.* & Rajan, S. Western Ghats (Kerala), endemic
480. *Connarus sclerocarpus* (Wight & Arn.) Schellenb. Southern Western Ghats, endemic
481. *Connarus wightii* Hook. f. Southern Western Ghats, endemic
482. *Rourea minor* (Gaertn.) Merr.

FABACEAE (LEGUMINOSAE, PAPILIONACEAE)

Subfamily : FABOIDAE

483. *Abrus precatorius* L.,
484. *Abrus pulchellus* Wall. ex Thw.
485. *Alysicarpus rugosus* (Willd.) DC.,
486. *Aeschynomene indica* L.
487. *Aganope thyrsiflora* (Benth.) Polhill
488. *Alysicarpus bupleurifolius* (L.) DC.
489. *Alysicarpus glumaceus* (Vahl.)DC.
490. *Alysicarpus heterophyllus* (Benth. ex Baker.) Jafri & Ali
491. *Alysicarpus monilifer* (L.) DC.,
492. *Alysicarpus vaginalis* (L.) DC. var. vaginalis Baker
493. *Atylosia albicans* (Wight & Arn.) Benth.
494. *Atylosia goensis* (Dalz.) Dalz
495. *Atylosia lineata* Wight & Arn. Southern Western Ghats, endemic
496. *Atylosia rugosa* Wight & Arn. Southern Western Ghats, endemic
497. *Atylosia scarabaeoides* (L.) Benth. Southern Western Ghats, endemic
498. *Atylosia trinervia* (DC.) Gamble. Southern Western Ghats, endemic
499. *Butea monosperma* (Lam.) Taub.
500. *Calapogonium muconoides* Desv.
501. *Canavalia africana* Dunn.
502. *Canavalia mollis* Wight & Arn.
503. *Centrosema pubescens* Benth.
504. *Crotalaria albida* Heyne ex Roth.
505. *Crotalaria barbata* Graham ex Wight & Arn. Southern Western Ghats, endemic
506. ***Crotalaria beddomeana*** Thoth. & Ansari. S. Western Ghats (Kerala), endemic
507. *Crotalaria calycina* Schrank .Southern Western Ghats, endemic
508. ***Crotolaria candicans*** Wight & Arn.Southern Western Ghats, endemic
509. *Crotalaria clarkei* Gamble. Southern Western Ghats, endemic, threatened
510. *Crotalaria evolvuloides* Wight ex Wight & Arn. Southern Western Ghats, endemic
511. *Crotolaria ferruginea* Grah. ex Benth
512. ***Crotalaria fysonii*** Dunn. Southern Western Ghats, endemic
513. ***Crotalaria fysonii*** Dunn var. ***glabra*** Gamble. S.Western Ghats(Kerala), endangered
514. *Crotalaria grahamiana* Wight & Arn. Southern Western Ghats, endemic
515. *Crotalaria heyneana* Graham ex Wight & Arn. Southern Western Ghats, endemic
516. *Crotalaria humifusa* Graham ex Benth.
517. *Crotolaria juncea* L.,
518. *Crotalaria longipes* Wight & Arn. Southern Western Ghats, endemic, rare

519. *Crotolaria medicaginea* Lam.,
520. *Crotalaria mysorensis* Roth. Southern Western Ghats, endemic
521. *Crotalaria nana* Burm. f.
522. *Crotalaria obtecta* Graham ex Wight & Arn. Southern Western Ghats, endemic
523. *Crotalaria obtecta* Graham ex Wight & Arn. Var. *glabrescens* (Benth.) Baker S.Western Ghats, endemic
524. *Crotalaria pallida* Dryand.
525. *Crotalaria peduncularis* Graham ex Wight & Arn. Southern Western Ghats, Critically endangered
526. *Crotolaria pusilla* Heyne ex Roth,
527. *Crotalaria retusa* L.
528. *Crotalaria salicifolia* Heyne ex Wight & Arn. Peninsular India, endemic
529. *Crotalaria scabrella* Wight & Arn.
530. *Crotalaria semperflorens* Vent.
531. *Crotalaria shevaroyensis* Gamble Southern Western Ghats, endemic
532. *Crotalaria spectabilis* Roth.
533. *Crotolaria subperfoliata* Wight ex Wight & Arn., endemic to Peninsular India
534. *Crotalaria triquetra* Dalz. Southern Western Ghats, endemic
535. *Crotalaria verrucosa* L.
536. *Crotalaria walkeri* Arn. Southern Western Ghats, endemic
537. *Crotalaria wightiana* Graham ex Wight & Arn. Southern Western Ghats, endemic
538. *Dalbergia beddomei* Thoth. Southern Western Ghats, endemic
539. *Dalbergia congesta* Graham ex Wight & Arn., Southern Western Ghats, Rare
540. *Dalbergia lanceolaria* L. f.
541. *Dalbergia latifolia* Roxb.
542. *Dalbergia paniculata* Roxb.,
543. *Dalbergia sissoides* Grah. ex Wight & Arn.
544. *Dalbergia volubilis* Roxb.
545. *Derris benthamii* (Thw.) Thw. Endangered .
546. *Derris brevipes* (Benth.) Baker .Southern Western Ghats, endemic
547. *Derris canarensis* (Dalz.) Baker. Southern Western Ghats, endemic
548. *Derris scandens* (Roxb.) Benth.
549. *Desmodium alysicarpoides* van Meeuwen
550. *Desmodium ferrugineum* Wall. ex Thw., ssp. *ferrugineum* Ohashi,
551. *Desmodium ferrugineum* Wall. ex Thw., ssp. *wynaadense* (Bedd. ex Gamble) Ohashi
552. *Desmodium gangeticum* (L.) DC.
553. *Desmodium heterocarpon* (L.) DC.
554. *Desmodium heterocarpon* (L.) DC. Var. *strigosum* van Meeuwen
555. *Desmodium heterophyllum* (Willd.) DC.
556. *Desmodium laxiflorum* DC.
557. *Desmodium laxum* DC.
558. *Desmodium microphyllum* (Thunb.) DC.
559. *Desmodium motorium* (Houtt.) Merr.
560. *Desmodium pryonii* DC.
561. *Desmodium pulchellum* (L.) Benth.
562. *Desmodium repandum* (Vahl) DC.
563. *Desmodium styracifolium* (Osbeck) Merr.

564. *Desmodium triangulare* (Retz.) Merr.
565. *Desmodium triflorum* (L.) DC.
566. *Desmodium triquetrum* (L.) DC.
567. *Desmodium uncinatum* (Jacq.) DC.
568. *Desmodium velutinum* (Willd.) DC.
569. *Desmodium zonatum* Miq.
570. *Dolichos trilobus* L.
571. *Dumasia villosa* DC.
572. *Dunbaria ferruginea* Wight & Arn.,
573. *Erythrina stricta* Roxb.
574. *Erythrina suberosa* Roxb.,
575. *Erythrina variegata* L. var. *orientalis* Merr
576. *Flemingia grahamiana* Wight & Arn.
577. *Flemingia macrophylla* (Willd.) Prain ex Merr.
578. *Flemingia nelgheriensis* (Baker) Wight. Southern Western Ghats, endemic
579. *Flemingia semialata* Roxb.
580. *Flemingia strobilifera* (L.) R. Br. ex Ait.
581. *Flemingia wallichii* Wight & Arn.
582. ***Flemingia wightiana*** Graham ex Wight & Arn. Peninsular India, endemic
583. *Galactia villosa* Wight & Arn.,
584. *Geissaspis cristata Wight & Arn.*
585. *Goniogyna hirta* (Willd.) Ali.
586. *Indigofera astragalina* DC.
587. *Indigofera cassioides* Rottl. ex. DC.
588. *Indigofera colutea* (Burm. f.) Merr.
589. *Indigofera galegoides* DC.
590. *Indigofera glandulosa* Roxb. ex Willd.
591. *Indigofera hirsuta* L.,
592. *Indigofera linnaei* Ali
593. *Indigofera marginulata* Graham ex Wight & Arn.,
594. *Indigofera pedicellata* Wight & Arn.
595. *Indigofera spicata* Forsk.
596. *Indigofera tinctoria* L.
597. *Indigofera trifoliata* L.
598. *Indigofera wightii* Graham ex Wight & Arn. Southern Western Ghats, endemic
599. *Kunstleria keralensis* Mohanan & Nair. Southern Western Ghats(Kerala), endemic
600. *Millettia rubiginosa* Wight & Arn. Southern Western Ghats, endemic
601. *Mucuna atropurpurea* DC.
602. *Mucuna monosperma* DC. ex Wight
603. *Mucuna hirsuta* Wight & Arn. Southern Western Ghats, endemic
604. ***Mucuna pruriens*** (L.) DC. Var. ***thekkadiensis*** Thoth & Ravi. S.Western Ghats(Kerala), endemic
605. *Mundulea sericea* (Willd.) A. Cheval.
606. *Neonotonia wightii* (Grah. ex Wight & Arn.) Lackey. Southern Western Ghats, endemic
607. *Neonotonia wightii* (Grah. ex Wight & Arn.) Lackey var. *coimbatorensis* Karthik. S.Western Ghats, endemic
608. *Ormocarpum cochinchinensis* (Lour.) Merr. Peninsaular India, endemic

609. *Ormosia travancorica* Bedd. Southern Western Ghats, endemic
610. *Paracalyx scariosa* (Roxb.) Ali
611. *Parochetus communis* Buch.-Ham. ex Don
612. *Pongamia pinnata* (L.) Pierre,
613. *Pseudarthria viscida* (L.) Wight & Arn.
614. *Pterocarpus marsupium* Roxb.
615. *Pycnospora lutescens* (Poir.) Schind.
616. *Rhynchosia cana* (Willd.) DC.
617. *Rhynchosia courtallensis* vander Maesen
618. *Rhynchosia densiflora* (Roth) DC.,
619. *Rhynchosia hirta* (Andrews) Mickle & Verdcort
620. *Rhynchosia rufescens* (Willd.) DC.
621. *Rhynchosia viscosa* (Roth) DC.,
622. *Rothia indica* (L.) Druce
623. *Sesbania grandiflora* (L.) Poir.
624. *Shuteria vestita* Wight & Arn.
625. *Smithia blanda* Vahl ex Wight & Arn.
626. *Smithia capitata* Dalz. Southern Western Ghats, endemic
627. *Smithia conferta* Sm. Southern Western Ghats, endemic
628. *Smithia hirsuta* Dalz. Southern Western Ghats, endemic
629. *Smithia racemosa* Heyne ex Wight & Arn. Southern Western Ghats, endemic
630. *Smithia sensitiva* Ait. Southern Western Ghats, endemic
631. *Smithia venkobarowii* Gamble .Southern Western Ghats, **Possibly Extinct**
632. *Sophora velutina* Lindl.,
633. *Spatholobus parviflorus* (Roxb. ex DC.) O. Ktze.
634. *Spatholobus purpureus* Benth. ex Baker. Western Ghats, endemic
635. *Stylosanthes fruticosa* (Retz.) Alston
636. *Tephrosia candida* DC.
637. *Tephrosia maxima* Pers.,
638. *Tephrosia pulcherrima* (Wight ex Baker) Drumm.
639. *Tephrosia pumila* (Lam.) Pers.,
640. *Tephrosia purpurea* (L.) Pers.
641. *Tephrosia tinctoria* Pers.
642. *Tephrosia villosa* (L.) Pers.,
643. *Tephrosia vogelii* Hook.,
644. *Uraria lagopodioides* (L.) Desv.
645. *Uraria rufescens* (DC.) Schind.
646. *Vigna grahamiana* (Wight & Arn.) Verdc
647. *Vigna radiata* (L.) Wilczek. Var radiate
648. *Vigna radiata* (L.) Wilczek. var.*sublobata* (Roxb.) Verdc.
649. *Vigna trilobata* (L.) Verdc.
650. *Vigna umbellata* (Thumb.) Ohwi & Ohashi,
651. *Vigna vexillata* (L.) A. Rich.
652. *Vigna vexillata* (L.) A. Rich. var *wightii* (Benth ex Bedd.) Babu & Sharma. S.Western Ghats, endemic
653. *Zornia gibbosa* Span.

Subfamily : C A E S A L P I N I O I D E A E

654. *Acrocarpus fraxinifolius* Wight & Arn. Southern Western Ghats, endemic
655. *Bauhinia malabarica* Roxb. Southern Western Ghats, endemic
656. *Bauhinia phoenicea* Wight & Arn.
657. *Bauhinia racemosa* Lam.,
658. *Caesalpinia bonduc* (L.) Roxb
659. *Caesalpinia cucullata* Roxb.
660. *Caesalpinia decapetala* (Roth.) Alston
661. *Caesalpinia mimosoides* Lam.
662. *Caesalpinia spicata* Dalz.,
663. *Cassia absus* L.
664. *Cassia alata* L.
665. *Cassia auriculata* L
666. *Cassia fistula* L.
667. *Cassia hirsuta* L.
668. *Cassia intermedia* Sharma et al
669. *Cassia kleinii* Wight & Arn.,
670. *Cassia leschenaultiana* (DC.) Degner.
671. *Cassia mimosoides* L.
672. *Cassia montana* Hyene ex Roth., endemic to Peninsular India
673. *Cassia occidentalis* L.
674. *Cassia siamea* Lam.
675. *Cassia sophera* L.
676. *Cassia timorensis* DC.
677. *Cassia tora* L.
678. *Delonix regia* (Boj. ex Hook.) Rafin.,
679. *Hardwickia binata* Roxb., Peninsular India Endemic
680. ***Humboldtia bourdillonii*** Prain. Southern Western Ghats (Kerala), Endangered
681. *Humboldtia vahliana* Wight. Southern Western Ghats, endemic
682. *Kingiodendron pinnatum* (Roxb. ex DC.) Harms. Southern Western Ghats, endemic
683. *Parkinsonia aculeata* L.
684. *Pterolobium hexapetalum* (Roth) Sant. & Wagh
685. *Saraca asoca* (Roxb.) de Wilde Vulnerable
686. *Tamarindus indica* L.,

Subfamily : M I M O S O I D E A E

687. *Acacia caesia* (L.) Willd.
688. *Acacia catechu* (L.f.) Willd.,
689. *Acacia chundra* (Roxb. ex Rottl.) Willd.,
690. *Acacia dealbata* Link
691. *Acacia ferruginea* DC.,
692. *Acacia leucophloea* (Roxb.) Willd.,
693. *Acacia mearnsii* Wilde,
694. *Acacia nilotica* (L.) Willd. ex Del. ssp. *indica* (Benth.) Brenan
695. *Acacia pennata* (L.) Willd.
696. *Acacia planifrons* Wight & Arn.,

697. *Acacia sinuata* (Lour.) Merr.
698. *Acacia torta* (Roxb.) Crib.
699. *Adenanthera pavonia* L.,
700. *Albizia amara* (Roxb.) Boivin
701. *Albizia chinensis* (Osbeck) Merr.
702. ***Albizia lathamii*** Hole, endemic to Peninsular India (Kerala) and **Critically Endangered**
703. *Albizia lebbeck* (L.) Willd.
704. *Albizia odoratissima* (L. f.) Benth
705. *Archidendron clypearia* (Jack) Nielsen
706. *Archidendron monadelphum* (Roxb.) Nielson Southern Western Ghats, endemic
707. *Dichrostachys cinera* (L.) Wight & Arn.,
708. *Entada rheedei* Spreng
709. *Mimosa diplotricha* C. Wight & Sanvalle
710. *Mimosa pudica* L.
711. *Pithecellobium dulce* (Roxb.) Benth.
712. *Prosopis juliflora* (Sw.) DC.,
713. *Xylia xylocarpa* (Roxb.) Taub.

ROSACEAE

714. *Eriobotrya japonica* (Thunb.) Lindl.
715. *Photinia integrifolia* Lindl var. sublanceolata Miq.,
716. *Photinia serratifolia* (Desf.) Kalkman Southern Western Ghats, endemic
717. *Photinia serratifolia* (Desf.) Kalkman var. *serratifolia*. Henry *et al* Southern Western Ghats, endemic
718. *Photinia serratifolia* (Desf.) Kalkman var. *tomentosa* (Gamble) Vivek. & Shetty S.Western Ghats, endemic
719. *Prunus ceylanica* (Wight) Miq.
720. *Rosa leschenaultiana* Red. Southern Western Ghats, endemic
721. *Rubus ellipticus* Smith
722. *Rubus glomeratus* Blume
723. *Rubus micropetalus* Gard.
724. *Rubus indicus* Thunb
725. *Rubus niveus* Thunb.
726. *Rubus racemosus* Roxb. Southern Western Ghats, endemic

PARNASSIACEAE

727. *Parnassia mysorensis* (Bedd.) Kosterm.
728. *Parnassia wightiana* Wall. Ex Wight & Arn.

CRASSULACEAE

729. ***Kalanchoe bhidei*** Cooke Southern Western Ghats, endemic
730. ***Kalanchoe grandiflora*** Wall. ex Wight & Arn. Southern Western Ghats, endemic
731. *Kalanchoe olivacea* Dalz. & Gibs. Endemic to Peninsular India and threatened
732. *Kalanchoe schweinfurthii* Penzig. Southern Western Ghats, endemic

DROSERACEAE

733. *Drosera burmannii* Vahl
734. *Drosera indica* L.
735. *Drosera peltata* Sm.

HALORAGACEAE

736. *Laurembergia coccinea* (Bl.) Kan.

737. *Myriophyllum oliganthum* (Wight & Arn.) F. V. Muell.

RHIZOPHORACEAE

738. *Carallia brachiata* (Lour.) Merr.

COMBRETACEAE.

739. *Anogeissus latifolia* (Roxb.) Bedd.
740. *Calycopteris floribunda* Lam.
741. *Combretum albidum* G. Don
742. *Quisqualis malabarica* Bedd. Southern Western Ghats, endemic
743. *Terminalia arjuna* (Roxb. ex DC.) Wight & Arn.,
744. *Terminalia bellirica* (Gaertn.) Roxb.
745. *Terminalia chebula* Retz.
746. *Terminalia elliptica* Willd.
747. *Terminalia paniculata* Roth. Peninsular India endemic
748. *Terminalia travancorensis* Wight & Arn. Southern Western Ghats, endemic

MYRTACEAE

749. *Eucalyptus glonulus* Labill.
750. *Eucalyptus grandis* Hill. Ex Maid.
751. *Eugenia bracteata* (Willd.) Roxb. ex DC.
752. ***Eugenia calcadensis*** Bedd. Southern Western Ghats, endemic, vulnerable
753. *Eugenia discifera* Gamble. Southern Western Ghats, endemic, endangered
754. *Eugenia thwaitesii* Duthie
755. *Rhodomyrtus tomentosus* (Ait.) Hassk.
756. *Syzygium benthamianum* (Wight ex Duthie) Gamble. S Western Ghats, endemic, Vulnerable.
757. *Syzygium bourdillonii* (Gamble) Rathkr. & Nair .Southern Western Ghats, Endangered.
758. *Syzygium caryophyllatum* (L.) Alston
759. *Syzygium cumini* (L.) Skeels. Southern Western Ghats, endemic
760. *Sysygium densiflorum* Wall. ex Wight & Arn. Southern Western Ghats, endemic Vulnerable.
761. *Syzygium gardneri* Thw. Southern Western Ghats, endemic
762. *Syzygium hemisphericum* (Wight) Alston
763. *Syzygium heyneanum* (Duthie) Wall. ex Gamble. Southern Western Ghats, endemic
764. *Syzygium jambos* (L.) Alston
765. *Syzygium laetum* (Buch.-Ham.) Gandhi. Southern Western Ghats, endemic
766. *Syzygium lanceolatum* (Lam.) Wight & Arn.,
767. *Syzygium malabaricum* (Bedd.) Gamble. Southern Western Ghats, endemic
768. *Syzygium mundagam* (Bourd.) Chithra. Southern Western Ghats, endemic
769. *Syzygium munronii* (Wight) Chandr. Peninsular India, endemic
770. *Sysygium myhendrae* (Bedd. Ex Brandis) Gamble. Southern Western Ghats, endemic Endengered
771. *Syzygium occidentalis* (Bourd.) Gandhi. Southern Western Ghats, endemic, vulnerable
772. *Syzygium parameswaranii* Mohanan & Henry.Southern Western Ghats, endemic, Endangered.
773. ***Sysygium periyarensis*** Jomy & Sasidh. Southern Western Ghats (Kerala), endemic
774. *Syzygium rubicundum* Wight & Arn.
775. *Syzygium tamilnadensis* Rathakr. & Chithra. Southern Western Ghats, endemic
776. *Psidium guajava* L.

LECYTHIDACEAE

777. *Barrigtonia acutangula* (L.) Gaertn.

778. *Careya arborea* Roxb.

MELASTOMATACEAE

779. *Clidemia hirta* D. Don
780. *Medinella anamalai* Sasidh. & Sujanapal. Southern Western Ghats (Kerala), endemic
781. *anaMedinilla beddomei* Clarke. Southern Western Ghats, endemic
782. *Medinilla fuchsioides* Gard. Southern Western Ghats, endemic
783. *Medinilla malabarica* Bedd. Southern Western Ghats, endemic vulnerable
784. *Melastoma malabathricum* L
785. *Memecylon angustifolium* Wight. Southern Western Ghats, endemic
786. *Memecylon depressum* Benth. ex Triana. Southern Western Ghats, endemic
787. *Memecylon edule* Roxb.
788. *Memecylon flavescens* Gamble .Southern Western Ghats, endemic Endangered
789. *Memecylon grande* Retz.
790. *Memecylon lawsonii* Gamble. Southern Western Ghats, endemic
791. *Memecylon malabaricum* (Clarke) Cogn. Southern Western Ghats, endemic
792. *Memecylon molestum* (Clarke) Cogn., endemic to Peninsular India
793. *Memecylon subcordatum* Cogn. Southern Western Ghats, endemic
794. *Memecylon talbotianum* Brandis Southern Western Ghats, endemic
795. *Memecylon umbellatum* Burm.f.,
796. *Osbeckia aspera* (L.) Bl. Var. *aspera*
797. *Osbeckia aspera* (L.) Bl. var. *travancorica* (Bedd.) Hansen S Western Ghats, endemic **Possibly Extinct**
798. *Osbeckia aspera* (L.) Bl. var. *wightiana* (Benth. ex Wight & Arn.) Trim. SouhWestern Ghats, endemic
799. *Osbeckia brachystemon* Naud. Southern Western Ghats, endemic
800. *Osbeckia gracilis* Bedd. Southern Western Ghats, endemic
801. *Osbeckia leschenaultiana* DC. Southern Western Ghats, endemic
802. *Osbeckia octandra* (L.) DC.
803. ***Osbeckia reticulata*** Bedd. Southern Western Ghats, endemic
804. *Osbeckia virgata* D. Don ex Wight et Arn.
805. *Osbeckia wynaadensis* Clarke. Southern Western Ghats, endemic
806. *Osbeckia zeylanica* L. f.
807. *Sonerila brunonis* Wight & Arn. Southern Western Ghats, endemic
808. *Sonerila clarkei* Cogn. Southern Western Ghats, endemic
809. ***Sonerila devikolamensis*** Nayar. Southern Western Ghats, endemic
810. *Sonerila gamblei* Giri & Nayar. Southern Western Ghats, endemic
811. *Sonerila grandiflora* R. Br. ex Wight & Arn. Southern Western Ghats, endemic Rare
812. ***Sonerila nemakadensis*** Fischer. Southern Western Ghats, endemic Threatened
813. ***Sonerila parameswaranii*** Ravik. & Lakshm. Southern Western Ghats, endemic
814. *Sonerila rheedii* Wight & Arn. Southern Western Ghats, endemic
815. *Sonerila rotundifolia* Bedd. Southern Western Ghats, endemic
816. *Sonerila sahyadrica* Giri & Nayar. Southern Western Ghats, endemic
817. ***Sonerila speciosa*** Zenk. Southern Western Ghats, endemic. Vulnerable
818. *Sonerila tinnevelliansis* Fischer. Southern Western Ghats, endemic
819. *Sonerila wallichii* Benn. Southern Western Ghats, endemic

LYTHRACEAE

820. *Ammannia baccifera* L., ssp. baccifera Koehne

821. *Ammania baccifera* L. Ssp. Aegyptiaca (Willd.) Koehne
822. *Ammannia multiflora* Roxb.,
823. *Rotala illecebroides* (Arn. ex Clarke) Koehne
824. *Lagerstroemia microcarpa* Wight Southern Western Ghats, endemic
825. *Lagerstroemia speciosa* (L.) Pers.
826. *Nesaea brevipes* Koehne
827. *Nesaea lanceolata* (Heyne ex Clarke) Koehne Southern Western Ghats, endemic
828. *Rotala illecebroides* (Arn. Ex Clarke) Koehne Southern Western Ghats, endemic
829. *Rotala indica* (Willd.) Koehne Southern Western Ghats, endemic
830. ***Rotala ritchiei*** (Clarke) Koehne Southern Western Ghats, endemic **Critically Endangered**
831. *Rotala rosea* (Poir.) Cook Southern Western Ghats, endemic
832. *Rotala rotundifolia* (Buch.-Ham. ex Roxb.) Koehne

ONAGRACEAE

833. *Circaea alpina* L. ssp. *Imaicola* (Asch. & Magn.)Kitamura
834. *Ludwigia adscendens* (L.) Hara
835. *Ludwigia hysssopifolia* IG.Don) Exell.
836. *Ludwigia octovalvis* (Jacq.) Raven ssp. Sessiliflora (Michaux) Raven
837. *Ludwigia perennis* L.
838. *Oenothera laciniata* Hill.

PASSIFLORACEAE

839. *Adenia hondala* (Gaertn.) Wilde
840. *Adenia wightiana* (Wall. Ex Wight & Arn.) Engl.
841. *Passiflora edulis* Sims
842. *Passiflora foetida* L. var *foetida*
843. *Passiflora foetida* L. hispida (DC) Killip ex Gleasson
844. *Passiflora leschenaultii* DC. Southern Western Ghats, endemic
845. *Passiflora lligularis* Juss.
846. *Passiflora mollissiana* (HBK) L.H. Bailey

CUCURBITACEAE

847. *Cerasiocarpum bennettii* (Miq.) Cogn. Southern Western Ghats, endemic
848. *Citrullus colocynthis* Schr
849. *C. lanatus* Mats
850. *Corallocarpus epigaeus* (Rottl. & Willd.) Clarke
851. *Ctenolepis garcinii* (Burm.f.) Clarke
852. *Cucumella silentvalleyii* Manilal *et al.* Southern Western Ghats, endemic
853. *Cucumis prophetarum* L.
854. *Diplocyclos palmatus* (L.) Jeffrey
855. *Gymnopetalum wightii* Arn. Southern Western Ghats, endemic
856. *Luffa cylindrica* (L.) M. Roem.
857. *Momordica dioica* Roxb. ex Willd.
858. *Mukia leiosperma* (Wight & Arn.) Wight
859. *Mukia maderaspatana* (L.) Roem.
860. *Solena amplexicaulis* (Lam.) Gandhi
861. *Trichosanthes anamalayansis* Bedd. Southern Western Ghats, endemic
862. *Trichosanthes cucumeriana* L.

863. *Trichosanthes lobata* Roxb. Southern Western Ghats, endemic
864. *Trichosanthes nervifolia* L.
865. *Trichosanthes tricuspidata* Lour. var. *tricuspidata,* Southern Western Ghats, endemic
866. *Zanonia indica* L.
867. *Zehneria maysorensis* (Wight & Arn.) Arn. var. *maysorensis* Southern Western Ghats, endemic
868. *Zehneria maysorensis* (Wight & Arn.) Arn. var. *oblonga* Prasad and Mini
869. *Zehneria maysorensis* (Wight & Arn.) Arn. var. *umbellata* (Chakravarthy) Kumari
870. *Zehneria scabra* (L. f.) Sond.
871. *Zehneria thwaitesii* (Schweinf.) Jeffrey

BEGONIACEAE

872. *Begonia albo-coccinea* Hook. Southern Western Ghats, endemic
873. ***Begonia aliciae*** Fischer. Southern Western Ghats, Considered extinct
874. *Begonia fallax* A. DC.
875. *Begonia floccifera* Bedd. Southern Western Ghats, endemic
876. *Begonia malabarica* Lam. Southern Western Ghats, endemic
877. *Begonia trichocarpa* Dalz.

DATISCACEAE

878. *Tetrameles nudiflora* R. Br.

CACTACEAE

879. *Opuntia sricta* (Haw.) Haw.,
880. *Opuntia vulgaris* Mill.,

AIZOACEAE

881. *Trianthema decandra* L.,

MOLLUGINACEAE

882. *Gisekia pharnaceoides* L
883. *Glinus lotoides* L.
884. *Glinus oppositifolia* (L.) A. DC.
885. *Mollugo pentaphylla* L.
886. *Mollugo nudicaulis* Lam.,

APIACEAE

887. ***Bunium notham*** (Clarke) Mukherjee. Southern Western Ghats, Considered extinct
888. ***Bupleurum distichophyllum*** Wight & Arn. Southern Western Ghats, endemic
889. *Bupleurum mucronatum* Wight & Arn.
890. *Bupleurum wightii* Kozo-Polj.
891. *Centella asiatica* (L.) Urban
892. *Heracleum candolleanum* (Wight & Arn.) Gamble. Southern Western Ghats, endemic
893. *Heracleum ceylanicum* Gardn. ex Clarke
894. *Heracleum rigens* Wall. ex DC
895. *Heracleum sprengelianum* Wight & Arn. Southern Western Ghats, endemic
896. *Hydrocotyle javanica* Thunb.
897. *Hydrocotyle sibthorpioides* Lam.
898. *Peucedanum anamallayense* Clarke .Southern Western Ghats, endemic
899. ***Pimpinella candolleana*** Wight & Arn. Southern Western Ghats, endemic
900. ***Pimpinella leschenaultii*** DC. Southern Western Ghats, endemic
901. ***Pimpinella pulneyensis*** Gamble. Southern Western Ghats, Considered extinct.

902. *Sanicula elata* Buch.-Ham ex D. Don
903. ***Vanasushava pedata*** (Wight) Mukh. & Const. Southern Western Ghats, endemic

ARALIACEAE

904. *Aralia malabarica* Bedd. Southern Western Ghats, endemic. Vulnerable
905. ***Pentapanax leschenaultii*** (DC) Seem. Southern Western Ghats (Kerala), endemic
906. *Polyscias acuminata* (Wight) Seem.
907. *Schefflera bourdillonii* Gamble. Southern Western Ghats, endemic
908. ***Schefflera chandrasekharanii*** Ramam. & Rajan. Southern Western Ghats(Kerala), endemic
909. *Schefflera racemosa* (Wight) Harms. Southern Western Ghats, endemic
910. *Schefflera stellata* (Geartn.) Harms
911. *Schefflera venulosa* (Wight & Arn.) Harms var *venulosa*. Southern Western Ghats, endemic
912. *Schefflera venulosa* (Wight & Arn.) Harms var. *obliquenervia* Gample
913. *Schefflera venulosa* (Wight & Arn.) Harms var. *roxburghii* (Gamble) Khanna. SWestern Ghats, endemic
914. *Schefflera wallichiana* (Wight & Arn.) Harms Southern Western Ghats, endemic

CORNACEAE

915. *Mastixia arborea* (Wight) Bedd. Southern Western Ghats, endemic
916. *Mastixia arborea* (Wight) Bedd. subsp. *meziana* (Wang.) Matthew. SWestern Ghats, endemic

ALANGIACEAE

917. *Alangium salvifolium* (L.f.) Wang. var. *salvifolium*. Southern Western Ghats, endemic
918. *Alangium salvifolium* (L.f.) Wang. var. *sundanam* (Miq.) Bloem.

CAPRIFOLIACEAE

919. *Lonicera leschenaultii* Wall. Endemic to Peninsular India
920. *Viburnum coriaceum* Blume,
921. *Viburnum erubescens* Wall. ex DC. Southern Western Ghats, endemic
922. *Viburnum punctatum* Buch.-Ham. ex D. Don

RUBIACEAE

923. *Acranthera anamallica* Bedd. Southern Western Ghats, endemic
924. *Aidia gardneri* (Lour.) Tirveng. Southern Western Ghats, endemic
925. *Argostemma courtallense* Arn. Southern Western Ghats, endemic
926. *Argostemma rostratum* Wall.
927. *Argostemma verticillatum* Wall.
928. *Benkara malabarica* (Lam.) Tirvengadum
929. *Canthium angustifolium* Roxb. Southern Western Ghats, endemic
930. *Canthium coromandelicum* (Burm. f.,) Alston
931. *Canthium dicoccum* (Gaertn.) Teijsm. & Binn.
932. ***Canthium ficiforme*** Hook. f. Southern Western Ghats (Kerala), endemic
933. *Canthium neilgherrense* Wight. Southern Western Ghats, endemic
934. *Canthium rheedii* DC. Southern Western Ghats, endemic
935. *Canthium travancoricum* (Bedd.) Hook. f. Southern Western Ghats, endemic
936. *Catunaregam spinosa* (Thunb.) Tirvengadum. Southern Western Ghats, endemic
937. *Catunaregam torulosa* (Dennst.) Tirv.;
938. *Chassalia curviflora* (Wall.) Thw.
939. *Coffea crassifolia* Gamble. Southern Western Ghats, endemic
940. *Dentella repens* (L.) J. R. & G. Forst.

941. *Galium asperifolium* Wall.
942. *Gardenia gummifera* L. f.,
943. *Gardenia resinifera* Roth,
944. *Geophila repens* (L.) Johnst.
945. *Haldina cordifolia* (Roxb.) Ridsd. Southern Western Ghats, endemic
946. *Hedyotis affinis* Roem. & Schult.
947. *Hedyotis anamalayana* (Gamble) Rao & Hemadri. Southern Western Ghats, endemic
948. *Hedyotis articularis* R. Br. ex Wight & Arn. ssp. *Articularis*. Southern Western Ghats, endemic
949. ***Hedyotis articularis*** R. Br. ssp. ***santapaui*** (Shetti & Vivek.)Deb & Dutta. SWestern Ghats,endemic,rare.
950. *Hedyotis aspera* Heyne ex Roth,
951. *Hedyotis auricularia* L. Southern Western Ghats, endemic
952. ***Hedyotis bourdillonii*** Gamble. Southern Western Ghats (Kerala), endemic
953. *Hedyotis brachypoda* (DC.) Sivar. & Biju
954. ***Hedyotis buxifolia*** Bedd. Southern Western Ghats (Kerala), endemic, rare
955. *Hedyotis corymbosa* (L.) Lam.
956. ***Hedyotis devikolamensis*** Deb & Dutta. Southern Western Ghats, endemic
957. *Hedyotis diffusa* Willd.,
958. *Hedyotis eualata* (Gamble) Henry & Subram.
959. *Hedyotis herbacea* L.
960. *Hedyotis leschenaultiana* DC. Southern Western Ghats, endemic
961. *Hedyotis membranacea* Thw.
962. *Hedyotis nitida* Wight & Arn.
963. *Hedyotis puberula* (G. Don) R. Br. Ex Arn.
964. *Hedyotis purpurascens* Hook.f., Endemic to Peninsular India
965. *Hedyotis swertioides* Hook.f. Southern Western Ghats, endemic. Rare
966. *Hedyotis stylosa* Southern Western Ghats, endemic
967. *Hedyotis wightii* (Hook. f.). K.K.N. Nair. Endemic to Peninsular India
968. *Hymenodictyon obovatum* Wall. Southern Western Ghats, endemic
969. *Hymenodictyon orixense* (Roxb.) Mabber. Southern Western Ghats, endemic
970. *Ixora brachiata* Roxb. ex DC. Endemic to Western Ghats
971. *Ixora coccinea* L.
972. *Ixora cuneifolia* Roxb. ex DC. Endemic to Peninsular India
973. *Ixora elongate* Heyne ex G. Don. Southern Western Ghats, endemic
974. *Ixora johnsoni* Hook. f. Southern Western Ghats, critically endangered
975. *Ixora malabarica* (Dennst.) Mabber. Southern Western Ghats, endemic
976. *Ixora monticola* Gamble. Southern Western Ghats, endemic, vulnerable
977. *Ixora nigricans* R. Br. ex Wight & Arn.
978. *Ixora pavetta* Andr.
979. *Knoxia mollis* Wight and Arn.
980. *Knoxia sumatrensis* (Retz.) DC. Var *sumatrensis*
981. *Knoxia sumatrensis* (Retz.) DC. var. *glaberrima* Bhatt. et Deb. SWestern Ghats, endemic
982. *Knoxia sumatrensis* (Retz.) DC. var. *sumatrensis;* Bhatt. & Deb
983. *Knoxia sumatrensis* (Retz.) DC. var. *hookeriana* Bhatt. & Deb
984. *Knoxia wightiana* Wall. ex Wight & Arn. Endemic to Peninsular India
985. *Lasianthus acuminatus* Wight. Southern Western Ghats, endemic

986. ***Lasianthus dichotomous*** Wight. Southern Western Ghats, endemic, Endangered
987. ***Lasianthus parvifolius*** Wigh.t Southern Western Ghats, endemic
988. *Lasianthus strigillosus* Hook. f. Southern Western Ghats, endemic, vulnerable
989. *Mitracarpus villosus* (Sw.) DC.
990. *Mitragyna parvifolia* (Roxb.) Korth.
991. *Morinda pubescens* J.E. Smith,
992. *Morinda umbellata* L.
993. *Mussaenda belilla* Buch.-Ham. Western Ghats, endemic
994. *Mussaenda hirsutissima* (Hook. f.) Hutchinson ex Gamble. Southern Western Ghats, endemic
995. *Mussaenda tomentosa* Wight ex Wall. Southern Western Ghats, endemic
996. *Mycetia acuminata* (Wight) O. Ktze. Southern Western Ghats, endemic
997. *Neanotis decipiens* (Hook. f.) W. H. Lewis. Western Ghats, endemic
998. *Neanotis hutchinsonii* Deb & Dutta. Southern Western Ghats, endemic
999. *Neanotis indica* (DC) Lweis var *affinis* (Wall ex Wight & Arn.) Lewis
1000. *Neanotis monosperma* (Wall ex Wight & Arn.) Lewis. Peninsular India endemic
1001. *Neanotis tubulosa* (G. Don) Mabber.
1002. *Neolamarckia cadamba* (Roxb.) Bosser
1003. *Neonauclea purpurea* (Roxb.) Merr. Peninsular India, endemic
1004. *Neurocalyx calycinus* (R. Br. ex Benn.) Robins. Peninsular India, endemic
1005. *Octotropis travancorica* Bedd. Peninsular India, endemic. Rare
1006. *Ophiorrhiza barberi* Gamble Southern Western Ghats, endemic Endangered
1007. *Ophiorrhiza brunonis* Wight & Arn. var *brunonis* Southern Western Ghats, endemic
1008. ***Ophiorrhiza brunonis*** Wight & Arn. var. ***johnsonii*** Hook f. SWestern Ghats (Kerala), endemic. **Posssibly Extinct**
1009. *Ophiorrhiza caudate* Fischer Southern Western Ghats, endemic
1010. *Ophiorrhiza eriantha* Wight, Southern Western Ghats, endemic
1011. ***Ophiorrhiza grandiflora*** Wight Southern Western Ghats Kerala), endemic
1012. *Ophiorrhiza mungos* L.
1013. ***Ophiorrhiza munnarensis*** Fischer. S. Western Ghats, endemic **Critically Endangered**
1014. ***Ophiorrhiza nairii*** Ramam. & Rajan. Southern Western Ghats (Kerala), endemic
1015. *Ophiorrhiza pectinata* Arn.
1016. ***Ophiorrhiza pykarensis*** Gamble. Southern Western Ghats, Critically endangered
1017. *Ophiorrhiza rugosa* Wall. var. prostrata (D. Don) Deb & Mondal
1018. *Oxyceros rugulosus* (Thw.) Tirvengadum
1019. *Pavetta brevifolia* DC. var. *brevifolia.* Southern Western Ghats, endemic
1020. ***Pavetta brevifolia*** DC. var. ***subcoriacea*** Gamble. Southern Western Ghats, endemic
1021. *Pavetta calophylla* Bremek. Southern Western Ghats, endemic
1022. *Pavetta hispidula* Wight & Arn.
1023. ***Pavetta laeta*** Bremek., Endemic to Peninsular India
1024. *Pavetta siphonantha* Dalz.
1025. *Pavetta tomentosa* Roxb. ex J. E. Smith
1026. *Pseudaidia speciosa* (Bedd.) Tiruveng.
1027. *Psilanthus wightianus* (Wight & Arn.) J. Leroy,
1028. *Psychotria anamalayana* Bedd. South India.
1029. ***Psychotria barberi*** Gamble . Southern Western Ghats (Kerala), endemic .Vulnerable.
1030. *Psychotria bisulcata* Wight & Arn.

1031. ***Psychotria connata*** Wall. Southern Western Ghats (Kerala & Tamil Nadu).
1032. *Psychotria flavida* Talbot. Peninsular India, endemic
1033. *Psychotria glandulosa* (Dennst.) Suresh. South India and Sri Lanka.
1034. *Psychoria globicephala* Gamble. Southern Western Ghats endemic, endengered
1035. *Psychotria keralensis* Deb & Gang. Southern Western Ghats (Kerala).
1036. *Psychotria macrocarpa* Hook. f. Southern Western Ghats (Kerala and Tamil Nadu).Endangered.
1037. *Psychotria nigra* (Gaertn.) Alston var. *nigra.* Peninsular India and Sri Lanka.
1038. *Psychotria nigra* (Gaertn.) Alston var. peninsularis (Hook.f.) eb & Gangopad.
1039. *Psychotria nilgiriensis* Deb & Gang. Southern Western Ghats.
1040. *Psychotria nudiflora* Wight & Arn. Southern Western Ghats (Kerala & Tamil Nadu).
1041. *Psychotria subintegra* (Wight & Arn.) Hook. f., Southern Western Ghats. Endemic
1042. *Psychotria truncata* Wall. Western Peninsular India. Endemic
1043. *Richardia scabra L.*
1044. *Rubia cordifolia* L.
1045. *Saprosma foetens* (Wight) K. Schum. Southern Western Ghats
1046. *Saprosma glomeratum* (Gard.) Bedd. Southern Western Ghats.
1047. *Spermacoce articularis* L. f.
1048. *Spermacoce latifolia* Aublet
1049. *Spermacoce mauritiana* Osea Gideon ex Verdc.
1050. *Spermococe ocymoides* Burm.f.,
1051. *Spermacoce pusilla* Wall.
1052. *Tarenna asiatica* (L.) O. Ktze. ex K. Schum.
1053. *Tarenna monosperma* (Wight & Arn.) Raju. Southern Western Ghats. Endangered
1054. *Wendlandia thyrsoidea* (Schultes) Steud. Peninsular India and Sri Lanka.

VALERIANACEAE

1055. *Valeriana hardwockii* Wall. var arnottiana (Wight) Clarke
1056. *Valeriana hookeriana* Wight
1057. ***Valeriana leschenaultii*** DC Southern Western Ghats (Kerala), endemic

ASTERACEAE

1058. *Acanthospermum hispidum* DC.
1059. *Achillea millefolium* L.
1060. *Adenostemma lavenia* (L.) O. Ktze
1061. *Adenostemma macrophylla* (Bl.) DC.
1062. *Ageratina adenophora* (Spreng.) King & Robins.
1063. *Ageratum conyzoides* L.
1064. *Ageratum haustonianum* Mill.
1065. *Anaphalis aristata* DC. Endemic to Peninsular India.
1066. *Anaphalis barnesii* Fischer. Endemic to Southern Western Ghats. Endangered
1067. ***Anaphalis bournei*** Fyson. Endemic to Southern Western Ghats.
1068. *Anaphalis lawii* (Hook. f.) Gamble Endemic to Peninsular India.
1069. ***Anaphalis marcescens*** (Wight) Clarke
1070. *Anaphalis meeboldii* W.W. Smith Endemic to Western Ghats.
1071. ***Anaphalis notoniana*** DC. Endemic to Southern Western Ghats. Endangered
1072. *Anaphalis subdecurrens* (DC.) Gamble South India and Sri Lanka.
1073. ***Anaphalis travancorica*** W. W. Smith, endemic to Peninsular India

1074. *Artemisia japonica* Thunb
1075. *Artemisia nilagirica* (Clarke) Pamp. Peninsular India.
1076. *Bidens biternata* (Lour.) Merr. & Sheriff
1077. *Bidens pilosa* L.
1078. *Blainvillea acmella* (L.) Philip.,
1079. *Blepharispermum petiolare* DC. South India and Sri Lanka.
1080. *Blumea alata* (D. Don) DC.
1081. *Blumea barbata* DC.
1082. *Blumea belangeriana* DC.
1083. *Blumea eriantha* DC. Southern Western Ghats. Rare
1084. *Blumea hieracifolia* (D. Don) DC.
1085. *Blumea lacera* (Burm. f.) DC.
1086. *Blumea lanceolaria* (Roxb.) Druce var. *lanceolaria*
1087. *Blumea lanceolaria* (Roxb.) Druce var. *spectabilis* (DC) Randeria
1088. *Blumea malcolmii* (Clarke) Hook.f., endemic to Peninsular India
1089. *Blumea membranacea* Wallich ex DC. var. *jacquemontii* (Hook.f.)) Randeria, India.
1090. *Blumea mollis* (D. Don) Merr.
1091. *Blumea oxyodonta* DC.
1092. *Blumea virens* Wall. ex DC.
1093. *Centipeda minima* (L.) A. Braun & Asch.
1094. *Chromolaena odorata* (L.) King & Robins.
1095. *Cicerbita cyanea* (D.Don) P. Beauv.
1096. *Cirsium wallichii* DC.
1097. *Conyza aegyptiaca* (L.) Ait.
1098. *Conyza bonariensis* (L.) Cronq.
1099. *Conyza japonica* (Thunb.) Less.
1100. *Conyza leucantha* (D. Don) Ludlow & Raven,
1101. *Conyza stricta* Willd.
1102. *Cosmos caudatus* Kunth
1103. *Cyathocline lutea* Lawson. Endemic to Western Ghats
1104. *Dichrocephala chrysanthemifolia* (Blume) DC
1105. *Dichrocephala integrifolia* (L. f.) O. Ktze.
1106. *Eclipta prostrata* (L.) L.
1107. *Elephantopus scaber* L.
1108. *Eleutheranthera ruderalis* (Sw.) Sch.-Bip.
1109. *Emilia javanica* (Burm.f.) Robs
1110. *Emilia scabra* DC. Peninsular India.
1111. *Emilia sonchifolia* (L.) DC.
1112. *Erechtites valerianifolia* (Wolf) DC.
1113. *Erigeron karvinskianus* DC.
1114. *Erigeron sublyratus* DC
1115. *Galinsoga parviflora* Cav.
1116. *Gnaphalium coarctatum* Willd. Endemic to Peninsular India Endangered
1117. *Gnaphalium polycaulon* Pers.
1118. *Gnaphalium pulvinatum* Delile

1119. *Grangea maderaspatana* (L.) Poir.
1120. *Gynura crepidioides* Benth
1121. *Gynura lycopersicifolia* DC.
1122. *Gynura nitida* DC. Peninsular India.
1123. *Gynura pseudo-china* (L.) DC.
1124. *Gynura travancorica* W. W. Smith Southern Western Ghats.
1125. *Helichrysum buddleioides* DC. Western Peninsular India.
1126. *Helichrysum perlanigerum* Gamble. Endemic to Idukki district (Kerala).
1127. *Kleinia grandiflora* (Wall. ex DC) Rani
1128. *Kleinia walkerii* (Wight) Uniyal
1129. *Laggera crispata* (Vahl) Hepper & Wood
1130. *Launaea acaulis* (Roxb.) Babc. ex Kerr.
1131. *Mikania cordata* (Burm. f.) Robinson
1132. *Moonia heterophylla* Arn.
1133. *Myriactis wightii* DC. var. *wightii*. Endemic to South India. Endangered
1134. ***Myriactis wightii*** DC. var. ***bellidioides*** Hook.f. Endemic to South India.Endangered
1135. *Parthenium hysterophorus* L.
1136. *Phyllocephalum courtallense* (Wight) Narayana. Endemic to Peninsular India
1137. *Phyllocephalum phyllolaenum* (DC.) Narayana. Peninsular India.
1138. *Phyllocephalum scabridum* (DC.) Kirkman. Western Peninsular India.
1139. *Psiadea ceylanica* (Arn.) Gricrson
1140. *Senecio corymbosa* Wall. ex DC.
1141. *Senecio intermedius* Wight
1142. *Senecio lavandulaefolius* DC.
1143. ***Senecio neelgherryanus*** DC. Southern Western Ghats Kerala), endemic
1144. *Senecio scandens* Buch.-Ham. ex D. Don
1145. *Senecio stylosus* Balakr.
1146. *Senecio zeylanicus* DC.
1147. *Sigesbeckia orientalis* L.
1148. *Sonchus oleraceus* L.
1149. *Sonchus wightianus* DC.
1150. *Sphaeranthus amaranthoides* Burm. f.
1151. *Sphaeranthus indicus* L.
1152. *Spilanthes calva* DC
1153. *Spilanthes paniculata* DC.
1154. *Spilanthes radicans* Jacq.
1155. *Synedrella nodiflora* (L.) Gaertn.
1156. *Tithonia diversifolia* (Hemsl.) A. Gray
1157. *Tridax procumbens* L.
1158. *Vernonia albicans* DC
1159. ***Vernonia anaimudica*** Shetty & Vivek. Southern Western Ghats (Kerala) vulnerable
1160. ***Vernonia anamallica*** Bedd. Ex Gamble. Southern Western Ghats(Kerala) Vulnerable
1161. *Vernonia anthelmintica* (L.) Willd.
1162. *Vernonia arborea* Buch.-Ham.,
1163. ***Vernonia bourneana*** W.W. Smith. Endemic to Peninsular India

1164. *Vernonia cinerea* (L.) Less.
1165. *Vernonia comorinensis* W. W. Smith. Endemic to Peninsular India.
1166. *Vernonia conyzoides* DC. Endemic to Peninsular India
1167. *Vernonia divergens* (Roxb.) Edgew.
1168. ***Vernonia fysonii*** Calder. Southern Western Ghats(Kerala) Endangered.
1169. *Vernonia heynei* Bedd. ex Gamble. Southern Western Ghats(Kerala & Tamil Nadu).
1170. *Vernonia indica* Clarke. Western Peninsular India.
1171. *Vernonia malabarica* Hook.f. Southern Western Ghats (Kerala) vulnerable
1172. ***Vernonia multibracteata*** Gamble. Southern Western Ghats (Kerala).
1173. *Vernonia peninsularis* (Clarke) Clarke ex Hook. f. Peninsular India.
1174. *Vernonia pulnneyensis* Gamble. Southern Western Ghats (Kerala). Endangered
1175. ***Vernonia rauii*** Uniyal. Southern Western Ghats(Kerala) **Considered Extinct.**
1176. *Vernonia saligna* DC var. *nilghirensis* Hook. f. Southern Western Ghats. Vulnerable
1177. *Vernonia salvifolia* Wight. Southern Western Ghats. Endangerd
1178. *Vernonia travancorica* Hook. f. Southern Western Ghats.
1179. ***Vernonia vivekananthanii*** Uniyal. Southern Western Ghats (Kerala)
1180. *Vicoa indica* (L.) DC.
1181. *Wedelia urticaefolia* (Bl.) DC. Peninsular India.
1182. *Xanthium indicum* Koen.
1183. *Youngia japonica* (L.) DC.

CAMPANULACEAE

1184. *Asyneuma fulgens* (Wall.) Briq.
1185. ***Campanula alphonsii*** Wall. ex A. DC. Southern Western Ghats (Kerala)
1186. *Wahlenbergia erecta* (Roth ex Schult.) Tuyn
1187. *Wahlenbergia hookeri* (Clarke) Tuy. Endemic to South India. Rare
1188. *Wahlenbergia marginata* (Thunb.) A. DC.,

LOBELIACEAE

1189. *Lobelia alsinoides* Lam.
1190. *Lobelia dichotoma* Miq.
1191. *Lobelia heyneana* Schult.
1192. *Lobelia leschenaultiana* (Presl) Skottsb.
1193. *Lobelia nicotianaefolia* Roth ex Roem. & Schult.
1194. *Lobelia zeylanica* Linn.

VACCINIACEAE

1195. *Vaccinium leschenaultii* Wight var.*leschenaultii*. Southern Western Ghats. Rare
1196. ***Vaccinium leschenaultii*** Wight var ***rotundifolia*** (Wight) Clarke. Southern Western Ghats. Rare
1197. *Vaccinium neilgherrense* Wight. Southern Western Ghats.

ERICACEAE

1198. *Gaulteria fragrantissima* Wall.
1199. *Rhododendron arboreum* J. E. Smith, ssp nilagiricum (Zenk.) Tagg. SWestern Ghats. Rare

PLUMBAGINACEAE

1200. *Plumbago zeylanica* L.

PRIMULACEAE

1201. *Anagallis pumila* Sw.
1202. *Lysimachia procumbens* Baudo Rare

MYRSINACEAE

1203. ***Antistrophe glabra*** Pandur. & Nair. Endemic to Southern Western Ghats (Kerala). Rare
1204. *Ardisia blatteri* Gamble. Southern Western Ghats (Kerala). Rare
1205. *Ardisia pauciflora* Heyne ex.Roxb.
1206. *Ardisia rhomboidea* Wight. Peninsular India.
1207. *Ardisia sonchifolia* Mez. Southern Western Ghats.
1208. *Ardisia stonei* Sasi. & Sivar. Southern Western Ghats (Kerala).
1209. *Embelia adnata* Bedd. ex Clarke . Southern Western Ghats.
1210. *Embelia basaal* (Roem. & Schultes) A. DC.
1211. *Embelia ribes* Burm. f.
1212. *Maesa indica* (Roxb.) DC.
1213. *Rapanea capitellata* (Wall.) Mez var. *capitellata*
1214. *Rapanea capitellata* (Wall.) Mez var. *sessilis* Gamble. Endemic to S. Western Ghats.
1215. *Rapanea daphnoides* Mez Endemic to Southern Western Ghats. Rare
1216. ***Rapanaea thwaitesii*** Mez. Endemic to Southern Western Ghats. Rare & threatened.

SAPOTACEAE

1217. *Chrysophyllum roxburghii* G. Don
1218. *Isonandra lanceolata* Wight
1219. *Isonandra perrottetiana* A. DC. Southern Western Ghats. Rare
1220. *Isonandra stocksii* Clarke. Southern Western Ghats. Rare
1221. *Madhuca longifolia* (Koenig) J.F.Macbr.
1222. *Madhuca neriifolia* (Moon) H. J. Lam
1223. *Manilkara hexandra* (Roxb.) Dubard. Endemic to Peninsular India
1224. ***Manilkara roxburghiana*** (Wight) Dubard. Southern Western Ghats, endemic
1225. *Mimusops elengi* L.
1226. *Palaquium ellipticum* (Dalz.) Baill. Western Ghats.
1227. *Palaquium ravii* Sasi. & Vink. Southern Western Ghats (Kerala). Rare
1228. *Xantolis tomentosa* (Roxb.) Raf. var. *tomentosa*
1229. *Xantolis tomentosa* (Roxb.) Raf. var. *elengioides*. Endemic to Peninsular India

EBENACEAE

1230. *Diospyros assimilis* Bedd. Southern Western Ghats. Rare
1231. *Diospyros bourdillonii* Brandis. Southern Western Ghats.
1232. *Diospyros buxifolia* (Bl.) Hiern
1233. *Diospyros candolleana* Wight. Western Peninsular India.
1234. *Diopyros cordifolia* Roxb.
1235. *Diospyros ebenum* Koen.
1236. *Diospyros ferrea* (Willd.) Bakh. var ferrea
1237. *Diospyros ferrea* (Willd.) Bakh. var angustifolia (Miq.) Mohanan. Endemic to Southern Western Ghats.
1238. *Diospyros ghatensis* Ramesh & Franceschi. Endemic to Southern Western Ghats. Rare
1239. *Diospyros malabarica* (Desr.) Kostel.
1240. *Diospyros melanoxylon* Roxb.,
1241. *Diospyros montana* Roxb.
1242. *Diospyros nilagirica* Bedd. Southern Western Ghats.
1243. *Diospyros ovalifolia* Wight
1244. *Diospyros paniculata* Dalz . Southwards from Konkan, in Western Ghats; endemic.

1245. *Diospyros pruriens* Dalz. Peninsular India; endemic.
1246. *Diospyros racemosa* Roxb.
1247. *Diospyros sylvatica* Roxb.
1248. *Diospyros toposia* Buch.-Ham. Southern Western Ghats. Rare
1249. *Diospyros trichophylla* Alston, Vulnerable.
1250. *Maba neilgherrensis* Wight.

SYMPLOCACEAE

1251. ***Symplocos anamallayana*** Bedd. Endemic to Southern Western Ghats. Endangered
1252. *Symplocos cochinchinensis* (Lour.) Moore
1253. *Symplocos foliosa* Wight . Endemic to Southern Western Ghats.
1254. *Symplocos macrophylla* Wall. ex A.DC. ssp. *macrophylla*, Henry. Endemic to South Western Ghats. Rare
1255. ***Symplocos macrophylla***Wall.exA.DC. ssp. ***microphylla*** (Wight) Nooteb.Endemic to SWestern Ghats (Kerala). Rare
1256. *Symplocos macrophylla* Wall ex A. DC. ssp. *rosea* (Bedd.) Nooteb. Endemic to Southern Western Ghats.
1257. *Symplocos monantha* Wight. Endemic to Southern Western Ghats. Considered extinct
1258. *Symplocos obtusa* Wall. ex G. Don
1259. *Symplocos pendula* Wight
1260. ***Symplocos pulchra*** Wight var. ***villosa*** (Brand.) Noteb. Endemic to S. Western Ghats.
1261. *Symplocos racemosa* Roxb.
1262. *Symplocos wynadense* (O. Ktze.) Nooteb. Endemic to Southern Western Ghats. Rare

OLEACEAE

1263. *Chionanthus courtallensis* Bedd. Endemic to Southern Western Ghats.
1264. *Chionanthus linocieroides* (Wight) Bennet & Raizada. Endemic to Southern Western Ghats. Endangered.
1265. *Chionanthus mala-elengi* (Dennst.) P.S.Green. Endemic to Peninsular India.
1266. ***Chionanthus ramiflorus*** Roxb. var. ***peninsularis*** Ravikum. & Lakshm. Endemic to SWestern Ghats.
1267. *Chionanthus ramiflorus* Roxb var. *ramiflorus*. Endemic to Southern Western Ghats.
1268. ***Chionanthus roxburghii*** (Spreng.) Srivast. & Kapoor. Endemic to S. Western Ghats.
1269. *Chionanthus zeylanica* L.
1270. *Jasminum angustifolium* (L.) Willd. Var. *angustifolium*
1271. *Jasminum angustifolium* (L.) Willd. var. *sessiliflorum* (Vahl) Green
1272. *Jasminum auriculatum* Vahl,
1273. *Jasminum azoricum* L.,
1274. *Jasminum bignoniaceum* Wall ex A.DC.
1275. ***Jasminum breviufolium*** A.DC. Endemic to Peninsular India.
1276. *Jasminum calophyllum* Wall. ex A. DC. Endemic to South India. Rare
1277. *Jasminum cordifolium* Wall. ex G. Don. Endemic to Southern Western Ghats.
1278. *Jasminum cuspidatum* Rottl.
1279. *Jasminum flexile* Vahl
1280. *Jasminum multiflorum* (Burm. f.) Andr.
1281. *Jasminum rottlerianum* Wall. ex DC.
1282. ***Jasminum roxburghianum*** Wall ex Clarke. Endemic to Southern Western Ghats
1283. ***Jasminum trichotomum*** Heyne ex Roth. Endemic to Peninsular India
1284. *Ligustrum perrottetii* DC. Peninsular India.
1285. *Ligustrum robustum* (Roxb.) Bl. Ssp walkerii (Decne.) P.S. Green
1286. *Myxopyrum smilacifolium* Bl.
1287. *Olea dioica* Roxb. India.

1288. *Olea glandulifera* Wall. ex G. Don

SALVADORACEAE

1289. *Azima tetracantha* Lam.

APOCYNACEAE

1290. *Aganosma cymosa* (Roxb.) G. Don
1291. *Alstonia scholaris* (L.) R. Br.
1292. *Alstonia venenata* R. Br.
1293. *Anodendron manubriatum* Merr.
1294. *Anodendron rhinosporum* Thw.
1295. *Carissa carandas* L.,
1296. *Carissa inermis* Vahl Endemic to Peninsular India.
1297. *Cascabela thevetia* (L.) Lippold
1298. *Catharanthus pusillus* (Murr.) G. Don
1299. *Catharanthus roseus* (L.) G. Don,
1300. *Chilocarpus denudatus* Bl.
1301. *Chonemorpha grandiflora* (Roth) M. R. & S. M. Almeida
1302. *Holarrhena pubescens* (Buch.-Ham.) Wall. ex G. Don
1303. *Hunteria ceylanica* (Retz.) Gard. Ex Thw.
1304. *Nerium oleander* L.
1305. *Ichnocarpus frutescens* (L.) R. Br
1306. *Kammatia caryophyllata* (Roxb.) Nicols. Endemic Karnataka and Kerala
1307. *Parsonsia inodora* (Lour.) M.R. & S.M. Almedia
1308. *Plumeria alba* L..
1309. *Plumeria rubra* L.,
1310. *Rauvolfia micrantha* Hook. f. Endemic to Southern Western Ghats.
1311. *Rauvolfia serpentina* (L.) Benth. ex Kurz
1312. *Rauvolfia tetraphylla* L.
1313. *Rauvolfia verticillata* (Lour.) Baill.
1314. *Tabernaemontana divaricata* (L.) R. Br.
1315. *Tabernaemontana gamblei* Subram. & Henry. Endemic to Southern Western Ghats.
1316. *Tabernaemontana heyneana* Wall. Endemic to Western Ghats. Near threatened
1317. *Wrightia arborea* (Dennst.) Mabber.
1318. *Wrightia tinctoria* (Roxb.) R. Br.

ASCLEPIADACEAE

1319. *Asclepias curassavica* L.
1320. ***Bidaria indica*** Rahman & Wilcock. Southern Western Ghats, endemic. Rare
1321. *Bidaria montana* (Roxb.) Rahman & Wilcock. Southern Western Ghats, endemic
1322. ***Brachystelma swarupa*** Kishore & Goider Endemic to Southern Western Ghats
1323. *Calotropis gigantea* (L.) R. Br.
1324. *Caramulla adscendens* (Roxb.) Haw. var. attenuata (Wight) Grav. & Mayuranathan
1325. ***Caramulla indica*** (Wight & Arn.) N. E. Br., endemic to Peninsular India
1326. ***Caraluma procumbens*** Grav. & Mayur. Endemic to SouthWestern Ghats.**Considered Extinct.**
1327. *Caramulla umbellata* Haw.,
1328. ***Ceropegia beddomei*** Hook. f. Southern Western Ghats (Kerala), endemic. Rare
1329. *Ceropegia candelabrum* L. var. *candelabrum*

1330. *Ceropegia candelabrum* L. var. *biflora* (L.) Ansari
1331. *Ceropegia decaisneana* Wight. Endemic to Southern Western Ghats. Rare
1332. *Ceropegia elegans* Wall.
1333. *Ceropegia ensifolia* Bedd. Southern Western Ghats (Kerala); endemic.
1334. *Ceropegia omissa* Huber. Endemic to Peninsular India
1335. *Ceropegia hirsuta* Wight & Arn. Peninsular India. Very rare
1336. *Ceropegia intermedia* Wight. Endemic to Peninsular India.
1337. *Ceropegia juncea* Roxb.,
1338. *Ceropegia maculata* Bedd. Southern Western Ghats (Kerala), endemic. Very rare
1339. *Ceropegia metziana* Miq. Southern Western Ghats (Kerala), endemic. Very rare
1340. *Ceropegia omissa* H. Hubber .Southern Western Ghats (Kerala), **Considered Extinct**
1341. ***Ceropegia pusilla*** Wight & Arn. Peninsular India, endemic. Rare
1342. *Cosmostigma racemosum* (Roxb.) Wight
1343. *Cynanchum alatum* Wight & Arn. Peninsular India, endemic. Rare
1344. ***Gymnema elegans*** Wight & Arn. Peninsular India, endemic. Rare
1345. *Gymnema khandalense* Sant. Peninsular India, endemic. Rare
1346. *Gymnema sylvestre* (Retz.) R. Br. ex Schult.
1347. *Holostemma ada-kodien* Schult.
1348. ***Heterostemma vasudavanii*** Swarup. & Mangaly. Southern Western Ghats (Kerala), endemic. Very rare
1349. *Hoya ovalifolia* Wight & Arn.
1350. *Hoya pauciflora* Wight
1351. *Hoya retusa* Dalz. Western Ghats. Endemc
1352. *Hoya wightii* Hook. f. South India. Endemic
1353. *Leptadenia reticulata* (Retz.) Wight & Arn.
1354. ***Marsdenia brunoniana*** Wight & Arn.
1355. *Marsdenia tirunelvelica* Henry & Subr. South India, endemic. Rare
1356. *Pergularia daemia* (Forssk.) Chiov.
1357. *Sarcostemma acidum* (Dennst.) Voigt.
1358. *Sarcostemma brunonianum* Wight & Arn.
1359. *Secamone emetica* (Retz.) R. Br. ex Schultes
1360. *Tylophora capparidifolia* Wight & Arn. Southern Western Ghats, endemic.
1361. *Tylophora fasciculata* Buch.-Ham. ex Wight & Arn.
1362. *Tylophora macrantha* Hook. f. Southern Western Ghats; endemic.
1363. *Tylophora mollissima* Wight & Arn. Southern Western Ghats, endemic.
1364. ***Tylophora rotundifolia*** Buch.-Ham. ex Wight Peninsular India.
1365. *Tylophora subramanii* Henry. Southern Western Ghats, endemic. Rare
1366. *Tylophora tetrapetala* (Dennst.) Suresh in Nicols. et al, var. *tenuissima* (Roxb. ex Willd.) Swarup
1367. *Wattakaka volubilis* (L. f.) Stapf

PERIPLOCACEAE

1368. *Cryptolepis buchananii* Roem. & Schult.
1369. *Cryptolepis grandiflora* Wight. Endemic to Peninsular India
1370. *Decalepis hamiltonii* Wight & Arn. Endemic to Peninsular India
1371. *Hemidesmus indicus* (L.) R. Br. var. indicus
1372. *Hemidesmus indicus* (L.) R. Br. var. pubescens (Wight & Arn.) Hook.f. Endemic to Peninsular India
1373. ***Utleria salicifolia*** Bedd. Southern Western Ghats, endemic. Endangered.

LOGANIACEAE

1374. *Fagraea ceylanica* Thunb.
1375. *Gardneria ovata* Wall.
1376. *Strychnos colubrina* L.
1377. *Strychnos lenticellata* Hill. Southern Western Ghats, endemic.
1378. *Strychnos minor* Dennst.
1379. *Strychnos nux-vomica* L.
1380. *Strychnos potatorum* L. f.,
1381. *Strychnos vanprukii* Craib Southern Western Ghats. Rare

BUDDLEJACEAE

1382. *Buddleja asiatica* Lour.

GENTIANACEAE

1383. *Canscora diffusa* (Vahl) R. Br. ex Roem. & Schultes
1384. *Canscora perfoliata* Lam. South West India.
1385. *Canscora roxburghii* Arn. ex Miq.
1386. ***Exacum anamallayanum*** Bedd. Southern Western Ghats, endemic. Rare
1387. *Exacum atropurpureum* Bedd. Southern Western Ghats, endemic. Rare
1388. *Exacum carinatum* Roxb.
1389. *Exacum courtallense* Arn. Southern Western Ghats, endemic
1390. ***Exacum grande*** Klack. South India, endemic. Rare
1391. *Exacum sessile* L.
1392. *Exacum tetragonum* Roxb. Southern Western Ghats, endemic.
1393. *Exacum wightianum* Arn. Southern Western Ghats, endemic.
1394. *Gentiana quadrifaria* Blume
1395. *Hoppea fastigiata* (Griseb.) Clarke
1396. *Swertia corymbosa* (Griseb.) Wight ex Clarke . Peninsular India.
1397. ***Swertia minor*** (Griseb.) Knobl. Southern Western Ghats (Kerala), endemic.

MENYANTHACEAE

1398. *Nymphoides hydrophylla* (Lour.) O. Ktze.
1399. *Nymphoides indica* (L.) O.Ktze.

HYDROPHYLLACEAE

1400. *Hydrolea zeylanica* (L.) Vahl,

BORAGINACEAE

1401. *Carmona retusa* (Vahl.) Masamune
1402. *Coldenia procumbens* L.
1403. *Cordia gharaf* (Forssk.) Ehrenb. ex Asch
1404. *Cordia monoica* Roxb.,
1405. *Cordia obliqua* Willd.
1406. *Cordia octandra* DC. Endemic to Southern Western Ghats (Kerala). Endangered
1407. *Cordia wallichii* G. Don
1408. *Cynoglossum zeylanicum* (Vahl ex Hornem.) Thunb. ex Lehm.
1409. *Ehretia canarensis*(Clarke) Gamble .Endemic to Peninsular India
1410. ***Ehetia ovalifolia*** Wight. endemic to Peninsular India
1411. ***Ehretia pubescens*** **Benth.** Endemic to Peninsular India
1412. ***Ehretia wightiana*** Wall. ex G. Don. Eendemic to Peninsular India. Threatened

1413. *Heliotropium indicum* L.
1414. *Heliotropium marifolium* Retz.,
1415. *Rotula aquatica* Lour.
1416. *Tournefortia heyneana* Wall. ex G. Don. Southern Western Ghats; endemic.
1417. *Trichodesma indicum* (L.) Lehm
1418. *Trichodesma zeylanicum* (Burm. f.) R. Br.

CONVOLVULACEAE

1419. *Argyreia cuneata* (Willd.) Ker-Gawl. Peninsular India. Rare
1420. ***Argyreia daltonii*** Clarke. Peninsular India. Rare
1421. *Argyreia hirsuta* Wight & Arn. var. hirsute
1422. ***Argyreia hirsuta*** Wight & Arn. var ***coacta*** Clarke
1423. *Argyreia imbricata* (Roth.) Sant. & Patel. Peninsular India. Rare
1424. *Argyreia kondaparthiensis* Daniel & Vajravelu
1425. *Argyereia nervosa* (Burm. F.) Bojer
1426. *Argyreia sericea* Dalz.
1427. *Cuscuta chinensis* Lam.,
1428. *Cuscuta reflexa* Roxb.
1429. *Cuccuta tyagii*
1430. *Erycibe paniculata* Roxb.
1431. *Evolvulus alsinoides* (L.) L.
1432. *Evolvulus numularis* (L.) L.
1433. *Hewittia malabarica (L.) Suresh*
1434. *Ipomoea alba* L.
1435. *Ipomoea barlerioides* (Choisy) Benth. ex Clarke
1436. *Ipomoea cairica* (L.) Sweet
1437. *Ipomoea campanulata* L.
1438. *Ipomoea deccana* Austin
1439. *Ipomea dichroa* Choisy
1440. *Ipomoea eriocarpa* R. Br.
1441. *Ipomoea hederifolia* L.
1442. *Ipomoea mauritiana* Jacq.
1443. *Ipomea mombassana* Vatke,
1444. *Ipomoea nil* (L.) Roth.
1445. *Ipomoea obscura* (L.) Ker.-Gawl.
1446. *Ipomoea pes-tigridis* L.
1447. *Ipomoea staphylina* Roem. & Schult.
1448. *Ipomoea turbinata* Lag.
1449. *Ipomoea wightii* (Wall.) Choisy
1450. *Merremia hederacea* (Burm. f.) Hall. f.
1451. *Merremia tridentata* (L.) Hall. f.
1452. *Merremia vitifolia* (Burm. f.) Hall. f.
1453. *Merremia umbellata* (L.) Hall. f.
1454. *Rivea ornata* (Roxb.) Choisy.,
1455. ***Stictocardia sivarajanii*** Biju et al., Southern Western Ghats. endemic

SOLANACEAE

1456. *Brugmansia suaveolens* (Humb. & Bonpl. ex Willd.) Bercht. & Presl.
1457. *Cestrum nocturnum* L.
1458. *Cyphomandra batecea* L.
1459. *Datura metel* L.
1460. *Lycianthes laevis* (Dunal) Bitter, ssp. *bigeminata* (Nees) Deb
1461. *Lycianthes laevis* (Dunal) Bitter, ssp. *laevis* . Southern Western Ghats.
1462. *Lycopersicon esculentum* Miller
1463. *Nicandra physalodes* (L.) Gaertn.
1464. *Nicotiana tabacum* L.
1465. *physalis angulata* L.
1466. *Physalis peruviana* L.
1467. *Solanum americanum* Mill.
1468. *Solanum anguivi* Lam.
1469. *Solanum anguivi* Lam. var. *anguivi*.
1470. *Solanum anguivi* Lam. var. *multiflora* (Roth) Chithra Pen.India.
1471. *Solanum capsicoides* All.
1472. *Solanum denticulatum* Blume
1473. *Solanum erianthum* D. Don
1474. *Solanum giganteum* Jacq.
1475. *Solanum jasminoides* Paxt.
1476. *Solanum lasiocarpum* Dunal
1477. *Solanum melongena* L.
1478. *Solanum pubescens* Willd.,
1479. *Solanum seaforthianum* Andr.
1480. *Solanum sisymbrifolium* Lam.
1481. *Solanum torvum* Sw.
1482. *Solanum trilobatum* L.
1483. *Solanum virginianum* L.

SCROPHULARIACEAE

1484. *Adenosma subrepens* Benth.
1485. *Artanema longifolia* (L.) Vatke
1486. *Bacopa monnieri* (L.) Pennell
1487. *Buchnera hispida* Buch.-Ham. ex D. Don
1488. *Calceolaria mexicana* Benth.
1489. *Centranthera indica* (L.) Gamble
1490. *Dopatrium junceum* (Roxb.) Buch.-Ham. ex Benth.
1491. *Dopatrium nudicaule* (Willd.) Benth.
1492. *Kickxia ramosissima* (Wall.) Janchen
1493. *Limnophila aromatica* (Lam.) Merr.
1494. *Limnophila chinensis* (Osbeck) Merr.
1495. *Limnophila indica* (L.) Druce
1496. *Limnophila repens* (Benth.) Benth.
1497. *Lindernia anagallis* (Burm. f.) Pennell
1498. *Lindernia antipoda* (L.) Alston
1499. *Lindernia caespitosa* (Blume) Panigrahi

1500. *Lindernia ciliata* (Colsm.) Pennell
1501. *Lindernia crustacea* (L.) F. Muell.
1502. *Lindernia hyssopioides* (Linn.) Haines
1503. *Lindernia oppositifolia* (Retz.) Mukerjee
1504. *Lindernia parviflora* (Roxb.) Haines
1505. *Lindernia rotundifolia* (L.) Mukerjee
1506. *Lindernia ruellioides* (Colsm.) Pennell
1507. *Lindernia viscosa* (Hornem.) Merr.
1508. *Mazus pumilus* (Burm. f.) Steenis
1509. *Mecardonia procumbens* (Mill.) Small
1510. *Micrargeria wightii* Benth.
1511. *Mimulus orbicularis* Benth. India. Rare
1512. *Pedicularis perrottetii* Benth. Endemic to Southern Western Ghats
1513. *Pedicularis zeylanica* Benth. Southern Western Ghats and Sri Lanka.
1514. *Scoparia dulcis* L.
1515. *Sopubia delphiniifolia* (L.) G. Don
1516. *Sopubia trifida* Buch.-Ham. ex D. Don
1517. *Striga angustifolia* (D. Don) Sald.
1518. *Striga asiatica* (L.) O. Ktze.
1519. *Striga gesnerioides* (Willd.) Vatke
1520. *Torenia bicolor* Dalz South India.
1521. *Torenia courtallensis* Gamble. South-East Asia. Rare
1522. *Torenia lindernioides* Sald. Southern Peninsular India. Rare
1523. *Torenia travancorica* Gamble

OROBANCHACEAE

1524. *Aeginetia indica* L.
1525. *Aeginetia pedunculata* (Roxb.) Wall.
1526. ***Campbellia cytinoides*** Wight . Southern Western Ghats. Rare
1527. *Christisonia bicolor* Gard.
1528. ***Christisonia calcarata*** Wight. Western Peninsular India. Rare
1529. *Christisonia tubulosa* (Wight) Benth. ex Hook. f., Southern Western Ghats. Rare

LENTIBULARIACEAE

1530. *Utricularia caerulea* L.
1531. *Utricularia graminifolia* Vahl
1532. ***Utricularia nayarii*** Janarthanam & Henry Kerala. Rare
1533. ***Utricularia praeterita*** Taylor. Western Ghats. Rare
1534. *Utricularia rosea-purpurea* Stapf ex Gamble,
1535. *Utricularia scandens* Benj.
1536. *Utricularia striatula* Sm.
1537. *Utricularia uliginosa* Vahl

GESNERIACEAE

1538. *Aeschynanthus perrottetii* A. DC. Peninsular India; endemic.
1539. *Didymocarpus fischeri* Gamble . Southern Western Ghats; endemic. Rare
1540. *Didymocarpus humboldtianus* Gard.
1541. ***Didymocarpus macrostachya*** Barnes. Southern Western Ghats; endemic. Critically endangered

1542. ***Didymocarpus meeboldii*** Smith. Southern Western Ghats; endemic. Critically endangered
1543. *Didymocarpus ovalifolia* Wight. Peninsular India. Vulnerable
1544. *Didymocarpus tomentosa* Wight. Southern Western Ghats.
1545. *Epithema carnosum* (G. Don) Benth. var. hispida Clarke
1546. *Rhynchoglossum notonianum* (Wall.) Burtt
1547. *Rhynchotechum permolle* (Nees) Burtt

BIGNONIACEAE

1548. *Dolichandrone arcuata* (Wight) Clarke
1549. *Oroxylum indicum* (L) Benth.
1550. *Pajanelia longifolia* (Willd.) K. Schum.
1551. *Radermachera xylocarpa* (Roxb.) K. Schum. Endemic to Peninsular India.
1552. *Spathodea campanulata* Beauv. F.
1553. *Stereospermum colais* (Buch.-Ham. ex Dillw.) Mabber.
1554. *Tecoma stans* (L.) Kunth

PEDALIACEAE

1555. *Martynia annua* L.
1556. *Pedalium murex* L.
1557. *Sesamum orientale* L.

ACANTHACEAE

1558. *Andrographis affinis* Nees. Endemic to Peninsular India
1559. *Andrographis atropurpurea* (Dennst.) Alston. Peninsular India.
1560. ***Andrographis explicata*** (Clarke) Gamble. Endemic to Southern Western Ghats.
1561. *Andrographis macrobotrys* Nees
1562. *Andrographis neesiana* Wight. Southern Western Ghats.
1563. *Andrographis paniculata* (Burm. f.) Wall. ex Nees
1564. ***Andrographis stellulata*** Clarke. Endemic to Southern Western Ghats
1565. *Asystasia chelonoides* Nees
1566. *Asystacia crispata* Benth. Endemic to Southern Western Ghats
1567. *Asystasia dalzelliana* Sant. S. Western India. Rare
1568. *Asystasia gangetica* (L.) T. Anders.
1569. *Asystasia travancorica* Bedd. Southern Western Ghats, endemic. Rare
1570. *Barleria acuminata* Nees, endemic to Peninsular India
1571. *Barleria courtallica* Nees Peninsular India; endemic.
1572. *Barleria cristata* L.,
1573. *Barleria involucrata* Nees var. *elata* (Dalz.) Clarke. SouthWestern Ghats; endemic.
1574. *Barleria involucrata* Nees var. *involucrata.* SouthWestern Ghats; endemic
1575. *Barleria lawii* T. Anders. Western Peninsular India; endemic.
1576. *Barleria mysorensis* Heyne ex Roth,
1577. *Barleria prionitis* L.,
1578. *Blepharis maderaspatensis* (L.) Heyne ex Roth,
1579. *Blepharis repens* (Vahl) Roth,
1580. *Crossandra infundibuliformis* (L.) Nees
1581. *Dicliptera cuneata* Nees Peninsular India.
1582. *Dicliptera foetida* (Forssk.) Blatt.
1583. *Dipteracanthus patulus* (Jacq.) Nees

1584. *Dipteracanthus prostratus* (Poir.) Nees. Endemic to Peninsular India.
1585. *Ecbolium ligustrinum* (Vahl) Vollesen
1586. *Ecbolium viride* (Forssk.) Alston
1587. *Eranthemum capense* L. Southern Western Ghats.
1588. *Gymnostachyum canescens* (Nees) T. Anders. Southern Western Ghats.
1589. *Gymnostachyum febrifugum* Benth. S. W. India.
1590. *Gymnostachyum latifolium* (Dalz.) T. Anders. Southern Western Ghats. Rare
1591. *Haplanthodes neilgherryensis* (Wight) Majumdar. South India, endemic. Rare
1592. *Hygrophila salicifolia* (Vahl) Nees
1593. *Hygrophila ringens* (L.) Steud.
1594. *Hygrophila schulli* (Buch.-Ham.)MR & SM Almeida
1595. *Justicia adhatoda* L.
1596. *Justicia betonica* L.
1597. *Justicia gendarussa* Burm. f.
1598. *Justicia glabra* Koen. ex Roxb
1599. *Justicia japonica* Thunb.
1600. *Justicia latispica* (Clarke) Gamble
1601. *Justicia neesii* Ramam. in Saldanha & Nicol.
1602. ***Justicia notha*** Clarke in Hook. f. India. Rare
1603. *Justicia procumbens* L.
1604. *Justicia prostrata* (Roxb. ex Clarke) Gamble
1605. *Justicia santapaui* Bennet. Southern Western Ghats.
1606. *Justicia tranquebariensis* L. f.,
1607. *Justicia trinervia* Vahl
1608. *Justicia wynaadensis* (Nees) Heyne ex T. Anders. Southern Western Ghats, endemic.
1609. *Lepidagathis chlorostachya* Nees
1610. *Lepdagathus fasciculata*
1611. *Lepidagathis incurva* Buch.-Ham. ex D. Don. S. W. India.
1612. *Lepidagathis scariosa* Nees
1613. *Peristrophe montana* Nees
1614. *Peristrophe paniculata* (Forssk.) Brummitt
1615. *Phaulopsis imbricata* (Forssk.) Sweet.
1616. *Pseuderanthemum malabaricum* (Clarke) Gamble
1617. *Rhinacanthus nasuta* (L.) Kurz.
1618. *Rungia apiculata* Bedd.
1619. *Rungia laeta* Clarke. Peninsular India, endemic.
1620. *Rungia latior* Nees . Peninsular India, endemic.
1621. *Rungia pectinata* (L.) Nees
1622. *Rungia sisparensis* T. Anders. Southern Western Ghats; endemic.
1623. *Rungia wightiana* Nees. Peninsular India; endemic.
1624. *Staurogyne zeylanica* (Nees) O. Ktze.
1625. *Strobilanthes amabilis* C.B. Clarke. Endemic to Southern Western Ghats. Rare
1626. *Strobilanthes anamallaica* Wood. Southern Western Ghats; endemic.
1627. *Strobilanthes anceps* Nees
1628. ***Strobilanthes andersonii*** Bedd.: Endemic to Eravikulam N P. considered as extinct

1629. *Strobilanthes asperrimus* Nees
1630. ***Strobilanthes aurita*** J.R.I. Wood.: Western Peninsular India; endemic. Rare
1631. *Strobilanthes calycina* Nees
1632. *Strobilanthes caudatus* T. Anders. Western Peninsular India; endemic. Rare
1633. *Strobilanthes ciliatus* Nees Southern Western Ghats; endemic.
1634. *Strobilanthes consanguineus* (Nees) Clarke. Peninsular India. Common
1635. ***Strobilanthes cuspidatus*** (Benth.) T. Anders. Peninsular India.
1636. *Strobilanthes decurrens* Nees. Southern Western Ghats.
1637. ***Strobilanthes dupeni*** Bedd ex C.B. Clarke. Endemic to Kerala
1638. *Strobilanthes foliosus* (Wight) T. Anders. Peninsular India. Rare
1639. *Strobilanthes gracilis* Bedd. Southern Western Ghats.
1640. *Strobilanthes heyneanus* Nees. Southern Western Ghats.
1641. ***Strobilanthes homotropus*** Nees. Southern Western Ghats. Rare
1642. ***Strobilanthes integrifolius*** (Dalzell) Kuntze:. Endemic to Western Ghats.
1643. ***Sstrobilanthes ixiocephalus*** Benth.. Endemic to Western ghats.
1644. *Strobilanthes jeyporensis* Bedd. Peninsular India. Rare
1645. *Strobilanthes kunthianus* (Nees) T. Anders. ex. Benth. Peninsular India.
1646. *Strobilanthes lawsonii* Gamble. Southern Western Ghats. Rare
1647. *Strobilanthes luridus* Wight. Southern Western Ghats.
1648. ***Strobilanthes matthewiana*** R.W. Scotland. Endemic to Southern Western Ghats
1649. ***Strobilanthes micranthus*** Wight. Southern Western Ghats.
1650. *Strobilanthes microstachya* Benth. Ex Hohen.. Endemic to Peninsular India.
1651. *Strobilanthes neilgherrensis* Bedd. Endemic to Southern Western Ghats.
1652. ***Strobilanthes neoasper*** Venu & P. Daniel. Endemic to Southern Western Ghats.
1653. ***Strobilanthes papillosus*** T. Anders., . Endemic to Southern Western Ghats.
1654. ***Strobilanthes perrottetianus*** Nees. Endemic to Southern Western Ghats.
1655. *Strobilanthes pulneyensis* Clarke. Southern Western Ghats.
1656. *Strobilanthes rubicundus* (Nees) T. Anders. Peninsular India.
1657. *Strobilanthes sessilis* Nees. Southern Western Ghats (Kerala). Rare
1658. *Strobilanthes tristis* (Wight) T. Anders. Southern Western Ghats.
1659. *Strobilanthes urceolaris* Gamble . Southern Western Ghats.
1660. ***Strobilanthes violaceus*** Bedd. Endemic to Southern Western Ghats.
1661. ***Strobilanthes virendrakumarana*** Venu & P Daniel. Endemic to Kerala.
1662. *Strobilanthes warreensis* Dalz. Southern Western Ghats.
1663. *Strobilanthes wightianus* Nees. Southern Western Ghats.
1664. ***Strobilanthes zenkerianus*** (Nees) T. Anders. Endemic to Southern Western Ghats.
1665. *Thunbergia alata* Boj. ex Sims
1666. *Thunbergia fragrans* Roxb. Peninsular India.
1667. *Thunbergia mysorensis* (Wight) T. Anders. Peninsular India.

V E R B E N A C E A E

1668. *Callicarpa tomentosa* (L.) Murr.
1669. *Clerodendrum paniculatum* L.
1670. *Clerodendrum phlomidis* L. f.
1671. *Clerodendrum serratum* (L.) Moon
1672. *Clerodendrum viscosum* Vent.

1673. *Gmelina arborea* Roxb.
1674. *Gmelina asiatica* L.,
1675. *Lantana camara* L.
1676. *Lantana indica* Roxb.
1677. *Lippia javanica* (Burm.f.) Spreng.
1678. *Premna coriacea* Clarke . South India.
1679. *Premna glaberrima* Wight . South India.
1680. *Premna latifolia* Roxb., var. *latifoliá*
1681. *Premna latifolia* Roxb. var *viburnoidea* Clarke
1682. ***Premna paucinervis*** (Clarke) Gamble. Endemic to South India. Rare & Threatened
1683. *Premna tomentosa* Willd. Endemic to Peninsular India
1684. ***Priva wightiana*** Schauer. Edemic to Peninsular India
1685. *Priva cordifolia* (L.f.) Druce
1686. *Pygmaeopremna herbacea* (Roxb.) Moldanke
1687. *Stachytarpheta jamaicensis* (L.) Vahl
1688. *Stachytarpheta urticifolia* (Salisb.) Sims
1689. *Tectona grandis* L. f.
1690. *Vitex altissima* L. f.
1691. *Vitex leucoxylon* L. f.
1692. *Vitex negundo* L.,

SYMPHOREMATACEAE

1693. *Sphenodesme paniculata* Clarke South India.
1694. *Symphorema involucratum* Roxb.

LAMIACEAE

1695. *Acrocephalus hispidus* (L.) Nicols. & Sivadas.
1696. *Anisochilus argenteus* Gamble. Southern Western Ghats (Kerala). Vulnerable
1697. *Anisochilus carnosus* (L. f.) Wall. ex Benth.
1698. ***Anisochilus dysophylloides*** Benth.var ***purpureus*** (Wight) Gamble. SouthWestern Ghats (Kerala and Tamil Nadu).
1699. *Anisochilus robustus* Hook. f. Peninsular India. Rare
1700. ***Anisochilus sericeus*** Benth. Peninsular India. **Critically Endangered.**
1701. *Anisochilus verticillatus* Hook. f. Western Peninsular India. Rare
1702. ***Anisochilus wightii*** Hook. f., Southern Western Ghats (Kerala). Rare
1703. *Anisomeles indica* (L.) O. Ktze.
1704. *Clinopodium umbrosum* (M. Bieb) K. Koch.
1705. *Colebrookea oppositifolia* Sm.
1706. *Coleus amboinicus* Lour.
1707. *Coleus barbatus* (Andr.) Benth.
1708. *Coleus malabaricus* Benth.
1709. *Coleus spicatus* Benth. Southern Western Ghats, endemic
1710. *Geniosporum elongatum* Benth.,
1711. *Gomphostemma eriocarpa* Benth. Southern Western Ghats; endemic
1712. *Gomphostemma heyneanum* Wall. ex Benth. var. *heyneana* South West India.
1713. *Gomphostemma heyneanum* Wall. ex Benth. var. *rottleri* Prain, Southern Western Ghats; endemic
1714. ***Gomphostemma keralensis*** Vivekananthan *et al* Idukki District, Kerala. Rare
1715. *Hyptis capitata* Jacq.

1716. *Hyptis suaveolens* (L.) Poit.
1717. *Leonitis nepetiifolia* (L.) R. Br.,
1718. *Leucas angularis* Benth.
1719. *Leucas aspera* (Willd.) Spreng
1720. *Leucas biflora* (Vahl) R. Br.
1721. *Leucas chinensis* (Retz.) R. Br.
1722. *Leucas ciliata* Benth. India.
1723. *Leucas hirta* (Heyne ex Roth) Spreng. Peninsular India.
1724. *Leucas indica* (L.) R. Br. ex Vatke
1725. ***Leucas lamifolia*** Desf. Southern Western Ghats; endemic
1726. ***Leucas lancaefolia*** Desf. Southern Western Ghats; endemic
1727. ***Leucas lavendulifolia*** Rees var ***decipiens*** (Hook.f.) Chandrab. Southern India, endemic
1728. *Leucas martinicensis* (Jacq.) R. Br.,
1729. *Leucas mollissima* Wall. ex Benth.
1730. ***Leucas pubescens*** Benth. Peninsular India. Rare & Threatened
1731. ***Leucas rosmarinifolia*** Benth. Southern Western Ghats; endemic
1732. ***Leucas suffruticosa*** Benth. Southern Western Ghats; endemic
1733. ***Leucas ternifolia*** **Desf.** Southern Western Ghats; endemic
1734. *Leucas urticaefolia* (Vahl) R. Br.,
1735. *Leucas vestita* Benth. var *vestita*. Peninsular India.
1736. *Leucas vestita* Benth. var *devikolamensis* Shety & Vivek. Southern Western Ghats (Kerala); endemic
1737. *Leucas zeylanica* (L.) R. Br.
1738. *Micromeria biflora* (Buch.-Ham ex D. Don) Benth.
1739. *Ocimum americanum* L.
1740. *Ocimum basilicum* L.,
1741. *Ocimum gratissimum* L.
1742. *Orthosiphon thymiflorus* (Roth) Sleensen
1743. *Plectranthus coesta* Buch.-Ham. ex D Don
1744. *Plectranthus coleoides* Benth. Southern Western Ghats, endemic
1745. *Plectranthus deccanicus* Briq. Peninsular India.
1746. *Plectranthus japonicus* (Burm. f.) Koidz.
1747. *Plectranthus nigrescens* (Benth) Hara
1748. *Plectranthus nilgherricus* Benth. Southern Western Ghats.
1749. *Plectranthus rivularis* Wight ex Hook. f. Southern Western Ghats. Critically endangered
1750. *Plectranthus stocksii* Hook. f. Southern Western Ghats; endemic
1751. *Plectranthus wightii* Benth. Peninsular India.
1752. *Pogostemon auricularia* (L.) Hassk.
1753. *Pogostemon benghalensis* (Burm. f.) O. Ktze. India.
1754. *Pogostemon heyneanus* Benth.
1755. *Pogostemon paniculatus* (Willd.) Benth. Western Peninsular India.
1756. *Pogostemon pubescens* Benth.
1757. *Pogostemon purpurascens* Dalz. Western Peninsular India.
1758. *Pogostemon rotundatus* Benth. Peninsular India.
1759. ***Pogostemon speciosus*** Benth. Southern Western Ghats. Rare
1760. *Pogostemon travancoricus* Bedd. var. *travancoricus* Southern Western Ghats (Kerala).

1761. *Pogostemon travancoricus* Bedd. var.***devikolamensis*** Shetty & Vivek.. SouthWestern Ghats (Kerala).
1762. *Pogostemon wightii* Benth. Southern Western Ghats. Rare
1763. *Scutellaria barbata* D. Don
1764. *Scutellaria colebrookeana* Benth. Peninsular India.
1765. *Scutellaria violacea* Heyne ex Benth.
1766. *Scutellaria wightiana* Benth. Southern Western Ghats.
1767. *Teucrium tomentosum* Heyne ex Benth.

PLANTAGINACEAE

1768. *Plantago erosa* Wall.

NYCTAGINACEAE

1769. *Boerhavia chinensis* (L.) Asch. & Schweinf.
1770. *Boerhavia diffusa* L.
1771. *Boerhavia erecta* L.,
1772. *Mirabilis jalapa* L
1773. *Pisonia aculeata* L.,

AMARANTHACEAE

1774. *Achyranthes aspera* L. var. aspera
1775. *Achyranthes aspera* L. var. pubescens (Miq.) Townsend India. Rare
1776. *Achyranthes bidentata* Bl.
1777. *Aerva lanata* (L.) Juss. ex Schult.,
1778. *Allmania nodiflora* (L.) R. Br. ex Wight
1779. *Alternanthera paronychioides* A. St. Hill.
1780. *Alternanthera pungens* Kunth
1781. *Alternanthera sessilis* (L.) R. Br. ex. DC.
1782. *Amaranthus caudatus* L
1783. *Amaranthus spinosus* L.,
1784. *Amaranthus viridis* L.
1785. *Celosia polygonoides* Retz.,
1786. *Celosia pulchella* Miq.
1787. *Cyathula prostrata* (L.) Bl.
1788. *Digera muricata* (L.) Mart.,
1789. *Gomphrena serrata* L.
1790. *Gomphrena celosoides* C. Martius,
1791. *Indobanalia thyrsiflora* (Moq.) Henry & Roy India.
1792. *Nothosaerva brachiata* (L.) Wight.
1793. *Psilotrichum elliotii* Baker & Clarke
1794. *Pupalia lappacea* (L.) Juss.
1795. *Pupalia lappacea* (L.) Juss. var. *orbiculata* (Heyne ex Wall.) Townsend

CHENOPODIACEAE

1796. *Chenopodium ambrosioides* L.

BASELLACEAE

1797. *Basella alba* L.

PHYTOLACCACEAE

1798. *Phytolacca octandra* L.

POLYGONACEAE

1799. *Polygonum barbatum* L.
1800. *Polygonum chinense* L.
1801. *Polygonum glabrum* Willd.
1802. *Polygonum hydropiper* L.
1803. *Polygonum hydropiper* L. var. flaccidum Steward
1804. *Polygonum hydropiper* L., var. hydropiper
1805. *Polygonum minus* Huds.
1806. *Polygonum nepalense* Meis.
1807. *Polygonum plebeium* R. Br.
1808. *Polygonum pulchrum* Bl.
1809. *Rumex nepalense* Spreng.

PODOSTEMACEAE

1810. *Dalzellia zeylanica* (Gard.) Wight
1811. *Farmeria indica* Willis
1812. *Indotristicha ramosissima* (Wight) van Royen . Southern Western Ghats.
1813. *Podostemon munnarense* (Nagendren & arekal) Mathew & Satheesh. Endemic to South Western Ghats.
1814. *Podostemum subulatus* Gard.
1815. *Polypleurum stylosum* (Wight)
1816. *Zeylanidium lichenoides* (Kurz) Engl. Southern Western Ghats.
1817. ***Zeylanicium maheswarii*** Mathew et al. Endemic to Southern Western Ghats (Kerala).
1818. *Zeylanidium olivaceum* (Gard.) Engl.

ARISTOLOCHIACEAE

1819. *Aristolochia indica* L.
1820. *Aristolochia tagala* Cham.
1821. ***Thottea dinghoui*** Swarup. Idukki District, Kerala. Rare
1822. ***Thottea idukkiana*** Pandura. & Nair. Idukki District, Kerala. Rare
1823. *Thottea siliquosa* (Lam.) Ding Hou.

PIPERACEAE

1824. *Lepianthes umbellatum* (L.) Raf.
1825. *Peperomia blanda* (Jacq.) Kunth
1826. *Peperomia heyneana* Miq.,
1827. *Peperomia pellucida* (L.) Kunth
1828. *Peperomia portulacoides* (Lam.) Dietr. South India.
1829. *Peperomia tetraphylla* (Forst.) Hook. & Arn.
1830. *Peperomia wightiana* Miq.
1831. *Piper argyrophyllum* Miq. Southern Western Ghats.
1832. *Piper barberi* Gamble Southern Western Ghats. Rare
1833. *Piper galeatum* Cas. Southern Western Ghats.
1834. *Piper hymenophyllum* Miq.
1835. *Piper longum* L.
1836. *Piper mullesua* Buch.-Ham. ex D. Don
1837. *Piper nigrum* L Peninsular India
1838. *Piper pseudonigrum* Velayudhan & Amal. Southern Western Ghats. Rare
1839. *Piper schmidtii* Hook.f.
1840. *Piper trichostachyon* (Miq.) C. DC Peninsular India.

1841. *Piper wightii* Miq. Southern Western Ghats.

CHLORANTHACEAE

1842. *Sarcandra chloranthoides* Gard.

MYRISTICACEAE

1843. *Gymnacranthera farquhariana* (Hook. f. & Thoms.) Warb.
1844. *Knema attenuata* (Hook. f. & Thoms.) Warb. Southern Western Ghats.
1845. *Myristica beddomei* King. Southern Western Ghats.
1846. *Myristica malabarica* Lam. Southern Western Ghats.

LAURACEAE

1847. *Actinodaphne bourdillonii* Gamble. Southern Western Ghats (Kerala).
1848. ***Actinodaphne bourneae*** Gamble. Southern Western Ghats (Kerala), endemic
1849. *Actinodaphne campanulata* Hook. f. var *campanulata* Southern Western Ghats. Vulnerable
1850. *Actinodaphne campanulata* Hook. f. var *obtusa* Gamble. Southern Western Ghats. Endangered
1851. *Actinodaphne malabarica* Balakr. Southern Western Ghats.
1852. *Actinodaphne salicina* Meisner. Southern Western Ghats. Rare
1853. *Actinodaphne tadulingamii* Gamble. Southern Western Ghats. Rare
1854. ***Alseodaphne semecarpifolia*** Nees var ***angustifolia*** Meisner
1855. *Alseodaphne semecarpifolia* Nees var. *parvifolia* Hook.f. Southern Western Ghats.
1856. *Beilschmiedia bourdillonii* Brandis. Peninsular India. Rare
1857. *Beilschmiedia wightii* (Nees) Benth. ex Hook. f. Southern Western Ghats.
1858. *Cinnamomum keralaense* Kosterm. Southern Western Ghats (Kerala). Rare
1859. *Cinnamomum macrocarpum* Hook. f. Western Peninsular India.
1860. *Cinnamomum malabatrum* (Burm. f.) Bl. Western Ghats.
1861. ***Cinnamomum perrottetii*** Meis. Southern Western Ghats (Kerala). Rare
1862. *Cinnamomum sulphuratum* Nees. Southern Western Ghats.
1863. *Cinnamomum verum* J. Presl.
1864. *Cinnamomum wightii* Meisner. Southern Western Ghats. Rare
1865. *Cryptocarya beddomei* Gamble. Southern Western Ghats (Kerala). Rare
1866. *Cryptocarya bourdillonii* Gamble . Peninsular India.
1867. ***Cryptocarya neilgherrensis*** Meissner. Endemic to Peninsular (Kerala) India
1868. ***Cryptocarya stocksii*** Meisner. Peninsular India. Rare
1869. *Litsea beddomei* Hook. f. Southern Western Ghats. Endangered
1870. *Litsea bourdillonii* Gamble Southern Western Ghats. Rare
1871. *Litsea coriacea* (Heyne ex Meisner) Hook. f. Western Ghats.
1872. *Litsea floribunda* (Bl.) Gamble. Throughout India.
1873. *Litsea glabrata* (Wall. ex Nees) Hook. f. Western Peninsular India.
1874. *Litsea insignis* Gamble Peninsular India.
1875. *Litsea laevigata* (Nees) Gamble India.
1876. *Litsea oleoides* (Meisner) Hook. f. Peninsular India.
1877. *Litsea quinqueflora* (Dennst.) Suresh
1878. *Litsea stocksii* (Meisner) Hook. f. Concan and Southwards.
1879. *Litsea wightiana* (Nees) Hook. f. var *wightiana* Southern Western Ghats.
1880. ***Litsea wightiana*** (Nees) Hook. f. var **tomentosa** (Meisner) Gamble. S.Western Ghats.
1881. *Neolitsea cassia* (L.) Kosterm.
1882. ***Neolitsea fischeri*** Gamble. Southern Western Ghats. Vulnerable

1883. *Neolitsea scrobiculata* (Meisner) Gamble
1884. *Persea macrantha* (Nees) Kosterm.
1885. *Phoebe lanceolata* Nees
1886. *Phoebe wightii* Meisner

HERNANDIACEAE

1887. *Gyrocarpus asiaticus* Willd.,

PROTEACEAE

1888. *Helicia nilagirica* Bedd. Southern Western Ghats. Rare

THYMELAEACEAE

1889. *Gnidia glauca* (Fresen.) Gilg

ELAEAGNACEAE

1890. *Elaeagnus kologa* Schlecht.
1891. *Elaeagnus conferta* Roxb.

LORANTHACEAE

1892. *Dendrophthoe falcata* (L. f.) Etting.. var. *falcata*
1893. *Dendrophthoe falcata* (L. f.) Etting. var. *pubescens* (Hook.f.)Chandra. Endemic to Peninsular India.
1894. *Dendrophthoe memecylifolia* (Wight & Arn.) Danser. Endemic to Peninsular India.
1895. *Dendrophthoe neelgherrensis* (Wight & Arn.) Tieghem
1896. *Dendrophthoe trigona* (Wight & Arn.) Danser ex Sant. Southern Western Ghats.
1897. *Helicanthes elasticus* (Desr.) Danser Peninsular India.
1898. *Helixanthera hookeriana* (Wight & Arn.) Danser
1899. *Helixanthera intermedia* (Wight) Danser . South Western India. Rare
1900. ***Helixanthera lepidophylla*** (Walp.) Danser. South Western India.
1901. *Helixanthera obtusata* (Schultes) Danser. Southern Western Ghats. Rare
1902. *Helixanthera wallichiana* (Schultes) Danser. South Western India.
1903. *Macrosolen capitellatus* (Wight & Arn.) Danser
1904. *Macrosolen parasiticus* (L.) Danser
1905. *Scurrula parasitica* L.
1906. *Taxillus bracteatus* (Heyne ex Will.) Tieghem, Southern Western Ghats
1907. *Taxillus cuneatus* (Heyne ex Roth) Danser
1908. ***Taxillus recurvus*** (DC) Tieghem. Southern Western Ghats
1909. *Taxillus tomentosus* (Heyne ex Roth) Tieghem

VISCACEAE

1910. *Korthalsella japonica* (Thunb.) Engl.
1911. *Viscum angulatum* Heyne ex DC.
1912. *Viscum articulatum* Burm. f. var. *articulatum*
1913. *Viscum articulatum* Burm. f. var. *dichotomum* Kurz.
1914. *Viscum heyneanum* DC.
1915. *Viscum monoicum* Roxb. ex DC.
1916. *Viscum orientale* Willd.
1917. *Viscum ramosissimum* Wight & Arn.

SANTALACEAE

1918. *Osyris quadripartita* Salzm. ex Decne.
1919. *Santalum album* L.
1920. *Scleropyrum pentandrum* (Dennst.) Mabber.

BALANOPHORACEAE

1921. *Balanophora dioica* R. Br.
1922. *Balanophora fungosa* J. R. & G. Forst. ssp *indica* (Arn.) Hansen
1923. *Balanophora fungosa* J. R. & G. Forst. ssp *indica* (Arn.) Hansen var. *minor* (Eichl.) Hansen

BUXACEAE

1924. *Sarcococca saligna* (D. Don) Muell.-Arg.

EUPHORBIACEAE

1925. *Acalypha brachystachya* Hornem.
1926. *Acalypha ciliata* Forssk.,
1927. *Acalypha fruticossa* Forssk.,
1928. *Acalypha indica* L.
1929. *Acalypha racemosa* Heyne ex Baill.
1930. *Actephila excelsa* (Dalz.) Muell.-Arg.
1931. *Agrostistachys borneensis* Becc.
1932. *Agrostistachys indica* Dalz. Peninsular India.
1933. *Antidesma acidum* Retz.
1934. *Antidesma alexiteria* L.
1935. *Antidesma menasu* (Tul.) Miq. ex Muell.-Arg.
1936. *Aporusa acuminata* Thw.
1937. *Aporusa fusiformis* Thw.
1938. *Aporusa lindleyana* (Wight) Baill.
1939. *Baccaurea courtallensis* (Wight) Muell.-Arg. Western Ghats.
1940. *Baliospermum montanum* (Willd) Muell.-Arg.
1941. *Bischofia javanica* Bl.
1942. *Blachia reflexa* Benth. Southern Western Ghats.
1943. *Blachia umbellata* (Willd.) Baill.
1944. *Breynia retusa* (Dennst.) Alston
1945. *Breynia vitis-idaea* (Burm. f.) Fischer
1946. *Bridelia airy-shawii* P. T. Li
1947. *Bridelia crenulata* Roxb. Peninsular India.
1948. *Bridelia scandens* (Roxb.) Willd. Peninsular India.
1949. *Claoxylon beddomei* Hook. f. Southern Western Ghats (Kerala).
1950. *Cleidion spiciflorum* (Burm.f.) Merr.
1951. *Croton bonplandianus* Baill.
1952. *Croton caudatus* Geiseler
1953. *Croton laccifer* L
1954. *Croton malabaricus* Bedd. Southern Western Ghats.
1955. *Croton tiglium* L.
1956. *Croton zeylanicus* Muell.-Arg.
1957. *Daphniphyllum neilgherrense* (Wight) K. Rosenth.
1958. *Dimorphocalyx lawianus* (Muell.-Arg.) Hook. f. Endemic to Western Ghats.
1959. *Drypetes elata* (Bedd.) Pax & Hoffm. Peninsular India.
1960. *Drypetes malabarica* (Bedd.) Airy Shaw. Southern Western Ghats.
1961. *Drypetes oblongifolia* (Bedd.) Airy Shaw. Southern Western Ghats (South Karnataka and Kerala).
1962. *Drypetes roxburghii* (Wall.) Hurusawa

1963. *Drypetes sepiaria* (Wight & Arn.) Pax & Hoffm.
1964. *Drypetes venusta* (Wight) Pax & Hoffm. Peninsular India.
1965. *Drypetes wightii* (Hook. f.) Pax & Hoffm. Peninsular India.
1966. *Epiprinus mallotiformis* (Muell.-Arg.) Croizat. Peninsular India.
1967. *Euphoribia antiquarum* L.,
1968. *Euphorbia cristata* Heyne ex Roth,
1969. *Euphorbia heterophylla* L.
1970. *Euphorbia hirta* L.
1971. *Euphorbia indica* Lam.,
1972. *Euphorbia nivulia* Buch.-Ham.
1973. *Euphorbia rosea* Retz.,
1974. *Euphorbia rothiana* Spreng.
1975. *Euphorbia thymifolia* L.
1976. *Euphorbia tirucalli* L.,
1977. *Euphorbia tortilis* Rottl. ex Ainslie,
1978. *Euphorbia trigona* Mill.
1979. *Euphorbia vajraveluii* Binojk. & Balakr. Western Ghats. Rare
1980. *Excoecaria oppositifolia* Griff. var *crenulata* (Wight) Chakrab. & Gangop.
1981. *Excoecaria robusta* Hook. f.
1982. *Givotia moluccana* (L.) Sreem.
1983. *Glochidion bourdillonii* Gamble. Southern Western Ghats (Kerala). Vulnerable
1984. *Glochidion ellipticum* Wight Peninsular India, endemic.
1985. *Glochidion heyneanum* (Wight & Arn.) Wight
1986. *Glochidion hohenackeri* (Muell.-Arg.) Bedd. var *hohenacheri.* Western Ghats, Canara and south, endemic. Rare
1987. *Glochidion hohenackeri* (Muell.-Arg.) Bedd. var. *johnstonei* (Hook.f.) Chandrab. & Gangop. Endemic to Western Ghats. Endangered
1988. *Glochidion zeylanicum* (Gaertn.) A. Juss. var. *zeylanicum*
1989. *Glochidion zeylanicum* (Gaertn.) A. Juss. var. *tomentosum* (Dalz.) Chandrab. & Gangop. Endemic to Western Ghats. Endangered
1990. *Glochidion zeylanicum* (Gaertn.) Juss.
1991. *Homonoia riparia* Lour.
1992. *Jatropha curcas* L.,
1993. *Jatropha glandulifera* Roxb.,
1994. *Jatropha villosa* Wight. Endemic to Penincular India
1995. *Macaranga indica* Wight
1996. *Macaranga peltata* (Roxb.) Muell.-Arg.
1997. *Mallotus beddomei* Hook. f. Southern Western Ghats (Kerala & Tamil Nadu)
1998. *Mallotus philippensis* (Lam.) Muell.-Arg.
1999. *Mallotus resinosus* (Blanco) Merr. var. *resinosus.* Southern Western Ghats, endemic.
2000. *Mallotus resinosus* (Blanco) Merr. var. *muricatus* (Wight) Balakr. Southern Western Ghats, endemic
2001. *Mallotus stenanthus* Muell.- Arg. endemic to Peninsular India
2002. *Mallotus tetracoccus* (Roxb.) Kurz.
2003. *Margaritaria indica* (Dalz.) Airy Shaw
2004. *Meineckia longipes* (Wight) Webster. Southern Western Ghats (Kerala), endemic.
2005. *Micrococca mercurialis* (L.) Benth.
2006. *Paracroton pendulus* (Hassk.) Miq. subsp. *zeylanicus* (Thw.) Balakr. & Chakrab.
2007. *Phyllanthus amarus* Schum. & Thonn.

2008. *Phyllanthus beddomei* (Gamble) Mohanan. Southern Western Ghats (Kerala), endemic.
2009. ***Phyllanthus chandrabosei*** Govaerts & Radcl.-Sm. Southern Western Ghats (Kerala), endemic. Threatened
2010. *Phyllanthus emblica* L.
2011. *Phyllanthus gardnerianus* (Wight) Baill.
2012. ***Phyllanthus indofischeri*** Bennet. Southern Western Ghats(Kerala), endemic.
2013. *Phyllanthus kozhikodianus* Sivar. & Mani.
2014. *Phyyanthus macraei* Muell.-Arg. Southern Western Ghats(Kerala), endemic.
2015. *Phyllanthus maderaspatensis* L.,
2016. ***Phyllanthus narayanaswamii*** Gamble. Southern Western Ghats (Kerala), endemic.
2017. *Phyllanthus pinnatus* (Wight) Webster . S. W. Ghats (Kerala & Tamil Nadu); endemic.
2018. *Phyllanthus polyphyllus* Willd.
2019. *Phyllanthus reticulatus* Poir.
2020. *Phyllanthus rheedii* Wight
2021. *Phyllanthus stipulacea* (Gamble) Kumari & Chandr. Southern Western Ghats, endemic.
2022. *Phyllanthus urinaria* L.
2023. *Phyllanthus virgatus* G. Forst.
2024. *Ricinus communis* L.
2025. *Sapium insigne* (Royle) Benth.
2026. *Sauropus androgynus* (L.) Merr.
2027. *Sauropus quadrangularis* (Willd.) Muell.-Arg.
2028. *Sebastiania chamaelea* (L.) Muell.-Arg.
2029. *Securinega leucopyrus* (Willd.) Muell.- Arg
2030. *Securinega virosa* (Roxb. ex Willd.) Baill.
2031. *Suregada angustifolia* (Baill. ex Muell.-Arg.) Airy Shaw
2032. *Tragia bicolor* Miq. Southern Western Ghats, endemic.
2033. *Tragia involucrate* L.
2034. *Tragia muelleriana* Pax & Hoffm.
2035. *Trewia nudiflora* L. Peninsular India.

URTICACEAE

2036. *Boehmeria glomerulifera* Miq.
2037. *Boehmeria macrophylla* Hornem.
2038. *Debregeasia longifolia* (Burm. f.) Wedd.
2039. *Debregeasia wallichiana* (Wedd.) Wedd.
2040. *Dendrocnide sinuata* (Bl.) Chew
2041. *Droguetia iners* (Forssk.) Schweinf
2042. *Elatostemma acuminatum* (Poir.) Brongn.
2043. *Elatostema lineolatum* Wight var.lineolatum
2044. ***Elatostema lineolatum*** Wight var. ***linearis*** Wedd.
2045. *Elatostema lineolatum* Wight var. *falcigera* Thw. India.
2046. *Elatostemma sessile* JR Forst. & JGA Forst.
2047. ***Elatostema wightii*** Hook. f. Southern Western Ghats.
2048. *Girardinia diversifolia* (Link) Friis
2049. *Laportea bulbifera* (Sieb. & Zucc.) Wedd.
2050. *Laportea interrupta* (L.) Chew
2051. *Lecanthus peduncularis* (Wall. ex Royle) Wedd.

2052. *Oreocnide integrifolia* (Gaud.) Miq.
2053. *Pellionia heyneana* Wedd.
2054. ***Pilea kingii*** Fischer. Southern Western Ghats (Kerala and Tamil Nadu). Rare
2055. *Pilea melastomoides* (Poir.) Bl.
2056. *Pilea microphylla* (L.) Liebm.
2057. *Pilea wightii* Wedd.
2058. *Pouzolzia auriculata* Wight
2059. *Pouzolzia bennettiana* Wight var.*bennettiana*
2060. *Pouzolzia bennettiana* Wight var. *acuta* (Wight) Fischer. Southern Western Ghats. Endemic
2061. *Pouzolzia meeboldii* Smith & Ramaswami. Southern Western Ghats. Endemic
2062. *Pouzolzia wightii* Benn.var. *caudata* (Bennet) Fischer. Southern Western Ghats. Endemic
2063. *Pouzolzia wightii* Benn.var. *nilghirensis* (Wight) Hook.f.
2064. *Pouzolzia wightii* Benn.var. *scabra* (Wight) Fischer .Southern Western Ghats. Endemic
2065. ***Pouzolzia wightii*** Benn. var. ***wallichiana*** Hook. f. Southern Western Ghats.
2066. *Pouzolzia wightii* Benn var. *wightii.* South Western India, Concan southwards.
2067. *Pouzolzia zeylanica* (L.) Benn.
2068. *Procris crenata* Robinson

U L M A C E A E

2069. *Celtis philippensis* Blanco
2070. *Celtis tetrandra* Roxb.
2071. *Celtis timorensis* Span.
2072. *Holoptelea integrifolia* (Roxb.) Planch.
2073. *Trema orientalis* (L.) Bl.

C A N N A B A C E A E

2074. *Cannabis sativa* L.

M O R A C E A E

2075. *Antiaris toxicaria* Lesch.
2076. *Artocarpus gomezianus* Wall. ex Trecul
2077. *Artocarpus heterophyllus* Lam.
2078. *Artocarpus hirsutus* Lam. Peninsular India.
2079. *Dorstenia indica* Wall. ex Wight
2080. *Ficus amplissima* J. E. Smith
2081. *Ficus arnottiana* (Miq.) Miq.
2082. *Ficus beddomei* King, Ann. Peninsular India.
2083. *Ficus benghalensis* L.,
2084. *Ficus callosa* Willd.
2085. *Ficus caulocarpa* Miq.
2086. *Ficus costata* Ait.
2087. *Ficus dalhousiae* Miq. endemic to Peninsular India
2088. *Ficus drupacea* Thunb. var *pubescens* (Roth.) Corner
2089. *Ficus exasperata* Vahl
2090. *Ficus hispida* L. f.
2091. *Ficus laevis* Blume var. *macrocarpa* (Miq.) Corner. Endemic to S. Western Ghats
2092. *Ficus microcarpa* L. f.
2093. *Ficus mollis* Vahl

2094. *Ficus nervosa* Heyne ex Roth
2095. *Ficus racemosa* L.
2096. *Ficus religiosa* L.
2097. *Ficus rigida* Jack var. *bracteata* (Corner) Bennet. Southern Western Ghats.
2098. *Ficus talbotii* King
2099. *Ficus tinctoria* Forst. f. ssp *gibbosa* (Blume) Corner var. *cuspidifera* (Miq.) Chithra
2100. *Ficus tinctoria* Forst. f. ssp. *parasitica* (Koen.ex Willd.) Corner
2101. *Ficus tsjahela* Burm. f.
2102. *Ficus virens* Ait. var. *wightiana* (Miq.) Chithra.E ndemic to Peninsular India.
2103. *Streblus asper* Lour.,

CASUARINACEAE

2104. *Casuarina litorea* L.

BETULACEAE

2105. *Alnus nepalensis* D.Don

SALICACEAE

2106. *Salix tetrasperma* Roxb.

HYDROCHARITACEAE

2107. Blyxa aubertii Rich. Canara and Southwards.

BURMANNIACEAE

2108. Burmannia coelestis D. Don

ORCHIDACEAE

2109. *Acampe ochracea* (Lindl.) Hochr.
2110. *Acampe praemorsa* (Roxb.) Blatt. & McCann.
2111. *Acanthephippium bicolor* Lindl.
2112. *Aenhenrya rotundifolia* (Blatt.) Sathish & Rasm. South India. Very rare
2113. *Aerides maculosum* Lindl. South India. Rare
2114. *Aerides ringens* (Lindl.) Fischer
2115. *Anoectochilus elatus* Lindl. Southern Western Ghats.
2116. *Aphyllorchis montana* Reichb. f.
2117. *Arundina graminifolia* (D. Don) Hochr.
2118. *Brachycorythis iantha* (Wight) Summerh
2119. *Brachycorythis splendida* Summerh. Southern Western Ghats.
2120. *Brachycorythis wightii* Summerh. Southern Western Ghats (Kerala)
2121. ***Bulbophyllum acutiflorum*** A. Rich. Southern Western Ghats (Kerala)
2122. ***Bulbophyllum albidum*** (Wight) Hook.f. Southern Western Ghats (Kerala)
2123. *Bulbophyllum aureum* (Hook. f.) J.J. Sm. Southern Western Ghats. Rare
2124. *Bulbophyllum elegantulum* (Rolfe) J. J. Sm. South India. Rare
2125. *Bulbophyllum fimbriatum* (Lindl.) Reichb. f.
2126. *Bulbophyllum fusco-purpureum* Wight. Southern Western Ghats. Rare
2127. ***Bulbophyllum macraei*** (Lindl.) Reichb. f.
2128. *Bulbophyllum mysorense* (Rolfe) J.J. Sm. Southern Western Ghats. Rare
2129. *Bulbophyllum rosemarianum* Sathish et al. Southern Western Ghats (Kerala)
2130. *Bulbophyllum sterile* (Lam.) Suresh. Endemic to South West India.
2131. *Bulbophyllum tremulum* Wight Southern Western Ghats.
2132. *Bulbophyllum xylophyllum* Par & Reichb. f. Southern Western Ghats. Rare

2133. *Calanthe sylvatica* (Thouars) Lindl.
2134. *Calanthe triplicata* (Willem.) Ames
2135. *Cheirostylis flabellata* (Wight) Hook. f.
2136. *Cheirostylis parvifolia* Lindl.
2137. *Chiloschista glandulosa* Blatt. & Mc Cann. India. Rare
2138. *Chrysoglossum maculosum* (Thw.) Hook.f.
2139. *Cirrhopetalum gamblei* Hook.f.
2140. *Cirrhopetalum neilgherrense* Wight. Southern Western Ghats. vulnerable
2141. *Cleisostoma tenuifolium* (L.) Garay
2142. *Coelogyne breviscapa* Lindl.
2143. *Coelogyne mossaiae* Rolfe . Southern Western Ghats. Vulnerable
2144. *Coelogyne nervosa* A. Rich Southern Western Ghats.
2145. *Cottonia peduncularis* (Lindl.) Reichb. f.
2146. *Crepidium purpureum* (Lindl.)Szlach.
2147. *Crepidium mackinnonii* (Ruthie) Szlach.
2148. *Cymbidium aloifolium* (L.) Sw.
2149. *Cymbidium ensifolium* (L.) Sw. var. haematodes (Lindl.) Du Puy & Cribb.
2150. ***Dendrobium anamalayanum*** Chandr. Southern Western Ghats.
2151. *Dendrobium barbatulum* Lindl. Southern Western Ghats. Rare
2152. *Dendrobium haemoglossum* Thw. Southern Western Ghats.
2153. *Dendrobium herbaceum* Lindl.
2154. *Dendrobium heterocarpum* Lindl.
2155. *Dendrobium heyneanum* Lindl. Southern Western Ghats.
2156. *Dendrobium macrostachyum* Lindl.
2157. *Dendrobium microbulbon* A. Rich. Peninsular India. Rare
2158. *Dendrobium nanum* Hook.f. Endemic to Peninsular India
2159. *Dendrobium nutantiflorum* Hawkes & Heller
2160. *Dendrobium ovatum* (L.) Kraenz. Southern Western Ghats.
2161. *Dendrobium panduratum* Lindl.
2162. *Dendrobium wightii* Hawkes & Heller. Southern Western Ghats. Rare
2163. *Diplocentrum congestum* Wight. Southern Western Ghats. Rare
2164. *Diplocentrum recurvum* Lindl.
2165. *Disperis neilgherrense* Wight . Southern Western Ghats. Rare
2166. *Epipogium roseum* (D. Don) Lindl.
2167. *Eria dalzellii* Lindl.
2168. *Eria microchilos* (Dalz.) Lindl.
2169. *Eria muscicola* (Lindl.) Lindl. Var brevilinguis Joseph & Chandras. Southern Western Ghats. Rare
2170. *Eria mysorensis* Lndl. Southern Western Ghats. Rare
2171. *Eria nana* A. Rich. Southern Western Ghats. Rare
2172. *Eria pauciflora* Wight. Southern Western Ghats.
2173. *Eria polystachya* A. Rich. Southern Western Ghats. Rare
2174. *Eria pseudoclavicaulis* Blatt. & McCann. Southern Western Ghats.
2175. *Eria reticosa* Wight . Peninsular India.
2176. *Eulophia epidendraea* (Koen.) Schltr.
2177. *Eulophea pratensis* Lindl.

2178. *Eulophea pulchra* (Thouars) Lindl.
2179. *Eulophia spectabilis* (Dennst.) Suresh
2180. *Flickingeria nodosa* (Dalz.) Seidenf.
2181. *Gastrochilus acaulis* (Lindl.) O. Ktze.
2182. *Gastrochilus bigibbus* (Reichb. f. ex Hook. f.) O. Ktze. India.
2183. *Geodorum densiflorum* (Lam.) Schltr.
2184. *Goodyera procera* (Ker.-Gawl.) Hook.
2185. ***Habenaria acuminata*** (Thw.) Trimen
2186. *Habenaria barnesii* Summerh. ex Fischer. Southern Western Ghats. Rare
2187. *Habenaria cephalotes* Lindl. Southern Western Ghats. Rare
2188. *Habenaria crassifolia* A. Rich. Peninsular India. Rare
2189. *Habenaria crinifera* Lindl.
2190. *Habenaria digitata* Lindl.
2191. *Habenaria elliptica* Wight. Southern Western Ghats. Rare
2192. *Habenaria elwesii* Hook. f. Southern W. Ghats. Rare
2193. ***Habenaria flabelliformis*** Summerh. Ex Fischer .Southern Western Ghats. Rare
2194. *Habenaria heyneana* Lindl. Western Peninsular India.
2195. *Habenaria longicorniculata* Grah. Peninsular India.
2196. *Habenaria longicornu* Lindl. Southern Western Ghats.
2197. ***Habenaria macrostachya*** Lindl. Southern Western Ghats, endemic
2198. *Habenaria malintana* (Blanco) Merr. Peninsular India.
2199. *Habenaria multicaudata* Sedgw. Endemic to Peninsular India. Rare
2200. *Habenaria ovalifolia* Wight. Peninsular India.
2201. *Habenaria peloroides* Par. & Reichb.
2202. ***Habenaria periyarensis*** Sasidharan, Rajesh & Jomy. Southern Western Ghats (Kerala)
2203. *Habenaria perrottetiana* A. Rich. Southern Western Ghats. Rare
2204. *Habenaria plantaginea* Lindl.
2205. *Habenaria rariflora* A. Rich. Peninsular India. Rare
2206. *Habenaria richardiana* Wight. Southern Western Ghats. Threatened
2207. ***Habernaria roxburghii*** Nicols. Endemic to Peninsular India
2208. *Habenaria viridiflora* (Sw.) R. Br.
2209. *Hetaeria olvalifolia* (Wight) Benth. Southern Western Ghats. Rare
2210. *Kingidium mysorensis* (Sald.) Sathish. Southern Western Ghats.
2211. *Kingidium niveum* Sathish, in Sathish & Manilal. South India. Rare
2212. *Liparis atropurpurea* Lindl.
2213. *Liparis caespitosa* (Thou.) Lindl.
2214. *Liparis elliptica* Wight
2215. *Liparis odorata* (Willd.) Lindl.
2216. *Liparis viridiflora* (Blume) Lindl.
2217. ***Liparis walkeriae*** Grah. Peninsular India. Rare
2218. *Liparis wightiana* Thw.
2219. *Luisia birchea* (A. Rich.) Bl. Southern Western Ghats.
2220. *Luisia zeylanica* Lindl.
2221. *Malaxis acuminata* D. Don
2222. *Malaxis rheedei* Sw.

2223. *Nervilia aragoana* Gaud.
2224. *Nervilia crociformis* (Zoll.& Morr.Scidenf.)
2225. *Nervilia plicata* (Andr.) Schltr.
2226. *Oberonia anamalayana* Joseph. Southern Western Ghats.
2227. *Oberonia arnottiana* Wight
2228. *Oberonia bicornis* Lindl. Peninsular India. Rare
2229. *Oberonia brachyphylla* Blatt. & McCann . Southern Western Ghats. Rare
2230. *Oberonia brunoniana* Wight Southern Western Ghats.
2231. *Oberonia chandrasekharanii* Nair *et al*. Southern Western Ghats (Kerala and Karnataka).
2232. *Oberonia feruginea* Parish. ex Hook. f..
2233. *Oberonia gammiei* King & prantl.
2234. *Oberonia longibracteata* Lindl.
2235. *Oberonia mucronata* (D. Don) Ormerod & Seidenf.
2236. *Oberonia nayarii* Ansari & Balakr. Southern Western Ghats. Rare
2237. *Oberonia platycaulon* Wight. Southern Western Ghats. Rare
2238. *Oberonia proudlockii* King & Pantl. Southern Western Ghats. Rare
2239. *Oberonia recurva* Lindl.
2240. *Oberonia santapaui* Kapad. Western Ghats.
2241. *Oberonia sebastiana* Shetty & Vivek. Southern Western Ghats.
2242. *Oberonia thwaitesii* Hook. f.
2243. *Oberonia verticillata* Wight Southern Western Ghats.
2244. *Oberonia wightiana* Lindl
2245. *Oeceoclades pulchra* (Thou.) Clements & Cribb
2246. *Pachystoma hirsutum* (Joseph & Vajr.) Sathish & Manilal. Southern Western Ghats.
2247. *Pachystoma pubescens* Bl.
2248. *Papilionanthe cylindrica* (Lindl.) Seidenf.
2249. *Pecteilis gigantea* (J. E. Sm.) Rafin.
2250. *Peristylus aristatus* Lindl.
2251. *Peristylus densus* (Lindl.) Sant. & Kapad.
2252. *Peristylus goodyeroides* (D. Don) Lindl.
2253. *Peristylus plantagineus* Lindl.
2254. *Peristylus richardianus* Wight Western Ghats. Rare
2255. *Pholidota imbricata* Hook.f..
2256. *Phraetia elegans* Lindl.
2257. *Podochilus malabaricus* Wight
2258. *Polystachya concreta* (Jacq.) Garay & H.R. Sweet
2259. *Pomatocalpa spicata* Breda. India. Rare
2260. *Porpax jerdoniana* (Wight) Rolfe South India. Rare
2261. *Porpax reticulata* Lindl. South India, endemic. Rare
2262. *Rhynchostylis retusa* (L.) Bl.
2263. *Robiquetia josephiana* Manilal & Sathish. South India. Very rare
2264. *Robiquetia virescens* (Gard. Ex Lindl) Jayaweer.
2265. *Satyrium nepalense* D. Don
2266. *Schoenorchis nivea* (Lindl.) Schltr.
2267. *Seidenfadeniella filiformis* (Reichb.f.)Christm. & Ormerod.

2268. ***Seidenfia crenulata*** (Ridley) Szlach. Southern Western Ghats (Kerala).
2269. ***Seidenfia densiflora*** (A. Rich) Szlach.
2270. *Sirhookera lanceolata* (Wight) O. Ktze.
2271. *Sirhookera latifolia* (Wight) O. Ktze.
2272. *Smithsonia maculata* (Dalz.) Sald. Southern Western Ghats.
2273. *Smithsonia viridiflora* (Dalz.) Sald. Southern Western Ghats, endemic.
2274. *Spiranthes sinensis* (Pers.) Ames
2275. *Taeniophyllum alwisii* Lindl.
2276. *Taeniophyllum scaberulum* Hook. f. Southern Western Ghats, endemic. Rare
2277. *Tainia bicornis* (Lindl.) Reichb. f.
2278. *Thelasis pygmaea* Lindl
2279. ***Thrixspermum muscaeflorum*** Rao & Jos. var. ***nilagiricum*** Jos.& Vajra. Endemic to Peninsular India
2280. *Trias bonaccordensis* Sathish. Southern Western Ghats. Rare
2281. *Trias stocksii* Benth. ex Hook. f. Southern Western Ghats.
2282. *Trichoglottis tenera* (Lindl.) Schltr.
2283. *Tropidia angulosa* (Lindl) Bl.
2284. *Vanda spathulata* (L.) Spreng.,
2285. *Vanda tessellate* (Roxb.) Hook. Ex D. Don
2286. *Vanda testacea* (Lindl.) Reichb. f.
2287. *Vanda thwaitesii* Hook. f.
2288. *Vanilla wightiana* Lindl. South India, endemic.
2289. *Xenikophyton smeeanum* (Reichb. F.) Garay. Southern Western Ghats.
2290. *Zeuxine cladestina* Bl. Southern Western Ghats. Very rare
2291. *Zeuxine flava* (Wall ex Lindl.) Benth. ex Hook. f. Southern Western Ghats.
2292. *Zeuxine longilabris* (Lindl.) Benth. ex Hook. f.

ZINGIBERACEAE

2293. *Alpinia abundiflora* Burtt & Smith South India.
2294. *Alpinia fax* Burtt. & RM Smith
2295. *Alpinia galanga* (L.) Sw.
2296. *Alpinia nigra* (Gaertn.) Burtt
2297. *Amomum cannicarpum* (Wight) Benth. South-Western India.
2298. *Amomum hypoleucum* Thw.
2299. *Amomum masticatorium* Thw.
2300. *Amomum muricatum* Bedd. Endemic to Western Ghats.
2301. Amomum pterocarpum Thw.
2302. *Boesenbergia pulcherrima* (Wall.) O. Ktze. Endemic to South India.
2303. *Costus speciosus* (Koenig) Smith
2304. *Curcuma aromatica* Salisb.
2305. *Curcuma coriacea* Mangaly & Sabu
2306. *Curcuma haritha* Mangaly & Sabu Endemic to South India. Rare
2307. *Curcuma montana* Rosc. South India.
2308. *Curcuma neilgherrensis* Wight. Southern Western Ghats.
2309. *Curcuma vamana* Sabu & Mangaly. Southern Western Ghats (Kerala).
2310. *Curcuma zedoaria* (Christm.) Rosc.
2311. *Elettaria cardamomum* (L.) Maton

2312. *Globa ceruna* Baker
2313. *Globba marantina* L.
2314. *Hedychium coronarium* Koenig
2315. *Hedychium flavescens*
2316. *Hedychium venustum* Wight. Endemic to South India.
2317. *Zingiber cernuum* Dalz. Endemic to Western Ghats.
2318. *Zingiber neesanum* (Grah.) Ramam. Southern Western Ghats.
2319. *Zingiber officinale* Rosc.
2320. *Zingiber wightianum* Thw.
2321. *Zingiber zerumbet* (L.) Smith

MARANTACEAE

2322. *Schumannianthus virgatus* (Roxb.) Rolfe. Endemic to South India.
2323. *Stachyphrynium spicatum* (Roxb.) Schum. South India.

MUSACEAE

2324. *Ensete superba* (Roxb.) Cheesman. South West India.

HAEMODORACEAE

2325. *Ophiopogon intermedius* D. Don India.
2326. *Peliosanthes teta* Andr. subsp. *humilis* (Andr.) Jessop

DIOSCOREACEAE

2327. *Dioscorea anguina* Roxb.
2328. *Dioscorea bulbifera* L. var. bulbifera
2329. *Dioscorea bulbifera* L. var. vera Prain & aburkill
2330. *Dioscorea hispida* Dennst. Peninsular India.
2331. *Dioscorea oppositifolia* L.
2332. *Dioscorea pentaphylla* L.
2333. *Dioscorea spicata* Roth,
2334. *Dioscorea tomentosa* Koen. ex Spreng.
2335. *Dioscorea wallichii* Hook. f. Peninsular India. Rare

AMARYLLIDACEAE

2336. *Crinum latifolium* L.
2337. *Pancratium triflorum* Roxb.

DRACAENACEAE

2338. Dracaena terniflora Roxb.
2339. Sanseviera roxburghiana Schult & Schult.f.

HYPOXIDACEAE

2340. *Curculigo orchioides* Gaertn.
2341. *Hypoxis aurea* Lour.
2342. *Molineria trichocarpa* (Wight) Balakr.

LILIACEAE

2343. *Aloe vera* (L.) Burm, f.,
2344. *Asparagus gonoclados* Baker Southern Western Ghats.
2345. *Asparagus racemosus* Willd.
2346. *Chlorophytum attenuatum* (Wight) Baker Western Ghats. Rare
2347. *Chlorophytum heynei* Rottl. ex Baker

2348. *Chlorophytum laxum* R. Br.
2349. *Dianella ensifolia* (L.) DC.
2350. *Disporum leschenaultianum* D. Don
2351. *Gloriosa superba* L.
2352. *Iphigenia indica* (L.) A. Gray ex Kunth
2353. *Lilium wallichianum* Schultes & Schultes f. Southern Western Ghats.
2354. *Urginea indica* (Roxb.) Kunth,

SMILACACEAE

2355. *Smilax aspera* L.
2356. *Smilax perfoliata* Lour.
2357. *Smilax wightii* A. DC. Southern Western Ghats.
2358. *Smilax zeylanica* L.

IRIDACEAE

2359. *Aristea ecklonii* Baker

PONTEDERIACEAE

2360. *Monochoria vaginalis* (Burm. f.) Presl

XYRIDACEAE

2361. *Xyris capensis* Thunb. var. schoenoides (Mart.) Nilsson
2362. *Xyris pauciflora* Willd.

COMMELINACEAE

2363. *Belosynapsis vivipara* (Dalz.) Fischer . Southern Western Ghats.
2364. *commelina attenuataKoenig*. Ex Vahl
2365. *Commelina benghalensis* L.
2366. *Commenlina clavata* Clarke.
2367. *Commelina diffusa* Burm. f.
2368. *Commelina ensifolia* R. Br.
2369. *Commelina erecta* L.
2370. *Commelina imberbis* Ehrenb. ex Hassk.
2371. *Commelina maculata* Edgew.
2372. *Cyanotis arachnoidea* Clarke
2373. *Cyanotis arcotensis* Rolla Rao. Peninsular India.
2374. *Cyanotis cristata* (L.) D. Don
2375. *Cyanotis fasciculata* (Heyne ex Roth) Schult. f.
2376. *Cyanotis papilionacea* (L.) Schult.f.
2377. *Cyanotis pilosa* Schult.f.
2378. *Cyanotis tuberosa* (Roxb.) Schultes f. Peninsular India. Rare
2379. *Cyanotis villosa* (Spreng.) Schultes f.
2380. ***Cyanotis wightii*** Clarke. Peninsular India. Rare
2381. *Dictyospermum montanum* Wight. Southern Western Ghats.
2382. *Dictyospermum ovalifolium* Wight. Southern Western Ghats. Rare
2383. *Dictyospermum protensum* Wight
2384. *Floscopa scandens* Lour.
2385. *Murdannia dimorpha* (Dalz.) Brueck. Peninsular India.
2386. *Murdannia glauca* (Thw. ex Clarke) Brueck.
2387. *Murdannia japonica* (Thunb.) Faden

2388. *Murdannia nudiflora* (L.) Brenan
2389. *Murdannia pauciflora* (Wight) Brueck. Peninsular India.
2390. *Murdannia simplex* (Vahl) Brenan
2391. *Murdannia spirata* (L.) Brueck.
2392. *Murdannia zeylanica* (Clarke) Brueck. Southern Western Ghats. Rare
2393. *Tonningia axillaris* (L.) O. Ktze.

JUNCACEAE

2394. *Juncus bufonius* L.
2395. *Juncus effuses* L.
2396. *Juncus inflexus* L.
2397. *Juncus leschenaultii* Gay

ARECACEAE

2398. *Arenga wightii* Griff. Western Ghats, endemic.
2399. *Bentinckia condapanna* Berry & Roxb. Endemic to Western Ghats. vulnerable
2400. *Calamus brandisii* Becc. ex Becc. & Hook. f. Southern Western Ghats, endemic.
2401. *Calamus delessertianus* Becc. Southern Western Ghats, endemic.
2402. *Calamus gamblei* Becc. ex Becc. & Hook. f. Western Ghats; endemic.
2403. *Calamus hookerianus* Becc. Western Ghats.
2404. *Calamus pseudotenuis* Becc. ex Becc. & Hook. f. Western Peninsular India
2405. *Calamus thwaitesii* Becc. & Hook. f. Western Ghats, endemic.
2406. *Calamus vattayila* Renuka . Southern Western Ghats. Rare
2407. *Caryota urens* L.
2408. *Corypha umbraculifera* L.
2409. *Phoenix loureirii* Kunth var. *laureirii*
2410. *Phoenix loureirii* Kunth var. *humilis* (Becc,) Barrow

TYPHACEAE

2411. *Typha angustifolia* L.

PANDANACEAE

2412. *Pandanus thwaitesii* Mart. Southern Western Ghats.

ARACEAE

2413. *Acorus calamus* L.
2414. *Alocasia fornicata* (Roxb.) Schott
2415. *Alocasia macrorrhizos* (L.) G. Don
2416. *Amorphophallus bulbifer* (Roth.) Bl.,
2417. *Amorphophallus hohenackeri* (Schott) Engl. & Gehrm. Southern Western Ghats. Rare
2418. *Amorphophallus paeoniifolius* (Dennst.) Nicols, var. *paeoniifolius* Sivadas.
2419. *Amorphophallus paeoniifolius* (Dennst.) Nicols, var. *campanulatus* (Decne) Sivad.
2420. *Anaphyllum wightii* Schott Western Ghats.
2421. *Ariopsis peltata* Nimmo.
2422. *Arisaema attenuatum* Barnes & Fischer . Southern Western Ghats. Threatened
2423. *Arisaema barnesii* Fischer . Southern Western Ghats.
2424. *Arisaema jacquemontii* Blume
2425. *Arisaema leschenaultii* Bl.
2426. *Arisaema murrayi* (Graham) Hook. Peninsular India. Rare
2427. ***Arisaema peltatum*** Fischer. Southern Western Ghats.

2428. ***Arisaema psittacus*** Barnes . Southern Western Ghats. Threatened
2429. *Arisaema sarracenioides* Barnes. Southern Western Ghats (Kerala). Threatened
2430. *Arisaema tortuosum* (Wall.) Schott in Schott & Endl.
2431. *Arisaema translucens* Fischer. Southern Western Ghats. Rare & Threatened
2432. *Arisaema tylophorum* Fischer. Southérn Western Ghats. Rare
2433. *Colocasia esculenta* (L.) Schott
2434. *Cryptocoryne consobrina* Schott. Endemic to Peninsular India, endangered
2435. *Cryptocoryne retrospiralis* (Roxb.) Kunth
2436. *Lagenandra meeboldii* (Engl.) Fischer. South India, Endemic.
2437. *Lagenandra ovata* (L.) Thw.
2438. *Lagenandra toxicaria* Dalz. Southern Western Ghats.
2439. *Pothos armatus* Fischer. Southern Western Ghats. Rare
2440. ***Pothos keralensis*** pandur. & Nair. Southern Western Ghats (Kerala).
2441. *Pothos scandens* L.
2442. *Pothos thomsonianus* Schott. Southern Western Ghats (Kerala). Rare
2443. *Remusatia vivipara* (Roxb.) Schott
2444. *Raphidophora pertusa* (Roxb.) Schott
2445. *Theriophonum infaustum* N. E. Br. South India.
2446. ***Theriophonum sivaganganum*** (Ramam. & Sebastine) Bogner. Endemic to P. India. Endangered

HYDROCHARITACEAE

2447. *Blyxa aubertii* L.
2448. *Blyxa octandra* (Roxb.) Planch. Ex Thw.
2449. *Hydrilla verticillata* (L.f.) Royle

NAJADACEAE

2450. *Najas indica* (Willd.) Cham.

ERIOCAULACEAE

2451. ***Eriocaulon brownianum*** Mart. ex Wall. Peninsular India.
2452. *Eriocaulon cinereum* R. Br.,
2453. *Eriocaulon conica* (Fyson) Fischer. Endemic to Southern Western Ghats. Rare
2454. *Eriocaulon leucomelas* Steud. Southern Western Ghats.
2455. *Eriocaulon longicuspis* Hook. f.
2456. *Eriocaulon nepalense* Prescott ex Bong.
2457. *Eriocaulon odoratum* Dalz.
2458. *Eriocaulon parviflorum* (Fyson) Ansari & Balakr. Peninsular India.
2459. ***Eriocaulon pectinatum*** Ruhl. Endemic to Southern Western Ghats.
2460. *Eriocaulon quinquangulare* L
2461. *Eriocaulon sexangulare* L
2462. *Eriocaulon thwaitesii* Koern. Southern Western Ghats (Kerala and Tamil Nadu).
2463. *Eriocaulon trilobum* Buch.-Ham. ex Koern. India. Very rare
2464. *Eriocaulon truncatum* Buch.-Ham. ex Mart.
2465. *Eriocaulon vasudevanii* Ansari & Balakr. Southern Western Ghats. Rare
2466. *Eriocaulon xeranthemum* Mart.

CYPERACEAE

2467. *Bulbostylis barbata* (Rottb.) Kunth ex Clarke
2468. *Bulbostylis densa* (Wall. ex Roxb.) Hand. Mazz.

2469. *Carex baccans* Nees ex Wight
2470. *Carex breviculmis* R. Br.
2471. *Carex filicina* Nees var. *filicina*
2472. *Carex filicina* Nees var.leptocarpus (Clarke) Kukenth.
2473. *Carex jackiana* Boott
2474. *Carex lenta* D. Don
2475. *Carex leucantha* Arn. ex Boott
2476. *Carex ligulata* Nees in Wight
2477. *Carex lindleyana* Nees
2478. *Carex longicruris* Nees
2479. *Carex maculata* Boott.
2480. *Carex myosurus* Nees. Southern Western Ghats. Rare
2481. *Carex nubigena* D.Don
2482. *Carex phacota* Sprengel
2483. *Carex speciosa* Kunth
2484. *Carex stramentitia* Boott ex Boeck.
2485. *carex wightiana* Nees
2486. *Cyperus compressus* L.
2487. *Cyperus cuspidatus* Kunth
2488. *Cyperus difformis* L.
2489. *Cyperus diffusus* Vahl
2490. *Cyperus diffusus* Vahl subsp. *diffusus*
2491. *Cyperus diffusus* Vahl subsp. *macrostachyus* (Boeckeler) Koyama
2492. *Cyperus digitatus* Roxb.
2493. *Cyperus distans* L. f. var. *distans*
2494. *Cyperus distans* L. f. var. *pseudonutans* Kukenth
2495. *Cyperus exaltatus* Retz.
2496. *Cyperus haspan* L.
2497. *Cyperus iria* L.
2498. *Cyperus michelianus* (L,) Link var. *pygmaeus* (Rottb.) Asch.
2499. *Cyperus nutans* Vahl ssp. *nutans*
2500. *Cyperus nutans* Vahl ssp. *eleusinoides* (Kunth) Koyama
2501. *Cyperus oatesii* Clarke
2502. *Cyperus pangorei* Rottb.
2503. *Cyperus pilosus* Vahl
2504. *Cyperus procerus* Rottb
2505. *Cyperus rotundus* L.
2506. *Cyperus tenuispica* Steud.
2507. *Cyperus zollingeri* Steud.
2508. *Eleocharis acutangula* (Roxb.) Schult.
2509. *Eleocharis congesta* D. Don
2510. *Eleocharis dulcis* (Burm. f.) Trim. ex Hensch.
2511. *Eleocharis retroflexa* (Poir.) Urban
2512. *Eleocharis tetraquetra* Nees
2513. *Fimbristylis aestivalis* (Retz.) Vahl

2514. *Fimbristylis aphylla* Steud.
2515. *Fimbristylis argentea* (Rottb.) Vahl
2516. *Fimbristylis bisumbellata* (Forssk.) Bubani
2517. *Fimbristylis cinnamometorum* (Vahl) Kunth
2518. *Fimbristylis complanata* (Retz.) Link
2519. *Fimbristylis dichotoma* (L.) Vahl
2520. *Fimbristylis dipsacea* (Rottb.) Clarke
2521. *Fimbristylis dura* (Zoll. & Moritz.) Merr.
2522. *Fimbristylis eragrostis* (Nees & Meyen ex Nees) Hance
2523. *Fimbristylis falcata* (Vahl) Kunth
2524. *Fimbristylis glabra* Steud.
2525. ***Fimbristylis kingii*** Clarke ex Boeck. Southern Western Ghats (Kerala).
2526. *Fimbristylis miliacea* (L.) Vahl
2527. *Fimbristylis monticola* Hochst. ex Steud.
2528. *Fimbristylis narayanii* Fischer South India. Rare
2529. *Fimbristylis ovata* (Burm. f.) Kern
2530. ***Fimbristylis stigmatotecta*** Govind. Southern Western Ghats (Kerala).
2531. *Fimbristylis tenera* Schult.
2532. *Fimbristylis tristachya* R. Br.,
2533. *Fimbristylis uliginosa* Hochst. ex Steud. Endemic to South India.
2534. *Fuirena ponmudiensis* Ravi & Anilkumar. Southern Western Ghats (Kerala). Rare
2535. *Fuirena umbellata* Rottb.
2536. *Hypolytrum nemorum* (Vahl) Spreng.
2537. *Kyllinga brevifolia* Rottb.
2538. *Kyllinga bulbosa* Beauv.
2539. *Kyllinga melanosperma* Nees
2540. *Kyllinga nemoralis* (J. R. & G. Forst.) Dandy ex Hutchins. & Dalziel
2541. *Kyllinga odorata* Vahl
2542. *Kyllinga squamulata* Vahl
2543. *Lipocarpha chinensis* (Osbeck) Kern.
2544. *Lipocarpha sphacelata* (Vahl) Kunth
2545. *Mariscus compactus* (Retz) Boldingh
2546. *Mariscus cyperinus* (Retz) Vahl var *cyperinus*
2547. *Mariscus cyperinus* (Retz) Vahl var *pictus* (Nees) Karthik.
2548. *Mariscus dubius* (Rottb.) Kukenth. ex Fischer
2549. *Mariscus javanicus* (Houtt.) Merr. & Metcalfe
2550. *Mariscus paniceus* (Rottb.) Vahl
2551. *Mariscus squarrosus* (L.) Clarke
2552. *Mariscus sumatrensis* (Retz.) Raynal
2553. *Pycreus apiculatus* Govind..
2554. *Pycreus flavidus* (Retz.) Koyama
2555. *Pycreus polystachyos* (Rottb.) P. Beauv.
2556. *Pycreus pumilus* (L.) Nees
2557. *Pycreus sanguinolentus* (Vahl) Nees ex Clarke
2558. *Pycreus stramineus* (Nees) Clarke

2559. *Pycreus sulcinux* (Clarke) Clarke
2560. *Pycreus unioloides* (R. Br.) Makino. Endemic to South India.
2561. *Rhynchospora corymbosa* (L.) Brit.
2562. *Rhynchospora rugosa* (Vahl) Gale
2563. *Rikliella squarrosa* (Linn.) Raynal
2564. *Schoenoplectus articulatus* (L.) Palla
2565. *Schoenoplectus juncoides* (Roxb.) Palla
2566. *Schoenoplectus mucronatus* (L.) Palla
2567. *Scleria annularis* Nees ex Steud.
2568. *Scleria caricina* (R. Br.) Benth.
2569. *Scleria levis* Retz.
2570. *Schleria lithosperma* (L.) Sw.
2571. *Scleria pergracilis* (Nees) Kunth
2572. *Scleria parvula* Steud.
2573. *Scleria rugosa* R. Br.
2574. *Scleria terrestris* (L.) Fassett

POACEAE

2575. *Agrostis peninsularis* Hook.f.
2576. *Agrostis pilosula* Trin.
2577. *Alloteropsis cimicina* (L.) Stapf
2578. *Andropogon lividus* Thw.
2579. ***Andropogon polyptycus*** Steud. Endemic to South India.
2580. *Anthoxanthum borii* Jain & Pal. Endemic to South India.
2581. *Apluda mutica* L.
2582. *Apocopis mangalorensis* (Hochst.) Henr.
2583. *Aristida adscensionis* L.,
2584. *Aristida hystrix* L. f. India. Rare
2585. *Aristida setacea* Retz.
2586. *Arthraxon hispidus* (Thunb.) Makino
2587. *Arthraxon lanceolatus* (Roxb.) Hochst. Peninsular India. Rare
2588. *Arthraxon lancifolius* (Trim.) Hochst.
2589. ***Arthraxon meeboldii*** Stapf. Peninsular India. Very rare
2590. *Arthraxon nudus* (Steud.) Hochst.
2591. *Arthraxon quartinianus* (A. Rich.) Nash. Peninsular India.
2592. ***Arthraxon villosus*** Fischer. Endemic to South India
2593. ***Arundinaria densifolia*** Munro.
2594. ***Arundinaria floribunda*** Thw.
2595. *Arundinella ciliata* (Roxb.) Nees ex Miq. Peninsular India.
2596. *Arundinella leptochloa* (Nees ex Steud.) Hook. f.
2597. *Arundinella mesophylla* Nees ex Steud. Peninsular India.
2598. *Arundinella pumila* (Hochst. ex A. Rich.) Steud.
2599. *Arundinella purpurea* Hochst. ex Steud. var. *purpurea*. Southern Western Ghats.
2600. *Arundinella purpurea* Hochst. ex Steud. var. laxa Bor. Southern Western Ghats.
2601. *Arundinella setosa* Trin.
2602. ***Arundinella vaginata*** Bor, endemic to Southern Western Ghats.

2603. *Axonopus compressus* (Sw.) P. Beauv.
2604. *Bambusa bambos* (L.) Voss
2605. *Bothriochloa insculpta* (Hochst. ex A. Rich.) A. Camus
2606. *Bothriochloa parameswaranii* Srekumar et al. Endemic to Southern Western Ghats (Kerala).
2607. *Bothriochloa pertusa* (L.) A. Camus
2608. *Brachiaria brizantha* (Hochst. ex A. Rich.) Stapf
2609. *Brachiaria distachya* (L.) Stapf. in Prain,
2610. *Brachiaria miliiformis* (J.S. Presl) A. Chase
2611. *Brachiaria ramosa* (L.) Stapf.
2612. *Brachiaria reptans* (Hoscht.) Stapf
2613. ***Brachiaria semiundulata*** (Hochst.) Stapf. Southern Western Ghats, endemic.
2614. *Brachiaria semiverticillata* (Rottl.) Alston
2615. *Brachiaria subquadripara* (Trin.) A. Hitchc.
2616. *Capillipedium assimile* (Steud.) A. Camus
2617. *Centotheca lappacea* (L.) Desv.
2618. *Chionachne koenigii* (Spreng.) Thw.
2619. *Chloris barbata* Sw.
2620. *Chloris dolichostachya* Lagasca,
2621. *Chloris roxburghiana* Schultes,
2622. *Chrysopogon aciculatus* (Retz.) Trin.
2623. *Chrysopogon asper* (Heyne ex Hook.f.) Blatt. & McCann Peninsular India
2624. *Chrysopogon hackelii* (Hook.f.) Fischer South India; endemic.
2625. *Chrysopogon nodulibarbis* (Steud.) Henrard
2626. ***Chrysopogon velutinus*** (Hook.f.) Bor. Endemic to Peninsular India, threatened
2627. *Cleistachne sorghoides* Benth.
2628. *Coelachne simpliciuscula* (Wight & Arn. ex Steud.) Benth.
2629. *Coix aquatica* Roxb. Southern Western Ghats.
2630. *Coix lacryma-jobi* L.
2631. *Cymbopogon caesius* (Nees ex Hook.f. & Arn.) Stapf
2632. *Cymbopogon citratus* (DC.) Stapf
2633. *Cymbopogon flexuosus* (Nees ex Steud.) Wats.
2634. *Cymbopogon travancorensis* N. L. Bor. Southern Western Ghats (Kerala), endemic.
2635. ***Cynodon barberi*** Rang. & Tad. Endemic to Peninsular India
2636. *Cynodon dactylon* (L.) Pers.
2637. *Cyrtococcum deccanense* N. L. Bor
2638. *Cyrtococcum longipes* (Wight & Arn. ex Hook.f.) A. Camus. Southern Western Ghats.
2639. *Cyrtococcum muricatum* (Retz.) Bor
2640. *Cyrtococcum oxyphyllum* (Steud.) Stapf.
2641. *Cyrtococcum patens* (L.) A. Camus
2642. *Cyrtococcum trigonum* (Retz.) A. Camus
2643. *Dactyloctenium aegyptium* (L.) P. Beauv.
2644. *Dendrocalamus strictus* (Roxb.) Nees
2645. *Dichanthium annulatum* (Forssk.) Stapf.
2646. *Dichanthium foulkesii* (Hook.f.) Jain & Desh Pande . Southern Western Ghats.
2647. *Dichanthium oliganthum* (Hochst. ex Steud.) Cope. Peninsular India, endemic. Rare

2648. *Digitasria abludens* (Roem. & Schultes) Veldk.
2649. *Digitaria bicornis* (Lam.) Roem. & Schult.
2650. *Digitaria ciliaris* (Retz.) Koeler, Descr.
2651. *Digitaria griffithii* (Hook.f.) Henr.
2652. *Digitaria longiflora* (Retz.) Pers.
2653. *Digitaria setigera* Roth. ex Roem. & Schult.
2654. *Digitasria violaceus* Link.
2655. *Digitaria wallichiana* (Wight & Arn. ex Steud.) Stapf.
2656. *Dimeria connivens* Hack. Peninsular India.
2657. *Dimeria deccanensis* Bor South India, endemic.
2658. *Dimeria fuscescens* Trim.
2659. ***Dimeria idukkiensis*** Ravi. & Anilkumar. Southern Western Ghats.
2660. *Dimeria kanjirapallilana* K. C. Jacob. Southern Western Ghats(Kerala), endemic. Rare
2661. ***Dimearia kurunthotticalana*** Jacob. Southern Western Ghats. Endangered
2662. *Dimeria lawsonii* (Hook.f.) Fischer. South India; endemic.
2663. *Dimeria mooneyi* Raizada ex Mooneyi India. Rare
2664. *Dimeria ornithopoda* Trim.
2665. ***Dimeaira sreenarayanii*** Ravi. & Anilkumar. Southern Western Ghats.
2666. *Dimeria thwaitesii* Hack.
2667. *Echinochloa colona* (L.) Link
2668. *Echinochloa crus-galli* (L.) P. Beauv.
2669. *Echinochloa stagnina* (Retz.) P. Beauv.
2670. *Eleusine coracana* (L.) Gaertn.
2671. *Eleusine indica* (L.) Gaertn.
2672. *Enneapogon schimperanus* (Hochst. ex A. Rich.) Renvoize
2673. *Enteropogon monostachyos* (Vahl.) Schum. ex Engl
2674. *Eragrostiella bifaria* (Vahl.) Bor
2675. *Eragrostis atrovirens* (Desv.) Trin. ex Steud.
2676. *Eragrostis diplachnoides* Steud.,
2677. *Eragrostis nigra* Nees ex Steud.
2678. *Eragrostis nutans* (Retz.) Nees ex Steud.
2679. *Eragrostis pilosa* (L.) P. Beauv.
2680. *Eragrostis riparia* (Willd.) Nees,
2681. *Eragrostis tef* (Zucc.) Trotter
2682. *Eragrostis tenella* (L.) P. Beauv. Ex Roem. & Schult.
2683. *Eragrostis tenuifolia* (A. Rich.) Hochst. ex Steud.
2684. *Eragrostis unioloides* (Retz.) Nees ex Steud.
2685. *Eragrostis viscosa* (Retz.) Trin.
2686. *Eulalia phaeothrix* (Hack.) O. Ktze.
2687. *Eulalia thwaitesii* (Hack.) O. Ktze.
2688. *Eulalia trispicata* (Schult.) Henr.
2689. *Garnotia arundinacea* Hook. f. South India. Rare
2690. *Garnotia courtallensis* (Arn. & Nees) Thw.
2691. *Garnotia elata* (Arn. ex Miq.) Janowski. Southern Western Ghats.
2692. *Garnotia exaristata* Gould

2693. *Garnotia tenella* (Arn. ex Miq.) Janowski
2694. ***Glyphochloa divergens*** (Hack.) W.D. Clayton. Southern Western Ghats (Kerala)
2695. *Glyphochloa forficulata* (Fischer) Clayton. South India. Rare
2696. *Hackelochloa granularis* (L.) O. Ktze.
2697. *Helictotrichon virescens* (Nees ex Steud.) Henrard,
2698. *Heteropogon contortus* (L.) P. Beauv. ex Roem. & Schult.
2699. *Ichnanthus vicinus* (Bail.) Merr.
2700. *Imperata cylindrica* (L.) Raeuchel, var. major (Nees) C.E. Hubb. ex Hubb. et Vaughan
2701. *Isachne bourneorum* Fischer. Endemic to South India.
2702. ***Isachne fischerii*** Bor. Southern Western Ghats (Kerala), rare.
2703. *Isachne globosa* (Thunb.) O. Ktze.
2704. *Isachne kunthiana* (Wight & Arn. ex Steud.) Wight & Arn. ex Thw.
2705. *Isachne miliacea* Roth.
2706. *Isachne setosa* Fischer. Southern Western Ghats.(Kerala).
2707. *Isachne walkeri* (Arn. ex Steud.) Wight & Arn. ex Thw.
2708. *Ischaemum agasthyamalayanum* Sreekumar *eta al.*. Southern Western Ghats (Kerala)
2709. *Ischaemum commutatum* Hack.
2710. *Ischaemum indicum* (Houtt.) Merr. Var. *indicum* subvar. *Indicum*
2711. *Ischaemum indicum* (Houtt.) Merr. var. *indicum* subvar. *scrobiculatum* (Nees ex Steud.) Bor
2712. *Ischaemum indicum* (Houtt.) Merr. var. *indicum* subvar. *villosum* (Nees) Bor
2713. *Ischaemum indicum* (Houtt.) Merr var. *wallichii*
2714. *Ischaemum mangaluricum* (Hack.) Stapf. ex Fischer
2715. *Ischaemum nilagiricum* Hack. Endemic to Southern Western Ghats.
2716. *Ischaemum tadulingamii* Nair & Sreekumar. Endemic to Southern Western Ghats (Kerala). Rare.
2717. *Ischaemum timorense* Kunth
2718. *Ischaemum zeylanicolum* (Hack.) Bor
2719. *Jansenella griffithiana* (C. Muell.) Bor
2720. *Leersia hexandra* Sw.
2721. *Leptochloa uniflora* Hochst. ex A. Rich.
2722. *Lolium temulentum* L.
2723. *Lophatherum gracilis* Brogn.
2724. *Melinis minutiflora* P. Beauv.
2725. *Microstegium ciliatum* (Trin.) A. Camus
2726. *Microstegium nudum* (Trin) A Camus
2727. *Ochlandra scriptoria* (Dennst.) fischer
2728. ***Ochlandra spirostylis*** Muktesh et al. Endemic to Southern Western Ghats (Kerala)
2729. *Ochlandra travancorica* Benth. ex Gamble. Southern Western Ghats (Kerala).
2730. *Oplismenus burmannii* (Retz.) P. Beauv.
2731. *Oplismenus compositus* (L.) P. Beauv.
2732. *Oplismenus undulatifolius* (Ard.) P. Beauv. ex Roem. & Schultes
2733. *Oropetium thomaeum* (L.f.) Trin.
2734. *Oryza meyeriana* (Zoll. & Mor. ex Steud.) Baill ssp. *granulata* (Nees & Arn. ex Watt) Tateoka
2735. *Oryza rufipogon* Griff. India. Rare
2736. *Oryza sativa* L.
2737. *Ottochloa nodosa* (Kunth) Dandy

2738. *Panicum antidotale* Retz.
2739. *Panicum brevifolium* L.
2740. *Panicum gardneri* Thw.
2741. *Panicum maximum* Jacq.
2742. *Panicum notatum* Retz.
2743. *Panicum paludosum* Roxb.
2744. *Panicum repens* L.
2745. *Panicum sumatrense* Roth ex Roem. & Schult.
2746. *Panicum trypheron* Schult.
2747. *Paspalidium flavidum* (Retz.) A. Camus
2748. *Paspalidium punctatum* (Burm.,f.) A. Camus
2749. *Paspalum canarae* (Steud.) Veldk. India. Common
2750. *Paspalum conjugatum* Berg.
2751. *Paspalum dilatatum* Poir.
2752. *Paspalum distichum* L.
2753. *Paspalum scrobiculatum* L.
2754. *Pennisetum hohenackeri* Hochst. ex Steud. Western India.
2755. *Pennisetum polystachyon* (L.) Schult.
2756. *Perotis indica* (L.) O. Ktze.
2757. *Phragmites karka* (Retz.) Trin. ex Steud.,
2758. *Poa annua* L.
2759. *Pogonatherum crinitum* (Thunb.) Kunth
2760. *Pseudanthistiria umbellata* (Hack.) Hook. f.
2761. *Pseudechinolaena polystachya* (HBK) Stapf
2762. *Pseudoraphis spinescens* (R. Br.) Vickery
2763. *Pseudosorghum fasciculare* (Roxb.) A. Camus
2764. *Pseudoxytenanthera bourdillonii* (Gamble) Naithani. Endemic to S. Western Ghats
2765. *Pseudoxytenanthera monadelpha* (Thw.) Sodestrom & Ellis
2766. *Rhynchelytrum repens* (Willd.) C.E. Hubb.
2767. *Rottboellia cochinchinensis* (Lour.) W. D. Clayton
2768. *Saccharum officinarum* L.
2769. *Saccharum spontaneum* L.
2770. *Sacciolepis indica* (L.) A. Chase
2771. *Sacciolepis interrupta* (Willd.) Stapf
2772. *Sacciolepis myosuroides* (R. Br.) A. Camus
2773. *Schizachyrium brevifolium* (Sw.) Nees ex Buese
2774. *Sehima nervosum* (Rottl.) Staff
2775. *Setaria barbata* (Lam.) Kunth.
2776. *Setaria geniculata* (Lamk.) P. Beavu.,
2777. *Setaria intermedia* Roem. & Schult.
2778. *Setaria palmifolia* (Koen.) Stapf.
2779. *Setaria paniculifera* (Steud.) Fourn. ex Hemsl.
2780. *Setaria pumila* (Poir.) Roem. & Schult.
2781. *Setaria verticillata* (L.) P. Beauv.
2782. *Sinarundinaria densifolia* (Munro) Chao & Renv.

2783. *Sinarundinaria walkeriana* (Munro) Chao & Renv
2784. *Sorghum bicolor* (L.) Moench.lor
2785. *Sorghum halepense* (L.) Pers.
2786. *Sorghum nitidum* (Vahl) Pers
2787. *Spodiopogon rhizophorus* (Steud.) Pilger. Endemic to Peninsular India.
2788. *Sporobolus indicus* (L.) R. Br var. *diander* (Retz.) Jovet & Guedes
2789. *Sporobolus indicus* (L.) R. Br. var. *fertilis* (Steud.) Jovet & Guedes
2790. *Sporobolus piliferus* (Trin.) Kunth
2791. *Sporobolus virginicus* (L.) Kunth,
2792. *Streptogyna crinita* P. Beauv. Endemic to Southern Western Ghats.
2793. *Teinostachyum wightii* Bedd. Endemic to Southern Western Ghats. Threatened
2794. *Themeda cymbaria* (Roxb.) Hack.
2795. *Themeda tremula* (Nees ex Steud.) Hack.
2796. *Themeda triandra* Forssk.
2797. *Trachys muricata* (L.) Pers. Ex Trin.
2798. *Tragus biflorus* Schult.
2799. *Tragus roxburghii* Panigrahi. Endemic to Peninsular India
2800. ***Tripogon ananthaswamianus*** Sreekumar *et al*.. Endemic to S.Western Ghats (Keala).
2801. *Tripogon bromoides* Roem. & Schult.
2802. *Tripogon capillatus* Jaub. & Spach. Southern Western Ghats. Rare
2803. ***Tripogon narayanii*** Sreekumar et al. Endemic to Southern Western Ghats (Kerala)
2804. ***Tripogon pauperculus*** Stapf . Endemic to Western Ghats. Rare
2805. ***Tripogon sivarajanii*** Sunil. Endemic to Southern Western Ghats (Kerala)
2806. *Urochloa panicoides* P. Beauv.
2807. *Vetiveria zizanioides* (L.) Nash
2808. *Zea mays* L.
2809. *Zenkeria elegans* Trin.
2810. ***Zenkeria jainii*** Nair et al. Endemic to Southern Western Ghats (Kerala)
2811. ***Zenkeria sebastinei*** Henry & Chandrab. Endemic to South India. Rare

Checklist of fauna of HRML

Amphibia:

Of the more than 181 species of Amphibia present in the Western Ghats, 50 species were recorded from the HRML of which 43 are endemic to the Western Ghats. The distribution of the frogs like *Raorchestes resplendens, Beddomixalus bijui* and *Nyctibatrachus poocha* is confined to this particular landscape as per the present information. *Beddomixalus* is a new genus described recently from Kadalar near Munnar. The type localities of 13 frogs in this list are the High Ranges and the neighbouring areas. As per the IUCN criteria, six species are Critically Endangered and 14 species are in other threat categories

CLASS: AMPHIBIA Gray
ORDER: ANURA
FAMILY: BUFONIDAE Gray
GENUS: *DUTTAPHRYNUS*, Frost, Grant, Faivovich, Bain, Haas, Hddad, Desa, Channing, Wilkinson, Donnellan, Raxworthy, Campbell, Blotto, Moler, Drewes, Nussbaum, Lynch, Green and Wheeler
1. *Duttaphrynus melanostictus* (Schneider 1799) Common Indian Toad
2. *Duttaphrynus microtympanum* (Boulenger 1882) Small-eared Toad, Southern Hill Toad Vulnerable
3. *Duttaphrynus parietalis* (Boulenger, 1882) Ridged Toad **Near Threatened**
GENUS: *PEDOSTIBES* Gunther
4. *Pedostibes tuberculosus* Gunther , 1875 Malabar Tree Toad **Endangered**
FAMILY: DICROGLOSSIDAE Anderson
GENUS: *EUPHLYCTIS* Fitzinger
5. *Euphlyctis cyanophlyctis* (Schneider, 1799) Skittering Frog Least Concern
6. *Euphlyctis hexadactylus* (Lesson, 1834) Indian Pond Frog Least Concern
GENUS: *FEJERVARYA* Bolkay
7. *Fejervarya keralensis* (Dubois, 1980) Kerala Warty Frog
GENUS: *HOPLOBATRACHUS* Peters
8. *Hoplobatrachus tigerinus* (Daudin, 1803) Indian Bull Frog Least Concern
FAMILY: MICRIXALIDAE Dubois, Ohler and Biju
GENUS: *MICRIXALUS* Boulenger
9. *Micrixalus fuscus* (Boulenger, 1882) Dusky Torrent Frog **Near Threatened**
FAMILY: MICROHYLIDAE Gunther
GENUS: *RAMANELLA* Rao and Ramanna
10. *Ramanella montana* (Jerdon, 1854) Jerdon's Ramanella **Near Threatened**
11. *Ramanella anamalaiensis* Rao, 1937 Anamalai Dot-Frog
12. *Kaloula taprobanica* Parker, 1934 Sri Lankan Kaloula
FAMILY: NASIKABATRACHIDAE Biju and Bossuyt
GENUS: *NASIKABATRACHUS* Biju and Bossuyt
13. *Nasikabatrachus sahyadrensis* Biju and Bossuyt, 2003 Pig Nose Frog **Endangered**
FAMILY: NYCTIBATRACHIDAE Blommers-Schlosser
GENUS: *NYCTIBATRACHUS* Boulenger
14. *Nyctibatrachus anamallaiensis* (Myers, 1942) Anamallai Night Frog
15. *Nyctibatrachus deccanensis* Dubois, 1984 Anamallai Night Frog **Vulnerable** Type locality: "Anamallaye"

16. *Nyctibatrachus poocha* Biju, S.D., Van Bocxlaer, I., Mahony, S., Dinesh, K.P., Radhakrishnan, C., Zachariah, A., Giri, V. & Bossuyt, F. 2011 Meowing Night Frog Type locality: Munnar

FAMILY: RANIDAE Rafinesque

GENUS: *CLINOTARSUS* Mivart

17. *Clinotarsus curtipes* (Jerdon, 1853) Bicoloured Frog **Near Threatened**

GENUS: *HYLARANA* Tschudi

18. *Hylarana temporalis* (Gunther, 1864) Bronze Frog **Near Threatened**

19. *Hylarana aurantiaca* (Boulenger, 1904) Golden frog

FAMILY: RANIXALIDAE Dubois

GENUS: *INDIRANA* Laurent

20. *Indirana beddomii* (Gunther, 1875) Beddome's Indian Frog

21. *Indirana phrynoderma* (Boulenger, 1882) Kerala Indian Frog **Critically Endangered**

FAMILY: RHACOPHORIDAE Hoffman

GENUS: *GHATIXALUS* Biju, Roelants and Bossuyt

22. *Ghatixalus asterops* Biju, Roelants and Bossuyt, 2008 Ghat Tree Frog Type Locality: Bear Shola, Kodaikanal

GENUS: *POLYPEDATES* Tschudi

23. *Polypedates occidentalis* Das and Dutta, 2006 Charpa Tree Frog

24. *Polypedates maculatus* (Gray, 1834) Chunam Frog

GENUS: *BEDDOMIXALUS* Abraham, Pryon, Ansil, Zachariah & Zachariah

25. *Beddomixalus bijui* (Zachariah, Dinesh, Radhakrishnan, Kunhikrishnan, Palot and Vishnudas, 2011) Kadalar Tree Frog Type Locality: Kadalar, Munnar

GENUS: *PSEUDOPHILAUTUS* Laurent

26. *Pseudophilautus wynaadensis* (Jerdon, 1853) Dark-eared Bush Frog **Endangered**

27. *Pseudophilautus kani* (Biju and Bossuyt, 2009) Kani Bush Frog

GENUS: *RAORCHESTES* Biju, Shouche, Dubois, Dutta and Bossuyt

28. *Raorchestes akroparallagi* (Biju and Bossuyt, 2009) Variable Bush Frog

29. *Raorchestes anili* (Biju and Bossuyt, 2006) Anil's Bush Frog Least Concern

30. *Raorchestes beddomii* (Gunther, 1876) Beddomes Bush Frog **Near Threatened**

31. *Raorchestes chlorosomma* (Biju and Bossuyt, 2009) Green-eyed Bush Frog **Critically Endangered**

32. *Raorchestes dubois* (Biju and Bossuyt, 2006) Kodaikanal Bush frog **Vulnerable**

33. *Raorchestes griet* (Bossuyt, 2002) Griet Bush Frog **Critically Endangered** Type Locality: Munnar

34. *Raorchestes jayarami* (Biju and Bossuyt, 2009) Jayaram's Bush Frog

35. *Raorchestes kadalarensis* Zachariah, Dinesh, Kunhikrishnan, Das, Raju, Radhakrishnan, Palot and Kalesh, 2011 Kadalar Bush Frog Type Locality: Kadalar, Munnar

36. *Raorchestes munnarensis* (Biju and Bossuyt, 2009) Munnar Bush Frog **Endangered** Type Loaclity:Munnar

37. *Raorchestes nerostagona* (Biju and Bossuyt, 2005) Water Drop Frog, Kalpetta Bush Frog **Endangered**

38. *Raorchestes ochlandrae* (Gururaja, Dinesh, Palot, Radhakrishnan and Ramachandra, 2007) Ochlandra Reed Frog

39. *Raorchestes ponmudi* (Biju and Bossuyt, 2005) Large Ponmudi Bush Frog **Critically Endangered**

40. *Raorchestes resplendens* Biju, Shouche, Dubois, Dutta and Bossuyt, 2010 Resplendent Shrub Frog **Critically Endangered** Type Locality: Anaimudi Summit, Munnar

41. *Raorchestes uthamani* Zachariah, Dinesh, Kunhikrishnan, Das, Raju, Radhakrishnan, Palot and Kalesh, 2011 Uthaman's Bush Frog

GENUS: RHACOPHORUS Kuhl and Van Hasselt

42. *Rhacophorus calcadensis* Ahl, 1927 Kalakkad Tree frog **Endangered**

43. *Rhacophorus malabaricus* Jerdon, 1870 Malabar Flying frog Least Concern

44. *Rhacophorous pseudomalabaricus* Vasudevan and Dutta, 2000 Malabar False tree frog **Critically Endangered**

ORDER GYMNOPHIONA

FAMILY ICHTHYOPHIDAE

GENUS: *ICHTHYOPHIS*. Fitzinger, 1826

45. *Ichthyophis peninsularis* Taylor, 1960
46. *Ichthyophis tricolor* Annandale, 1909
47. *Ichthyophis subterrestris* Taylor, 1960

GENUS URAEOTYPHLUS Peters, 1789

48. *Uraeotyphlus narayani* Seshachar, 1939
49. *Uraeotyphlus menoni* Annandale, 1913
50. *Uraeotyphlus oxyurus* Duméril and Bibron, 1841

Birds:

Total 310 species. Fifteen of the 16 Western Ghats Endemics recorded. * Endemic to Western Ghats (IUCN Threat Status CR, NT, VU etc.).

1. Little Grebe *Tachybaptus ruficollis*
2. Spot-billed Pelican *Pelecanus philippensis* NT
3. Little Cormorant *Phalacrocorax niger*
4. Indian Shag (Cormorant) *Phalacrocorax fuscicollis*
5. Great Cormorant *Phalacrocorax carbo*
6. Darter *Anhinga melanogaster* NT
7. Great Frigatebird *Fregata minor*
8. Little Egret *Egretta garzetta*
9. Grey Heron *Ardea cinerea*
10. Purple Heron *Ardea purpurea*
11. Large Egret *Casmerodius albus*
12. Median (Intermediate) Egret *Mesophoyx intermedia*
13. Cattle Egret *Bubulcus ibis*
14. Indian Pond-Heron *Ardeola grayii*
15. Little Green *Butorides striatus*
16. Black-crowned Night-Heron *Nycticorax nycticorax*
17. Malayan Night-Heron *Gorsachius melanolophus*
18. Yellow Bittern *Ixobrychus sinensis*
19. Chestnut Bittern *Ixobrychus cinnamomeus*
20. Black Bittern *Dupetor flavicollis*
21. Asian Openbill-Stork *Anastomus oscitans*
22. Lesser Whistling-Duck *Dendrocygna javanica*
23. Garganey *Anas querquedula*
24. Black Baza *Aviceda leuphotes*
25. Oriental Honey-Buzzard *Pernis ptilorhynchus*
26. Black-shouldered Kite *Elanus caeruleus*
27. Black Kite *Milvus migrans*
28. Brahminy Kite *Haliastur indus*

29. Lesser Grey-headed Fish-Eagle *Ichthyophaga humilis*
30. Greater Grey-headed Fish-Eagle *Ichthyophaga ichthyaetus*
31. Indian White-backed (White-rumped) Vulture *Gyps bengalensis* CR
32. Crested Serpent-Eagle *Spilornis cheela*
33. Short-toed Snake Eagle *Circaetus gallicus*
34. Pallid Harrier *Circus macrourus* NT
35. Montagu's Harrier *Circus pygargus*
36. Crested Goshawk *Accipiter trivirgatus*
37. Shikra *Accipiter badius*
38. Besra Sparrowhawk *Accipiter virgatus*
39. Eurasian Sparrowhawk *Accipiter nisus*
40. Common Buzzard *Buteo buteo*
41. Bonelli's Eagle *Hieraaetus fasciatus*
42. Booted Eagle *Hieraaetus pennatus*
43. Rufous-bellied Eagle *Hieraaetus kienerii*
44. Changeable Hawk-Eagle *Spizaetus cirrhatus*
45. Legge's Hawk-Eagle *Nisaetus kelaarti*
46. Black eagle *Icinaetus malayensis*
47. Osprey *Pandion haliaetus*
48. Common Kestrel *Falco tinnunculus*
49. Lesser Kestrel *Falco naumani*
50. Oriental Hobby *Falco severus*
51. Shahin Falcon *Falco peregrinus perigrinator*
52. Grey Francolin *Francolinus pondicerianus*
53. Rain Quail *Coturnix coromandelica*
54. Jungle Bush Quail *Perdicula asiatica*
55. Rock Bush Quail *Perdicula argoondah*
56. Painted Bush Quail *Perdicula erythrorhyncha*
57. Indian Peafowl *Pavo cristatus*
58. Red Spurfowl *Galloperdix spadicea*
59. Grey Junglefowl *Gallus sonneratii*
60. Yellow-legged Buttonquail *Turnix tanki*
61. Barred Buttonquail *Turnix suscitator*
62. Slaty-legged Crake *Rallina eurizonoides*
63. Ruddy-breasted Crake *Porzana fusca*
64. White-breasted Waterhen *Amaurornis phoenicurus*
65. Purple Moorhen *Porphyrio porphyrio*
66. Common Moorhen *Gallinula chloropus*
67. Pheasant-tailed Jacana *Hydrophasianus chirurgus*
68. Bronze-winged Jacana *Metopidius indicus*
69. Red-wattled Lapwing *Vanellus indicus*
70. Pintail Snipe *Gallinago stenura*
71. Eurasian woodcock *Scolopax rusticola*
72. Green Sandpiper *Tringa ochropus*
73. Common Sandpiper *Actitis hypoleucos*

74. Black-winged Stilt *Himantopus himantopus*
75. Small Pratincole *Glareola lactea*
76. River Tern *Sterna aurantia*
77. Sooty Tern *Sterna fuscata*
78. Whiskered Tern *Chlidonias hybridus*
79. White-winged Black Tern *Chlidonias leucopterus*
80. Blue Rock Pigeon *Columba livia*
81. Nilgiri Wood-Pigeon *Columba elphinstonii* *
82. Oriental Turtle-Dove *Streptopelia orientalis*
83. Spotted Dove *Streptopelia chinensis*
84. Laughing Dove *Spilopelia senegalensis*
85. Emerald Dove *Chalcophaps indica*
86. Orange-breasted Green-Pigeon *Treron bicincta*
87. Pompadour Green-Pigeon *Treron pompadora*
88. Yellow-footed Green Pigeon *Treron phoenicopterus*
89. Green Imperial-Pigeon *Ducula aenea*
90. Mountain Imperial-Pigeon *Ducula badia*
91. Indian Hanging-Parrot (Vernal Hanging Parakeet) *Loriculus vernalis*
92. Rose-ringed Parakeet *Psittacula krameri*
93. Plum-headed Parakeet *Psittacula cyanocephala*
94. Blue-winged (Malabar) Parakeet *Psittacula columboides* *
95. Pied Crested Cuckoo *Clamator jacobinus*
96. Red-winged Crested (Chestnut-winged) Cuckoo *Clamator coromandus*
97. Large Hawk-Cuckoo *Hierococcyx sparverioides*
98. Brainfever Bird (Common Hawk Cuckoo) *Hierococcyx varius*
99. Indian Cuckoo *Cuculus micropterus*
100. Common Cuckoo *Cuculus canorus*
101. Banded Bay Cuckoo *Cacomantis sonneratii*
102. Indian Plaintive Cuckoo (Gray bellied cuckoo) *Cacomantis passerinus*
103. Drongo Cuckoo *Surniculus lugubris*
104. Asian Koel *Eudynamys scolopacea*
105. Small Green-billed Malkoha *Phaenicophaeus viridirostris*
106. Blue-faced Malkoha *Phaenicophaeus viridirostris*
107. Greater Coucal *Centropus sinensis*
108. Lesser Coucal *Centropus bengalensis*
109. Grass owl *Tyto longimembris*
110. Barn Owl *Tyto alba*
111. Oriental Bay-Owl *Phodilus badius*
112. Oriental Scops-Owl *Otus sunia*
113. Collared Scops-Owl *Otus bakkamoena*
114. Forest (Spot-bellied) Eagle-Owl *Bubo nipalensis*
115. Brown Fish-Owl *Ketupa zeylonensis*
116. Mottled Wood-Owl *Strix ocellata*
117. Jungle Owlet *Glaucidium radiatum*
118. Spotted owlet *Athene brahma*

119. Brown Hawk-Owl *Ninox scutulata*
120. Ceylon (Sri Lanka) Frogmouth *Batrachostomus moniliger*
121. Great Eared-Nightjar *Eurostopodus macrotis*
122. Indian Jungle (Grey) Nightjar *Caprimulgus indicus*
123. Jerdon's Nightjar *Caprimulgus atripennis*
124. Common Indian (Indian) Nightjar *Caprimulgus asiaticus*
125. Franklin's (Savanna) Nightjar *Caprimulgus affinis*
126. Indian Edible-nest (Edible-nest) Swiftlet *Collocalia unicolor*
127. White-rumped Needletail-Swift (Needletail) *Zoonavena sylvatica*
128. Brown-backed Needletail-Swift (Needletail) *Hirundapus giganteus*
129. Asian Palm-Swift *Cypsiurus balasiensis*
130. Alpine Swift *Tachymarptis melba*
131. House Swift (Little swift) *Apus affinis*
132. Crested Tree-Swift *Hemiprocne coronata*
133. Indian Swiftlet *Aerodramus unicolor*
134. White-rumped Spinetail *Zoonavena sylvatica*
135. Malabar Trogon *Harpactes fasciatus*
136. Small Blue (Common) Kingfisher *Alcedo hercules*
137. Blue-eared Kingfisher *Alcedo atthis*
138. Oriental Dwarf Kingfisher *Alcedo meninting*
139. Stork-billed Kingfisher *Ceyx erithaca*
140. White throated Kingfisher *Halcyon smyrnensis*
141. Black-capped Kingfisher *Halcyon pileata*
142. Lesser Pied (Pied) Kingfisher *Ceryle rudis*
143. Blue-bearded Bee-eater *Nyctyornis athertoni*
144. Small (Green) Bee-eater *Merops orientalis*
145. Blue-tailed Bee-eater *Merops philippinus*
146. Chestnut-headed Bee-eater *Merops leschenaulti*
147. Indian Roller *Coracias benghalensis*
148. European Roller *Coracias garrulus*
149. Oriental Broad-billed Roller (Dollarbird) *Eurystomus orientalis*
150. Common Hoopoe *Upupa epops*
151. Malabar Grey Hornbill *Ocyceros griseus* *
152. Malabar Pied Hornbill *Anthracoceros coronatus*
153. Great Pied Honbill *Buceros bicornis* NT
154. Brown-headed Barbet *Megalaima zeylanica*
155. White-cheeked Barbet *Megalaima viridis*
156. Crimson-throated Barbet *Megalaima rubricapilla*
157. Coppersmith Barbet *Megalaima haemacephala*
158. Eurasian Wryneck *Jynx torquilla*
159. Speckled Piculet *Picumnus innominatus*
160. Brown-capped Pygmy Woodpecker *Dendrocopos nanus*
161. Yellow-fronted Pied Woodpecker *Dendrocopos mahrattensis*
162. Rufous Woodpecker *Celeus brachyurus*
163. Great Black (White-bellied) Woodpecker *Dryocopus javensis*

164. Small (Lesser) Yellow-naped Woodpecker *Picus chlorolophus*
165. Little Scaly-bellied Green (Streak-thraoted) Woodpecker *Picus xanthopygaeus*
166. Common Golden-backed Woodpecker (Common Flameback) *Dinopium javanense*
167. Lesser Golden-backed Woodpecker (Black-rumped Flameback) *Dinopium benghalense*
168. Greater Golden-backed Woodpecker (Greater Flameback) *Chrysocolaptes lucidus*
169. Heart-spotted Woodpecker *Hemicircus canente*
170. Indian Pitta *Pitta brachyura*
171. Greater short toed lark *Calandrella brachydactyla*
172. Malabar crested lark *Galerida malabarica*
173. Eastern skylark *Alauda gulgula*
174. Dusky Crag-Martin *Hirundo concolor*
175. Eurasian Crag- Martin *Ptyonoprogne rupestris*
176. Common House Martin *Delichon urbicum*
177. Barn Swallow *Hirundo rustica*
178. Hill Swallow(House swallow) *Hirundo domicola*
179. Red-rumped Swallow *Hirundo daurica*
180. Streaked throated swallow *Hirundo flavicola*
181. Forest Wagtail *Dendronanthus indicus*
182. Large Pied (White-browed) Wagtail *Motacilla maderaspatensis*
183. Grey Wagtail *Motacilla cinerea*
184. Richard's Pipit *Anthus richardi*
185. Paddyfield Pipit *Anthus rufulus*
186. Blyth's Pipit *Anthus godlewskii*
187. Brown Rock (Long-billed) Pipit *Anthus similis*
188. Olive-backed Pipit *Anthus hodgsoni*
189. Nilgiri Pipit *Anthus nilghiriensis* * **VU**
190. Large Cuckoo-Shrike *Coracina macei*
191. Black-headed Cuckoo-Shrike *Coracina melanoptera*
192. Small Minivet *Pericrocotus cinnamomeus*
193. Scarlet Minivet *Pericrocotus flammeus*
194. Pied (Bar-headed) Flycatcher Shrike *Hemipus picatus*
195. Large Woodshrike *Tephrodornis gularis*
196. Common Woodshrike *Tephrodornis pondicerianus*
197. Grey-headed Bulbul *Pycnonotus priocephalus* * **NT**
198. Black-crested Bulbul(Ruby throated) *Pycnonotus melanicterus*
199. Red-whiskered Bulbul *Pycnonotus jocosus*
200. Red-vented Bulbul *Pycnonotus cafer*
201. Yellow- throated Bulbul *Pycnonotus xantholaemus* **VU**
202. White-browed Bulbul *Pycnonotus luteolus*
203. Yellow-browed Bulbul *Iole indica*
204. Black Bulbul *Hypsipetes leucocephalus*
205. Common Iora *Aegithina tiphia*
206. Jerdon's Chloropsis (Blue-winged Leafbird) *Chloropsis cochinchinensis*
207. Gold-fronted Chloropsis (Golden-fronted Leafbird *Chloropsis aurifrons*
208. Asian Fairy-Bluebird *Irena puella*

209. Brown Shrike *Lanius cristatus cristatus*
210. Philippine Shrike *Lanius cristatus lucionensis*
211. Bay-backed Shrike *Lanius vittatus*
212. Long-tailed Shrike(Rufous backed) *Lanius schach*
213. Blue-headed Rock-Thrush *Monticola saxatilis*
214. Blue Rock-Thrush *Monticola rufiventris*
215. Malabar Whistling-Thrush *Myiophonus horsfieldii*
216. White-throated Ground (Orange-headed) *Zoothera citrina cyanotus*
217. Scaly Thrush *Zoothera dauma*
218. Pied Thrush *Zoothera wardii*
219. Eurasian Blackbird *Turdus merula*
220. Bourdillon's Blackbird *Turdus simillimus bourdilloni*
221. Indian Blue Robin *Luscinia brunnea*
222. White-bellied Shortwing *Brachypteryx major* * **VU**
223. Oriental Magpie-Robin *Copsychus saularis*
224. White-rumped Shama *Copsychus malabaricus*
225. Indian Robin *Saxicoloides fulicatus*
226. Pied Bush Chat *Saxicola caprata*
227. Wynaad Laughingthrush *Garrulax delesserti* *
228. Kerala laughing Thrush *Trochalopteron fairbanki fairbanki* * **NT**
229. Spotted (Spot-throated) Babbler *Pellorneum ruficeps*
230. Indian Scimitar-Babbler *Pomatorhinus horsfieldii*
231. Black-headed (Dark-fronted) Babbler *Rhopocichla atriceps*
232. Indian Rufous (Rufous) Babbler *Turdoides subrufus* *
233. Jungle Babbler *Turdoides striatus*
234. White-headed (Yellow-billed) Babbler *Turdoides affinis*
235. Quaker Tit-Babbler (Brown-cheeked) *Alcippe poioicephala*
236. Rufous-bellied Babbler *Dumetia hyperythra*
237. Yellow-eyed Babbler *Chrysomma sinense*
238. Streaked Fantail-Warbler *Cisticola juncidis*
239. Franklin's (Grey-breasted) Prinia *Prinia hodgsonii*
240. Ashy Prinia *Prinia socialis*
241. Plain Prinia *Prinia inornata*
242. Jungle Prinia *Prinia sylvatica*
243. Pale Grasshopper Warbler *Locustella naevia*
244. Blyth's Reed-Warbler *Acrocephalus dumetorum*
245. Indian Great Reed-Warbler (Clamorous Reed Warbler) *Acrocephalus stentoreus*
246. Thick-billed Warbler *Acrocephalus aedon*
247. Common Tailorbird *Orthotomus sutorius*
248. Greenish Leaf-Warbler *Phylloscopus trochiloides*
259. Large-billed Leaf-Warbler *Phylloscopus magnirostris*
250. Western Crowned Warbler *Phylloscopus occipitalis*
251. Tickells Warbler *Phylloscopus affinis*
252. Common Chiffchaff *Phylloscopus tristis*
253. Orphean Warbler *Sylvia hortensis*

254. Broad-tailed Grassbird *Schoenicola platyurus* * VU
255. Tytlers Warbler *Phylloscopus tytleri* NT
256. Asian Brown Flycatcher *Muscicapa dauurica*
257. Rusty-tailed Flycatcher *Muscicapa ruficauda*
258. Brown-breasted Flycatcher *Muscicapa muttui*
259. Kashmir Flycatcher *Ficedula subrubra* VU
260. Black and Orange Flycatcher *Muscicapa nigrorufa* * NT
261. Verditer Flycatcher *Eumyias thalassina*
262. Nilgiri Flycatcher *Eumyias albicaudatus* * NT
263. Red Throated Flycatcher *Ficedula parva*
264. White-bellied Blue-Flycatcher *Cyornis pallipes* *
265. Blue-throated Flycatcher *Cyornis rubeculoides*
266. Tickell's Blue-Flycatcher *Cyornis tickelliae*
267. Asian Paradise-Flycatcher *Terpsiphone paradisi*
268. Black-naped Monarch-Flycatcher *Hypothymis azurea*
269. Grey-headed Canary-flycatcher *Culicicapa ceylonensis*
270. White browed Fantail Flycatcher *Rhipidura aureola*
271. Great Tit *Parus major*
272. Black-lored Yellow *Parus xanthogenys*
273. Velvet-fronted Nuthatch *Sitta frontalis*
274. Thick-billed Flowerpecker *Dicaeum agile*
275. Tickell's Flowerpecker *Dicaeum erythrorhynchos*
276. Plain Flowerpecker *Dicaeum concolor*
277. Purple-rumped Sunbird *Nectarinia zeylonica*
278. Small (Crimson-backed) Sunbird *Nectarinia minima* *
279. Purple Sunbird *Nectarinia asiatica*
280. Loten's Sunbird *Nectarinia lotenia*
281. Little Spiderhunter *Arachnothera longirostra*
282. Oriental White-eye *Zosterops palpebrosus*
283. Common Rosefinch *Carpodacus erythrinus*
284. White-rumped Munia *Lonchura striata*
285. Black-throated Munia *Lonchura kelaarti*
286. Spotted (Scaly-breasted) Munia *Lonchura punctulata*
287. House Sparrow *Passer domesticus*
288. Yellow-throated Sparrow *Petronia xanthocollis*
289. Baya Weaver *Ploceus philippinus*
290. Grey-headed (Chestnut-tailed) Starling *Sturnus malabaricus malabaricus*
291. Blyth's Starling *Sturnus malabaricus blythi*
292. Brahminy Starling *Starling Sturnus pagodarum*
293. Rosy Starling *Sturnus roseus*
294. Common Myna *Acridotheres tristis*
295. Jungle Myna *Acridotheres fuscus*
296. Southern Hill-Myna *Gracula indica*
297. Eurasian Golden Oriole *Oriolus oriolus*
298. Black-naped Oriole *Oriolus chinensis*

299. Black-headed (Black-hooded) Oriole *Oriolus xanthornus*
300. Black Drongo *Dicrurus macrocercus*
301. Ashy Drongo *Dicrurus leucophaeus*
302. White -bellied Drongo *Dicrurus caerulescens*
303. Bronzed Drongo *Dicrurus aeneus*
304. Spangled Drongo *Dicrurus hottentottus*
305. Greater Racket-tailed Drongo *Dicrurus paradiseus*
306. Ashy Woodswallow *Artamus fuscus*
307. Indian (Rufous) Treepie *Dendrocitta vagabunda*
308. White-bellied Treepie *Dendrocitta leucogastra* *
309. House Crow *Corvus splendens*
310. Jungle (Large-billed) Crow *Corvus macrorhynchos*

Butterflies:

(A total 265 species of which 22 are Western Ghats Endemics)

FAMILY PAPILIONIDAE

1. *Troides minos* Cramer, 1779 Southern Birdwing **ENDEMIC**
2. *Pachliopta pandiyana* Moore,1881 Malabar Rose **ENDEMIC**
3. *Pachliopta aristolochiae* Fabricius, 1775 Common Rose
4. *Pachliopta hector* Linnaeus, 1758 Crimson Rose
5. *Graphium sarpedon* Linnaeus, 1758 Common Bluebottle
6. *Graphium doson* C. & R. Felder, 1864 Common Jay
7. *Graphium agamemnon* Linnaeus, 1758 Tailed Jay
8. *Graphium nomius* Esper,1785 Spot Swordtail
9. *Graphium antiphates* Cramer,1775 Five-bar Swordtail
10. *Papilio clytia* Linnaeus, 1758 Common Mime
11. *Papilio demoleus* Linnaeus, 1758 Lime Butterfly
12. *Papilio liomedon* Moore, 1875 Malabar Banded Swallowtail **ENDEMIC**
13. *Papilio dravidarum* Wood-Mason,1880 Malabar Raven **ENDEMIC**
14. *Papilio helenus* Linnaeus, 1758 Red Helen
15. *Papilio polytes* Linnaeus, 1758 Common Mormon
16. *Papilio polymnestor* Cramer, 1775 Blue Mormon
17. *Papilio paris* Linnaeus, 1758 Paris Peacock
18. *Papilio buddha* Westwood,1872 Malabar Banded Peacock **ENDEMIC**
19. *Papilio crino* Fabricius, 1793 Common Banded Peacock

FAMILY PIERIDAE

20. *Catopsilia pomona* Fabricius, 1775 Common Emigrant
21. *Catopsilia pyranthe* Linnaeus, 1758 Mottled Emigrant
22. *Eurema brigitta* Stoll, 1780 Small Grass Yellow
23. *Eurema laeta* Boisduval, 1836 Spotless Grass Yellow

24. *Eurema hecabe* Linnaeus, 1758 Common Grass Yellow
25. *Eurema blanda* Boisduval, 1836 Three-spot Grass Yellow
26. *Eurema andersonii* Moore, 1886 One-spot Grass Yellow
27. *Colias nilagiriensis* C. & R. Felder, 1859 Nilgiri Clouded Yellow **ENDEMIC**
28. *Delias eucharis* Drury , 1773 Common Jezebel
29. *Leptosia nina* Fabricius,1793 Psyche
30. *Prioneris sita* C. & R. Felder, 1865 Painted Sawtooth
31. *Pieris canidia* Sparrman,1767 Indian Cabbage White
32. *Cepora nerissa* Fabricius, 1795 Common Gull
33. *Cepora nadina* Lucas, 1852 Lesser Gull
34. *Anaphaeis aurota* Fabricius,1793 Pioneer
35. *Appias indra* Moore,1858 Plain Puffin
36. *Appias libythea* Fabricius. 1775 Striped Albatross
37. *Appias lyncida* Cramer, 1779 Chocolate Albatross
38. *Appias albina* Boisduval, 1836 Common Albatross
39. *Appias wardi* Moore,1884 Lesser Albatross **ENDEMIC**
40. *Colotis amata* Fabricius, 1775 Small Salmon Arab
41. *Colotis etrida* Boisduval, 1836 Small Orange Tip
42. *Colotis aurora* Cramer,1780 Plain Orange Tip
43. *Colotis danae* Fabricius, 1775 Crimson Tip
44. *Colotis fausta* Olivier, 1804 Large Salmon Arab
45. *Ixias marianne* Cramer, 1779 White Orange Tip
46. *Ixias pyrene* Linnaeus, 1764 Yellow Orange Tip
47. *Pareronia valeria* Cramer,1776 Common Wanderer
48. *Pareronia ceylanica* C. & R. Felder, 1865 Dark Wanderer
49. *Hebemoia glaucippe* Linnaeus,1758 Great Orange Tip

FAMILY NYMPHALIDAE (Morphinae)

50. *Discophora lepida* Moore, 1858. Southern Duffer

FAMILY NYMPHALIDAE (Satyrinae)

51. *Parantirrhoea marshalli* Wood-Mason,1881 Travancore Evening Brown **ENDEMIC**
52. *Melanitis leda* Linnaeus, 1758 Common Evening Brown
53. *Melanitis zitenius* Herbst, 1796 Great Evening Brown
54. *Melanitis phedima* Stoll, 1780 Dark Evening Brown
55. *Elymnias hypermnestra* Linnaeus, 1763 Common Palmfly
56. *Lethe europa* Fabricius, 1775 Bamboo Tree Brown
57. *Lethe drypetis* Hewitson,1863 Tamil Tree Brown
58. *Lethe rohria* Fabricius, 1787 Common Tree Brown
59. *Mycalesis anaxias* Hewitson, 1862 White-bar Bushbrown
60. *Mycalesis perseus* Fabricius, 1775 Common Bushbrown
61. *Mycalesis mineus* Linnaeus,1767 Dark-brand Bushbrown
62. *Mycalesis subdita* Moore, Tamil Bushbrown
63. *Mycalesis visala* Moore,1858 Long-brand Bushbrown
64. *Mycalesis patnia* Moore, 1857 Glad-eye Bushbrown
65. *Mycalesis oculus* Marshall, 1881 Red-disk Bushbrown **ENDEMIC**
66. *Mycalesis davisoni* Moore, (1880) Lepcha Bushbrown

67. *Orsotriaena medus* Fabricius,1775 Nigger
68. *Zipaetis saitis* Hewitson, 1863 Tamil Catseye **ENDEMIC**
69. *Ypthima ceylonica* Hewitson,186.5 Ceylon Four-ring
70. *Ypthima huebneri* Kirby,1871 Common Four-ring
71. *Ypthima baldus* Fabricius, 1775 Common Five-ring
72. *Ypthima ypthimoides* Moore,1881 Palni Four ring **ENDEMIC**

FAMILY NYMPHALIDAE (Charaxinae)

73. *Polyura athamas* Drury,1773 Common Nawab
74. *Polyura agraria* Swinhoe, 1887 Anomalous Common Nawab
75. *Polyura schreiber* Godart, 1824 Blue Nawab
76. *Charaxes bernardus* Fabricius, 1793 Tawny Rajah
77. *Charaxes solon* Fabricius, 1793 Black Rajah

FAMILY NYMPHALIDAE (Acraeinae)

78.*Acraea violae* Fabricius, 1793 Tawny Coster

FAMILY NYMPHALIDAE (Heliconiinae)

79. *Cethosia nietneri* C. & R. Felder, 1867 Tamil Lacewing
80. *Vindula erota* Fabricius, 1793 Cruiser
81. *Cupha erymanthis* Drury, 1773 Rustic
82. *Phalanta phalantha* Drury,1773 Common Leopard
83. *Cirrochroa thais* Fabricius, 1787 Tamil Yeoman
84. *Argyreus hyperbius* Linnaeus, 1763 Indian Fritillary
85. *Cirrochroa thais* Fabricius, 1787 Tamil Yeoman

FAMILY NYMPHALIDAE (Apaturinae)

86. *Rohana parisatis* Westwood,1850 Black Prince
87. *Euripus consimilis* Westwood,1850 Painted Courtesan

FAMILY NYMPHALIDAE (Limenitinae)

88. *Neptis jumbah* Moore,1858 Chestnut-streaked Sailer
89. *Neptis hylas* Linnaeus,1758 Common Sailer
90. *Neptis clinia* Moore, 1872 (Clear Sailer)
91. *Neptis soma* Moore,1858 Sullied Sailer
92. *Neptis viraja* Moore,1872 Yellowjack Sailer
93. *Pantoporia hordonia* Stoll, 1790 Common Lascar
94. *Neptis columella* Cramer,1780 Short-handed Sailer
95. *Athyma nefte* Cramer,1776. Colour Sergeant
96. *Athyma selenophora* Kollar,1844 Staff Sergeant
97. *Athyma ranga* Moore,1858 Blackvein Sergeant
98. *Athyma perius* Linnaeus,1758 Common Sergeant
99. *Limenitis procris* Cramer,1777 Commander
100. *Parthenos sylvia* Cramer, 1775 Clipper
101. *Tanaecia lepidea* Butler, 1868 Grey Count
102. *Euthalia aconthea* Cramer,1777 Common Baron
103. *Euthalia lubentina* Cramer, 1777 Gaudy Baron
104. *Dophla evelina* Stoll, 1790 Red-spot Duke
105. *Ariadne ariadne* Linnaeus, i 763 Angled Castor
106. *Ariadne merione* Cramer,1777 Common Castor

107. *Cyrestis thyodamas* Boisduval, 1846 Map Butterfly
108. *Libythea myrrha* Godart,1819 Club Beak
109. *Libythea lepita* Moore,1857 Common Beak

FAMILY NYMPHALIDAE (Nymphalinae)

110. *Junonia hierta* Fabricius 1798 Yellow Pansy
111. *Junonia orithya* Linnaeus, 1758 Blue Pansy
112. *Junonia lemonias* Linnaeus, 1758 Lemon Pansy
113. *Junonia almana* Linnaeus, 1758 Peacock Pansy
114. *Junonia atlites* Linnaeus, 1763 Grey Pansy
115. *Junonia iphita* Cramer,1779 Chocolate Pansy
116. *Cynthia cardui* Linnaeus, 1758 Painted Lady
117. *Vanessa indica* Herbst, 1794 Indian Red Admiral
118. *Kaniska canace* Linnaeus,1763 Blue Admiral
119. *Hypolimnas misippus* Linnaeus, 1764 Danaid Eggfly
120. *Hypolimnas bolina* Linnaeus, 1758 Great Eggfly
121. *Kallima horsfiedi* Kollar, 1844 South Indian Blue Oakleaf **ENDEMIC**

FAMILY DANAIDAE

122. *Parantica aglea* Stoll, 1782 Glassy Blue Tiger
123. *Parantica nilgiriensis* Moore,1877 Nilgiri Tiger **ENDEMIC**
124. *Tirumala limniace* Cramer, 1775 Blue Tiger
125. *Tirumala septentrionis* Butler, 1874 Dark Blue Tiger
126. *Danaus chrysippus* Linnaeus, 1758 Plain Tiger
127. *Danaus genutia* Cramer, 1779 Striped Tiger (Common Tiger)
128. *Euploea core* Stoll, 1780 Common Crow (Common Indian Crow)
129. *Euploea sylvester* Fabricius, 1793 Double-branded Crow
130. *Euploea klugii* Moore,1858 Brown King Crow
131. *Idea malabarica* Moore, 1877 Malabar Tree Nymph **ENDEMIC**

FAMILY RIODINIDAE

132. *Abisera echerius* Stoll, 1790 Plum Judy

FAMILY LYCAENIDAE

133. *Spalgis epius* Westwood,1851 Apefly
134. *Castalius rosimon* Fabricius, 1775 Common Pierrot
135. *Caleta caleta* Hewitson, 1876 Angled Pierrot
136. *Discolampa ethion* Westwood,1851 Banded Blue Pierrot
137. *Tarucus ananda* de Niceville, 1884 Dark Pierrot
138. *Tarucus nara* Kollar, 1844 Striped Pierrot
139. *Leptotes plinius* Fabricius, 1793 Zebra Blue
140. *Azanus ubaldus* Stoll, 1782 Bright Bulbul Blue
141. *Azanus jesous* Guerin-Meneville, 1847 African Bulbul Blue
142. *Everes lacturnus* Godart, 1824 Indian Cupid
143. *Udara akasa* Horsfield,1828 White Hedge Blue
144. *Acytolepis puspa* Horsfield, 1828 Common Hedge Blue
145. *Acytolepis lilacea* Hampson, 1889 Hampson's Hedge Blue
146. *Celatoxia albidisca* Mooe, 1884 White-disk Hedge Blue **ENDEMIC**
147. *Celastrina lavendularis* Moore, 1877 Plain Hedge Blue

148. *Neopithecops zalmora* Butler,1870 Quaker
149. *Megisba malaya* Horsfield,1828 Malayan
150. *Pseudozizeeria maha* Kollar,1844 Pale Grass Blue
151. *Zizeeria karsandra* Moore, 1865 Dark Grass Blue
152. *Zizina otis* Fabricius, 1787 Lesser Grass Blue
153. *Zizula hylax* Fabricius, 1775 Tiny Grass Blue
154. *Chilades laius* Stoll, 1780 Lime Blue
155. *Chilades parrhasius* Fabricius, 1793 Small Cupid
156. *Chilades pandava* Horsfield, 1829 Plains Cupid
157. *Freyeria putli* Kollar, 1.844 Grass Jewel
158. *Euchrysops cnejus* Fabricius, 1798 Gram Blue
159. *Catochrysops strabo* Fabricius,1793 Forget-me-not
160. *Lampides boeticus* Linnaeus,1767 Pea Blue
161. *Jamides bochus* Stoll,1782 Dark Cerulean
162. *Jamides celeno* Cramer, 1775 Common Cerulean
163. *Jamides alecto* C.Felder, 1860 Metallic Cerulean
164. *Nacaduba pactolus* C. Felder, 1860 Large Four-line Blue
165. *Nacaduba hermus* C. Felder, 1860 Pale Four-line Blue
166. *Nacaduba kurava* Moore,1858 Transparent Six-1ine Blue
167. *Nacaduba beroe* C. & R. Felder, 1860 Opaque Six-line Blue
168. *Ionolyce helicon* C. Felder, 1860 Pointed Line-blue
169. *Prosotas nora* C. Felder, 1860 Common Line-blue
170. *Prosotas dubiosa* Semper,1879 Tailless Line-blue
171. *Petrelaea dana* de Niceville, 1884 Dingy Line-blue
172. *Talicada nyseus* Guerin-Meneville, 1843 Red Pierrot
173. *Anthene emolus* Godart, 1824 Ciliate Blue
174. *Anthene lycaenina* R. Felder, 1868 Pointed Ciliate Blue
175. *Arhopala pseudocentaurus* Doubleday, 1847 Western Centaur Oakblue
176. *Arhopala amantes* Hewitson, 1862 Large Oakblue
177. *Arhopala bazaloides* Hewitson,1878 Tamil Oakblue
178. *Arhopala abseus* Hewitson, 1862 Aberrant Oakblue
179. *Thaduka multicaudata* Moore,1879 Many-tailed Oakblue
180. *Surendra quercetorum* Moore,1858 Common Acacia Blue
181. *Zinaspa todara* Moore, 1884 Silver-streaked Acacia Blue
182. *Iraota timoleon* Stoll,1783 Silver-streak Blue
183. *Amblypodia anita* Hewitson, 1862 Leaf Blue
184. *Spindasis vulcanus* Fabricius,1775 Common Silverline
185. *Spindasis ictis* Hewitson, 1865 Shot Silverline
186. *Spindasis lohita* Horsfield, 1829 Long-banded Silverline
187. *Loxura atymnus* Stoll,1780 Yamfly
188. *Catapaecilma major* H.H. Druce, 1895 Common Tinsel
189. *Cheritra freja* Fabricius, 1793 Common Imperial
190. *Rathinda amor* Fabricius, 1775 Monkey Puzzle
191. *Zesius chrysomallus* Hiibner,1823 Red Spot
192. *Tajuria cippus* Fabricius, 1798 Peacock Royal

193. *Tajuria jehana* Moore,1884 Plains blue Royal
194. *Hypolycaena nilgirica* Moore, 1884 Nilgiri Tit
195. *Hypolycaena othona* Hewitson, 1865 Orchid Tit
196. *Zeltus amasa* Hewitson, 1865 Fluffy Tit
197. *Deudorix epijarbas* Moore,1858 Comelian
198. *Deudorix isocrates* Fabricius, 1793 Common Guava Blue
199. *Bindahara phocides* Fabricius, 1793 The Plane
200. *Rapala iarbus* Fabricius, 1787 Indian Red Flash
201. *Rapala lankana* Moore,1879 Malabar Flash
202. *Rapala manea* Hewitson, 1863 Slate Flash
203. *Rapala varuna* Horsfield,1829 Indigo Flash
204. *Curetis thetis* Drury, 1773 Indian Sunbeam
205. *Curetis siva* Evans, 1954 Shiva Sunbeam **ENDEMIC**

FAMILY HESPERIIDAE

206. *Bibagig jaina* Moore,1866 Orange Awlet
207. *Bibagig gomata* Moore,1866 Pale Green Awlet
208. *Bibagig gena* Moore, 1866 Orange-tail Awl
209. *Hagora chromug* Cramer, 1780 Common Banded Awl
210. *Hagora taminatug* Hubner, 1818 White Banded Awl
211. *Hagora badra* Moore, 1858 Common Awl
212. *Badamia exclamationig* Fabriciug,1775 Brown Awl
213. *Choagpeg benjaminii* Guerin-Meneville, 1843 India Awlking
214. *Celaenorrhinug leucocera* Kollar , 1844 Common Spotted Flat
215. *Celaenorrhinus ambareega* Moore,1866 Malabar Spotted Flat
216. *Celaenorrhinug ruficornis* Mabille, 1879 Tamil Spotted Flat
217. *Tagiadeg japetug* Stoll, 1781 Common Snow Flat
218. *Tagiades gana* Moore,1866 Immaculate Snow Flat (Suffused Snow Flat)
219. *Tagiades litigiosa* MOschler, 1878 Water Snow Flat
220. *Gerosis bhagava* Moore, 1866 Common Yellow-breasted Flat
221. *Pseudocoladenia dan* Fabricius, 1787 Fulvous Pied Flat
222. *Coladenia indrani* Moore, 1866 Tricolour Flat
223. *Sarangesa dasahara* Moore, 1866 Common Small Flat
224. *Odontoptilum angulatum* C. Felder, 1862 Banded Angle (Chestnut Angle)
225. *Odontoptilum ransonnetii* R. Felder, 1868 Golden Angle
226. *Gomalia elma* Trimen, 1862 African Marbled Skipper
227. *Spialia galba* Fabricius, 1793 Indian Grizzled Skipper (Indian Skipper)
228. *Aeromachus pygmaeus* Fabricius, 1775 Pygmy Grass Hopper **ENDEMIC**
229. *Aeromachus dubius* Elwes & Edwards,1897 Dingy Scrub Hopper
230. *Ampittia dioscorides* Fabricius, 1793 Bush Hopper
231. *Halpe homolea* Hewitson,J868 Indian Ace.
232. *Halpe porus* Mabille,1877 Moore's Ace
233. *Sovia hyrtacus* de Niceville, 1897 Bicolour Ace **ENDEMIC**
234. *Thoressa honorei* de Niceville,1887 Madras Ace **ENDEMIC**
235. *Thoressa sitala* de Nicevil1e, 1885 Sitala Ace **ENDEMIC**
236. *Thoressa evershedi* Evans, 1910 Evershed's Ace **ENDEMIC**

237. *Iambrix salsala* Moore,1866 Chestnut Bob
238. *Psolos fuligo* Mabille,1876 Coon
239. *Notocrypta paralysos* Wood-Mason & de Niceville,1881 Common Banded Demon
240. *Notocrypta curvifascia* C. & R. Felder, 1862 Restricted Demon
241. *Udaspes folus* Cramer, 1775 Grass Demon
242. *Suastus gremius* Fabricius, 1798 Indian Palm Bob
243. *Cupitha purreea* Moore,1877 Wax Dart
244. *Baracus vittatus* C. Felder, 1862 Hedge Hopper
245. *Hyarotis adrastus* Stoll, 1780 Tree Flitter
246. *Quedara basiflava* de Niceville,1889 Yellow-base Tree Flitter
247. *Gangara thyrsis* Fabricius, 1775 Giant Red-eye
248. *Matapa aria* Moore, 1866 Common Red-eye
249. *Taractrocera maevius* Fabricius, 1793 Common Grass Dart
250. *Taractrocera ceramas* Hewitson, 1868 Tamil Grass Dart
251. *Oriens concinna* E1wes & Edwards,1897 Tamil Dartlet **ENDEMIC**
252. *Potanthus pava* Fruhstorfer,1911 Pava Dart
253. *Potanthus palnia* Evans,1914 Palni Dart
254. *Telicota colon* Fabricius,1775 Pale Palm Dart
255. *Telicota ancil la* Herrich-Schaffer, 1869 Dark Palm Dart
256. *Parnara bada* Moore, 1878 African Straight Swift
257. *Borbo bevani* Moore,18 Bevan's Swift
258. *Borbo cinnara* Wallace, 1866 Rice Swift
259. *Pelopidas subochracea* Moore, 1878 Large Branded Swift
260. *Pelopidas mathias* F abricius, 1798 Small Branded Swift
261. *Pelopidas conjuncta* Herrich-Schaffer,1869 Conjoined Swift
262. *Polytremis lubricans* Herrich-SchAffer, 1869 Contiguous Swift
263. *Baoris farri* Moore,1878 Paintbrush Swift
264. *Caltoris kumara* Moore,1878 Blank Swift
265.*Caltoris philippina* Herrich-Schaffer, 1869 Philippine Swift

Fishes:

Of the 72 species reported, one is Critically Endangered, 8 are Endangered, 6 are Vulnerable, 4 are Near Threatened

1. *Amblypharyngodon melettinus* (Valenciennes) LEAST CONCERN
2. *Anguilla bengalensis* (Gray) LEAST CONCERN
3. *Anguilla bicolor* McClelland LEAST CONCERN
4. *Aplocheilus lineatus* (Valenciennes) LEAST CONCERN
5. *Awaous gutum* (Hamilton) LEAST CONCERN
6. *Barbodes subnasutus* (Valenciennes) LEAST CONCERN
7. *Barilius bakeri* Day LEAST CONCERN

8. *Barilius gatensis* (Valenciennes)LEAST CONCERN
9. *Batasio travancoria* Hora and Law VULNERABLE
10. *Bhavania australis* (Jerdon) LEAST CONCERN
11. *Carinotetraodon travancoricus* (Hora & Nair) VULNERABLE
12. *Channa gachua* Hamilton LEAST CONCERN
13. *Channa marulius* (Hamilton) LEAST CONCERN
14. *Channa striata* (Bloch) LEAST CONCERN
15. *Clarias dussumieri* (Val) NEAR THREATENED
16. *Dayella malabarica* (Day) LEAST CONCERN
17. *Devario malabaricus* (Jerdon) LEAST CONCERN
18. *Etroplus maculatus* (Bloch) LEAST CONCERN
19. *Etroplus suratensis* (Bloch) LEAST CONCERN
20. *Garra hughi* Silas ENDANGERED
21. *Garra mullya* (Sykes) LEAST CONCERN
22. *Garra surendranathanii* Shaji, Arun & Easa ENDANGERED
23. *Glossogobius giuris* (Hamilton) LEAST CONCERN
24. *Glyptothorax annandalei* Hora LEAST CONCERN
25. *Glyptothorax madraspatanus* (Day) ENDANGERED
26. *Heteropneustes fossilis* (Bloch) LEAST CONCERN
27. *Homaloptera montana* Herre ENDANGERED
28. *Homaloptera santhamparensis* Arunachalam, *et al* NOT AVAILABLE
29. *Horabagrus brachysoma* (Guenther) VULNERABLE
30. *Hypselobarbus curmuca* (Hamilton) ENDANGERED
31. *Hypselobarbus kurali* Menon & Devi LEAST CONCERN
32. *Hypselobarbus thomassi* (Day) CRITICALLY ENDANGERED
33. *Oreonectes keralensis (Rita and Nalbant) VULNERABLE*
34. *Lepidocephalus thermalis (Valenciennes) LEAST CONCERN*
35. *Mastacembelus armatus* (Lacepede) LEAST CONCERN
36. *Megalops cyprinoids* (Broussonet) DATA DEFICIENT
37. *Mesonemacheilus guentheri* (Day) LEAST CONCERN
38. *Mesonemacheilus pambarensis* Devi and Indra NOT AVAILABLE
39. *Mesonemacheilus triangularis* (Day) LEAST CONCERN
40. *Mystus malabaricus* (Jerdon) NEAR THREATENED
41. *Mystus montanus* (Jerdon) LEAST CONCERN
42. *Mystus ocutatus* (Valenciennes) LEAST CONCERN
43. *Neotropius mitchelli* (Gunther) ENDANGERED
44. *Ompok bimaculatus* (Bloch) NEAR THREATENED
45. *Ompok malabaricus* (Valenciennes) LEAST CONCERN
46. *Osteobrama bakeri* (Day) LEAST CONCERN

47. *Osteochilichthys longidorsalis* Peth. & Kott ENDANGERED
48. *Parambassis dayi* (Bleeker) LEAST CONCERN
49. *Parambassis ranga* (Hamilton) LEAST CONCERN
50. *Parambassis thomassi* (Day) LEAST CONCERN
51. *Pristolepis marginata* (Jerdon) LEAST CONCERN
52. *Pristolepis rubripinnis* Kumar et.al. NOT AVAILABLE
53. *Pseudosphromenus dayi* (Cuvier)VULNERABLE
54. *Puntius assimilis* (Jerdon) VULNERABLE
55. *Puntius denisonii* (Day) LEAST CONCERN
56. *Puntius dorsalis* (Jerdon) LEAST CONCERN
57. *Puntius fasciatus* (Jerdon) LEAST CONCERN
58. *Puntius filamentosus* (Valenciennes) LEAST CONCERN
59. *Puntius mahecola* (Valenciennes) DATA DEFICIENT
60. *Puntius parrah* Day LEAST CONCERN
61. *Puntius punctatus* (Day) LEAST CONCERN
62. *Puntius vittatus* (Day) DATA DEFICIENT
63. *Rasbora dandia* (Valenciennes) LEAST CONCERN
64. *Salmophasia acinaces* (Valenciennes) LEAST CONCERN
65. *Salmophasia boopis* (Day) LEAST CONCERN
66. *Schistura denisoni* (Day) LEAST CONCERN
67. *Sicyopterus griseus* (Day) LEAST CONCERN
68. *Tor khudree* (Sykes) ENDANGERED
69. *Tor remadevi* Kurup and Radhakrishnan NOT AVAILABLE
70. *Travancoria jonesi* Hora ENDANGERED
71. *Wallago attu* (Bloch & Schneider) NEAR THREATENED
72. *Xenentodon cancila* (Hamilton) LEAST CONCERN

Mammals:

A total 79 species - 9 Endemic*, 8 Endangered, 13 Vulnerable, 6 Near Threatened

ORDER EULIPOTYPHLA

Family Erinaceidae

1. *Hemiechinus(Paraechinus)nudiventris* (Horsfield, 1851) Madras hedgehog VU

Family Soricidae

2. *Feroculus feroculus* (Kelaart, 1850) Kelaart's Long-clawed Shrew EN
3. *Suncus dayi* (Dodson, 1888) Day's shrew EN

4. *Suncus murinus* (Linnaeus, 1766) Grey musk shrew,Asian house shrew
5. *Suncus montanus* (Kelaart, 1850) Hill (mountain) shrew **VU**
6. *Suncus etruscus* (Savi, 1822) White-toothed (Etruscan)pygmy shrew

ORDER CHIROPTERA

Family Pteropodidae

7. *Rousettus leschenaulti* Desmarest, 1820 Fulvous fruit bat.
8. *Pteropus giganteus* (Brünnich, 1782) Indian flying fox
9. *Cynopterus brachyotis* (Müller, 1838) Lesser Short-nosed fruit bat Lesser dog-faced fruit bat
10. *Cynopterus sphinx* (Vahl, 1797) Greater short-nosed fruit bat or short-nosed Indian fruit bat

Family Rhinopomatidae

11. *Rhinopoma hardwickii* Gray, 1831 Lesser mouse-tailed bat

Family Emballonuridae

12. *Taphozous saccolamius* Temminck,1838 Pouch-bearing bat, Pouched tomb bat

Family Megadermatidae

13. *Megaderma lyra* É. Geoffroy, 1810 Greater false vampire
14. *Megaderma spasma* (Linnaeus, 1758) Lesser false vampire

Family Rhinolophidae

15. *Rhinolophus rouxii* Temminck, 1835 Rufous horseshoe bat
16. *Rhinolophus lepidus* Blyth,1844 Blyth's horseshoe bat
17. *Rhinolophus beddomei* Anderson, 1905 Lesser woolly horseshoe bat

Family Hipposideridae

18. *Hipposideros ater Templeton, 1848* Dusky leaf-nosed bat
19. *Hipposideros fulvus* Gray, 1838 Fulvous leaf-nosed bat, Fulvous round-leaf bat
20. *Hipposideros speoris* (Schneider, 1800) Schneider's leaf-nosed bat

Family Vespertilionidae

21. *Pipistrellus mimus* (*Pipistrellus tenuis mimus)*(Temminck, 1840) Evening bat, Indian pygmy bat
22. *Kerivoula picta (*Pallas, *1767)* Painted bat

ORDER PRIMATES

Family Lorisidae

23. *Loris lydekkerianus* Cabrera, 1908 Gray slender loris

Family Cercopithecidae

24. *Macaca radiata* (É. Geoffroy, 1812)Bonnet macaque
25. *Macaca silenus* (Linnaeus, 1758) Lion-tailed macaque * **EN**
26. *Semnopithecus priam* Blyth, 1844 Tufted gray langur **NT**
27. *Trachypithecus johnii* (J. Fischer, 1829) Nilgiri langur * **VU**

ORDER CARNIVORA

Family Canidae

28. *Canis aureus Linnaeus, 1758* Indian jackal
29. *Vulpes bengalensis* (Shaw, 1800) Bengal fox
30. *Cuon alpinus* (Pallas, 1811) Dhole or Asiatic wild dog **EN**

Family Ursidae

31. *Melursus ursinus* Shaw, 1791Sloth bear **VU**

Family Mustelidae

32. *Martes gwatkinsi* Horsfield, 1851 Nilgiri marten * **VU**
33. *Lutra lutra* (Linnaeus, 1758) Common otter **NT**

34. *Lutrogale perspicillata* (Geoffroy Saint Hilaire, 1826) Smooth coated otter **VU**
35. *Aonyx cinerea* (Illiger, 1815)Oriental small clawed otter, Asian small clawed otter **VU**

Family Viverridae

36. *Viverricula indica* Geoffroy Saint-Hilaire, 1803 Small Indian civet
37. *Paradoxurus hermaphroditus (Pallas, 1777)* Common palm civet
38. *Paradoxurus jerdoni* Blanford, 1885 Jerdon's (brown) palm civet *

Family Herpestidae

39. *Herpestes edwardsiiÉ. Geoffroy Saint-Hilaire, 1818*, Indian grey mongoose
40. *Herpestes fuscus* Waterhouse, 1838 Brown mongoose **VU**
41. *Herpestes smithii Gray, 1837* Ruddy mongoose
42. *Herpestes vitticollis Bennett, 1835* Stripe-necked mongoose

Family Felidae

43. *Prionailurus bengalensis (Kerr, 1792)* Leopard cat
44. *Felis chaus* Schreber, 1777 Jungle cat
45. *Prionailurus rubiginosus* Geoffroy Saint-Hilaire, 1831Rusty-spotted cat **VU**
46. *Panthera pardus* (Linnaeus, 1758) Leopard **NT**
47. *Panthera tigris* (Linnaeus, 1758)Tiger **EN**
48. *Prionailurus viverrinus* (Bennett, 1833) Fishing cat **EN**

ORDER PROBOSCIDEA

Family Elephantidae

49. *Elephas maximus* Linnaeus, 1758 Asian elephant **EN**

ORDER ARTIODACTYLA

Family Suidae

50. *Sus scrofa* Linnaeus, 1758 Wild boar

Family Tragulidae

51. *Moschiola indica (Gray, 1852)* Indian spotted chevrotain or mouse deer

Family Cervidae

52. *Muntiacus muntjak* Zimmermann, 1780 Barking deer
53. *Axis axis* (Erxleben, 1777) Chital
54. *Rusa unicolor* (Kerr, 1792) Sambar deer **VU**

Family Bovidae

55. *Bos gaurus* Smith, 1827 Gaur **VU**
56. *Hemitragus(Nilgiritragus) hylocrius (Ogilby, 1838)* Nilgiri tahr * **EN**

ORDER PHOLIDOTA

Family Manidae

57. *Manis crassicaudata* Gray, 1827 Indian pangolin **NT**

ORDER RODENTIA

Family Sciuridae

58. *Funambulus palmarum* (Linnaeus, 1766)Common palm squirrel
59. *Funambulus sublineatus* (Waterhouse, 1838) Dusky striped squirrel **VU**
60. *Funambulus tristriatus* (Waterhouse, 1837) Jungle striped squirrel *
61. *Ratufa indica (Erxleben, 1777)* Indian giant squirrel
62. *Ratufa macroura*(Pennant, 1769) Grizzled giant squirrel **NT**
63. *Petaurista philippensis* (Elliot, 1839)Indian giant flying squirrel
64. *Petinomys fuscocapillus* (Jerdon, 1847) Travancore flying squirrel **NT**

Family Muridae

65. *Platacanthomys lasiurus* Blyth,1859 Malabar spiny dormouse * **VU**
66. *Tatera indica* (Hardwicke, 1807)Indian gerbil
67. *Golunda ellioti* Gray, 1837 Indian bush rat
68. *Millardia meltada* Soft-furred field rat or
69. *Rattus rattus* (Linnaeus, 1758) Black rat
70. *Cremnomys blanfordi* (Thomas, 1881)White-tailed wood rat, Blanfords rat
71. *Mus booduga* (Gray, 1837) Indian field mouse
72. *Mus famulus* Bonhote, 1898 Bonhote's mouse * **EN**
73. *Mus musculus* Linnaeus, 1758 House mouse
74. *Mus platythrix Bennett,* 1832 Spiny field mouse, Flat haired mouse
75. *Vandeleuria oleracea* (Bennett, 1832) Indian long-tailed tree mouse
76. *Bandicota bengalensis* Gray, 1835 Lesser bandicoot rat
77. *Bandicota indica* (Bechstein, 1800) Large bandicoot rat
78. *Hystrix indica* Kerr, 1792 Indian porcupine

ORDER LAGOMORPHA

Family Hystricidae

79. *Lepus nigricollis* F. Cuvier, 1823 Blacknaped hare

Odonata (Dragon flies and damsel flies):

Of the 111species present 24 are Western Ghats endemics

Family Aeshnidae

1. *Anaciaeschna donaldi* Fraser, 1922
2. *Anaciaeschna jaspidea* (Burmeister, 1839)
3. *Anax guttatus* (Burmeister, 1839)
4. *Anax immaculifrons* Rambur, 1842
5. *Anax indicus* Lieftinck, 1942
6. *Gynacantha bayadera* Selys,1891
7. *Gynacantha dravida* Lieftinck,1960

Family Chlorogomphidae

Chlorogomphus xanthoptera (Fraser, 1919)*

Family Corduliidae

9. *Hemicordulia asiatica* Selys, 1878
10. *Idionyx minima* Fraser,1931*
11. *Idionyx periyashola* Fraser,1939*
12. *Idionyx saffronata* Fraser,1924*
13. *Idionyx travancorensis* Fraser, 1931*
14. *Macromidia donaldi* (Fraser,1924)*

Family Gomphidae

15. *Acrogomphus fraseri* Laidlaw,1925*
16. *Cyclogomphus heterostylus* Selys,1854*
17. *Gomphidia kodaguensis* Fraser,1923*
18. *Heliogomphus promelas* (Selys,1873)
19. *Ictinogomphus rapax* (Rambur, 1842)
20. *Macrogomphus annulatus* (Selys,1854)*
21. *Paragomphus lineatus* (Selys,1850)

Family Libellulidae

22. *Acisoma panorpoides* Rambur, 1842
23. *Aethriamanta brevipennis* (Rambur, 1842)
24. *Brachydiplax chalybea* Brauer, 1868
25. *Brachydiplax sobrina* (Rambur, 1842)
26. *Brachythemis contaminata* (Fabricius,1793)
27. *Bradinopyga geminata* (Rambur, 1842)
28. *Cratilla lineata* (Brauer, 1878)
29. *Crocothemis servilia* (Drury, 1770)
30. *Diplacodes trivialis* (Rambur,1842)
31. *Epithemis mariae* (Laidlaw,1915)*
32. *Hylaeothemis indica* Fraser,1946*
33. *Lathrecista asiatica* (Fabricius, 1798)
34. *Neurothemis fulvia* (Drury, 1773
35. *Neurothemis intermedia* (Rambur, 1842)
36. *Neurothemis tullia* (Drury, 1773)
37. *Onychothemis testacea* Laidlaw, 1902
38. *Orthetrum chrysis* (Selys, 1891)
39. *Orthetrum glaucum* (Brauer, 1865)
40. *Orthetrum luzonicum* (Brauer, 1868)
41. *Orthetrum pruinosum* (Burmeister,1839)
42. *Orthetrum sabina* (Drury, 1770)
43. *Orthetrum taeniolatum* (Schneider,1845)
44. *Orthetrum triangulare* (Selys, 1878)
45. *Palpopleura sexmaculata* (Fabricius, 1787)
46. *Pantala flavescens* (Fabricius, 1798)
47. *Potamarcha congener* (Rambur, 1842)
48. *Rhodothemis rufa* (Rambur, 1842)
49. *Rhyothemis triangularis* Kirby, 1889
50. *Rhyothemis variegata* (Linnaeus, 1763)
51. *Sympetrum fonscolombii* (Selys, 1840)
52. *Tetrathemis platyptera* Selys, 1878
53. *Tholymis tillarga* (Fabricius, 1798)
54. *Tramea basilaris* (Palisot de Beauvois, 1805)
55. *Tramea limbata* (Desjardins,1832
56. *Trithemis aurora* (Burmeister, 1839)
57. *Trithemis festiva* (Rambur, 1842)
58. *Trithemis pallidinervis* (Kirby, 1889)

59. *Urothemis signata* (Rambur, 1842)
60. *Urothemis signata* (Rambur, 1842)
61. *Urothemis signata* (Rambur, 1842)
62. *Zyxomma petiolatum* Rambur, 1842

Family Macromiidae

63. *Epophthalmia vittata* Burmeister,1839
64. *Macromia annaimalaiensis* Fraser,1931*

Family Calopterygidae

65. *Neurobasis chinensis* (Linnaeus, 1758)
66. *Vestalis apicalis* Selys, 1873
67. *Vestalis gracilis* (Rambur, 1842)
68. *Vestalis submontana* Fraser,1934*

Family Chlorocyphidae

69. *Calocypha laidlawi* (Fraser,1924)*
70. *Libellago lineata* (Burmeister, 1839)
71. *Rhinocypha bisignata* Hagen in Selys,1853

Family Coenagrionidae

72. *Aciagrion hisopa* (Selys, 1876)
73. *Agriocnemis femina* (Brauer, 1868)
74. *Agriocnemis keralensis* Peters,1981
75. *Agriocnemis pieris* Laidlaw,1919
76. *Agriocnemis pieris* Laidlaw,1919
77. *Agriocnemis splendidissima* Laidlaw,1919
78. *Archibasis oscillans* (Selys, 1877)
79. *Cercion dyeri* (Fraser,1920)
80. *Ceriagrion cerinorubellum* (Brauer, 1865
81. *Ceriagrion coromandelianum* (Fabricius, 1798)
82. *Ceriagrion olivaceum* Laidlaw, 1914
83. *Ceriagrion rubiae* Laidlaw, 1916
84. *Ischnura aurora* (Brauer, 1865)
85. *Ischnura senegalensis* (Rambur, 1842)
86. *Mortonagrion varralli* Fraser,1920
87. *Onychargia atrocyana* (Selys, 1865
88. *Paracercion calamorum* (Ris,1916)
89. *Pseudagrion decorum* (Rambur, 1842)
90. *Pseudagrion hypermelas* Selys,1876
91. *Pseudagrion indicum* Fraser, 1924
92. *Pseudagrion malabaricum* Fraser, 1924
93. *Pseudagrion microcephalum* (Rambur, 1842)
94. *Pseudagrion rubriceps* Selys, 1876

Family Euphaeidae

95. *Dysphaea ethela* Fraser, 1924
96. *Euphaea cardinalis* (Fraser,1924)*
97. *Euphaea fraseri* (Laidlaw,1920)*

Family Lestidae

98 *Indolestes gracilis* (Hagen in Selys, 1862)*
99. *Lestes elatus* Hagen in Selys,1862
100. *Lestes malabarica* Fraser,1929
101. *Lestes praemorsus* Hagen in Selys, 1862

Family Platycnemididae

102. *Copera marginipes* (Rambur, 1842)
103. *Copera vittata* Selys,1863

Family Platystictidae

104. *Platysticta deccanensis* Laidlaw,1915*
105. *Protosticta davenporti* Fraser,1931*
106. *Protosticta gravelyi* Laidlaw,1915*
107. *Protosticta sanguinostigma* Fraser,1922*

Family Protoneuridae

108. *Caconeura ramburi* (Fraser,1922)
109. *Caconeura risi* (Fraser,1931)*
110. *Esme mudiensis* Fraser,1931*
111. *Prodasineura verticalis* (Selys,1860)

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* Endemic to the Western Ghats.

Reptiles:

(Total 122 species, 42 Western Ghats Endemics*)

Family TESTUDINIDAE

1. *Melanochelys trijuga trijuga* (SCHWEIGGER, 1812)
2. *Vijayachelys sylvatica** (HENDERSON, 1912)
3. *Lessiemys punctata* ((Lacépède, 17888)
4. *Indotestudo travancorica** (BOULENGER, 1907)
5. *Geochelone elegans* SCHOEPF, 1795

Family GEKKONIDAE

6. *Hemidactylus anamallensis* * (GUNTHER, 1875)
7. *Hemidactylus brookii* GRAY, 1845
8. *Hemidactylus frenatus* Schlegel, 1836
9. *Hemidactylus leschenaultii* DUMÉRIL & BIBRON, 1836
10. *Hemidactylus subtriedrus* JERDON, 1853
11. *Hemidactylus triedrus* (DAUDIN, 1802)
12. *Cnemaspis kandiana* (KELAART, 1852)
13. *Cnemaspis gracilis**(BEDDOME, 1870)
14. *Cnemaspis indica** (GRAY, 1845)
15. *Cnemaspis beddomei** (THEOBALD, 1876)
16. *Cnemaspis ornatus** (BEDDOME, 1870)
17. *Cnemaspis wayanaadensis** (BEDDOME, 1870)
18. *Cnemaspis jerdoni (*THEOBOLD *1868)*
19. *Hemiphyllodactylus aurantiacus** (BEDDOME, 1870)

Family AGAMIDAE

20. *Calotes calotes* (LINNAEUS, 1758)
21. *Calotes versicolor* (DAUDIN, 1802)
22. *Calotes ellioti** GUNTHER, 1864
23. *Calotes rouxii** DUMÉRIL & BIBRON, 1837
24. *Calotes nemoricola** JERDON, 1853
25. *Calotes grandisquamis** GUNTHER, 1875
26. *Salea anamallayana* (*BEDDOME, 1878)
27. *Draco dussumieri** DUMIL & BIBRON, 1837
28. *Psammophilus dorsalis* (GRAY, 1831)
29. *Psammophilus blanfordanus* (STOLICZKA, 1871)

Family SCINCIDAE

30. *Eutropis carinata* (SCHNEIDER, 1801)
31. *Eutropis macularia* (BLYTH, 1853)
32. *Eutropis beddomei* (JERDON, 1870)
33. *Eutropis bibronii* (GRAY, 1839)
34. *Lygosoma punctata* (GMELIN, 1799)
35. *Ristella beddomi** BOULENGER, 1887
36. *Ristella rurkii** GRAY, 1839
37. *Ristella guentheri** BOULENGER, 1887
38. Kaestlea laterimaculata* (BOULENGER, 1887)
39. Kaestlea palnica* (BOETTGER, 1892)
40. Kaestlea beddomei (BOULENGER, 1887)
41.Kaestlea travancorica* (BEDDOME, 1870)
42. Dasia subcaerulea* (BOULENGER, 1891)
43. Sphenomorphus dussumieri* (DUMÉRIL & BIBRON, 1839)

Family LACERTIDAE

44. Ophisops leschenaultii MILNE-EDWARDS, 1829

Family CHEMELEONIDAE

45. Chameleo zeylanicus LAURENTI, 1768

Family VARANIDAE
46. Varanus bengalensis (DAUDIN, 1802)
Family TYPHLOPIDAE
47. *Ramphotyphlops brahminus* (DAUDIN, 1803)
48. *Typhlops porrectus* (DAUDIN, 1803)
49. *Typhlops beddomei** BOULENGER, 1890
Family UROPELTIDAE
50. *Melanophidium punctatum* BEDDOME, 1871
51. *Platyplectrurus madurensis* BEDDOME, 1877
52. *Platyplectrurus trilineatus* (BEDDOME, 1867)
53. *Teretrurus sanguineus* (BEDDOME, 1867)
54. *Teretrurus rhodogastor* (WALL, 1921)
55. *Plectrurus perroteti* DUMÉRIL & BIBRON, 1854
56. *Uropeltis ellioti* (GRAY, 1858)
57. *Uropeltis nitida* (BEDDOME, 1878)
58. Uropeltis ocellata (BEDDOME, 1863)
59. *Uropeltis beddomii* (GÜNTHER, 1862)
60. *Uropeltis macrorhyncha* (BEDDOME, 1877)
61. *Uropeltis woodmasoni* (THEOBALD, 1876)
62. *Uropeltis ceylanica* CUVIER, 1829
63. *Uropeltis arcticeps* (GÜNTHER, 1875)
64. *Uropeltis rubromaculata* (BEDDOME, 1867)
65. *Uropeltis rubrolineatus* (GÜNTHER, 1875)
66. *Uropeltis myhendrae* (BEDDOME, 1886)
67. *Uropeltis broughami* (BEDDOME, 1878)
68. *Uropeltis maculata* (BEDDOME, 1878)
69. *Uropeltis petersi* (BEDDOME, 1878)
70. *Uropeltis liura* (GÜNTHER, 1875)
71. Uropeltis pulneyensis (BEDDOME, 1863)
72. Uropeltis smithi (GANS, 1966)
73. Rhinophis sanguineus BEDDOME, 1863
74. Rhinophis fergusonianus BOULENGER, 1896
75. Rhinophis travancoricus BOULENGER, 1892
Family BOIDAE
76. *Python molurus* (LINNAEUS, 1758)
77. *Gonglyophis conicus* (SCHNEIDER, 1801)
78. *Eryx johnii* (RUSSELL, 1801)
Family COLUBRIDAE
79. *Coelognathus helena* (DAUDIN, 1803)
80. *Ptyas mucosa* (LINNAEUS, 1758)
81. *Lycodon aulicus* (LINNAEUS, 1754)
82. *Lycodon travancoricus** (BEDDOME, 1870)
83. *Oligodon affinis** GÜNTHER, 1862
84. *Oligodon arnensis* (SHAW, 1802)
85. *Oligodon brevicauda** GÜNTHER, 1862

86. *Oligodon nikhili** WHITAKER & DATTATRI, 1982
87. *Oligodon taeneolatus* (JERDON, 1853)
88. *Oligodon travancoricus** BEDDOME, 1877
89. *Oligodon venustus** (JERDON, 1853)
90. *Sibynophis subpunctatus* (DUMÉRIL & BIBRON, 1854)
91. *Dendrelaphis tristis* (DAUDIN, 1803)
92. *Dendrelaphis grandoculis** (BOULENGER, 1890)
93. *Dendrelaphis ashoki* VOGEL & VAN ROOIJEN, 2011
94. *Chrysopelea ornata* (SHAW, 1802)
95. *Ahaetulla nasuta* (LACÉPÈDE, 1789)
96. *Ahaetulla pulverulenta* (DUMÉRIL & BIBRON, 1854)
97. *Ahaetulla dispar** GÜNTHER, 1864)
98. *Amphiema stolatum* (LINNAEUS, 1758)
99. *Amphiesma beddomei** (GÜNTHER, 1864)
100. *Amphiesma monticola** (JERDON, 1853)
101. *Macrophisthodon plumbicolor* (CANTOR, 1839)
102. *Atretium schistosum* (DAUDIN, 1803)
103. *Xenochrophis piscator* (SCHNEIDER, 1799)
*104. Xylophis perroteti**(DUMÉRIL & BIBRON, 1854)
105. *X. stenorhynchus** (GÜNTHER, 1875)
106. *Boiga trigonata* (SCHNEIDER, 1802)
107. *Boiga forsteni* (DUMÉRIL & BIBRON, 1854)
108. *Boiga ceylonensis* (GÜNTHER, 1858)
109. *Boiga dightoni** (BOULENGER, 1894)

Family ELAPIDAE

110. *Bungarus caerules* BOULENGER, 1890
111. *Calliophis melanurus* (SHAW, 1802)
112. *Calliophis nigrescens** (GÜNTHER, 1862)
113. *Calliophis bibroni** (JAN, 1858)
114. *Naja naja* (LINNAEUS, 1758)
115. *Ophiophagus hannah* (CANTOR, 1836)

Family VIPERIDAE

116. *Daboia russellii* (SHAW & NODDER, 1797)
117. *Echis carinatus* (SCHNEIDER,1801)

Sub family: CROTALINAE

118. *Hypnale hypnale* (MERREM, 1820)
119. *Trimeresurus macrolepis** BEDDOME, 1862
120. *Trimeresurus malabaricus** (JERDON, 1854)
121. *Trimeresurus strigatus** GRAY, 1842

Family CROCODYLIDAE

122. Crocodylus palustris LESSON 1831

Annexure 3.

Population Status of Key Species in the HRML

No	Species	Area	Method of estimation	Agency	Year	Number/density
1	Nilgiri tahr	Eravikulam(776), Chinnar(33), Munnar(135) and Malayattoor(0) Division	Bounded Count	KFD+WWF	2010	944
2	Grizzled giant squirrel	Chinnar Wildlife Sanctuary and Marayoor Division	Sampling – line transacts	KFD+Periyar Foundation	2010	5.6/km2 No. 195
3	Tiger	Landscape(including Anamalai Tiger Reserve,TN)	Sampling and camera trapping	MOEF (NTCA)	2011	34
4	Elephant	Landscape	Dung count method	KFD+Periyar Foundation	2012	0.6735/km2

Annexure 4

A Summary of Panchayats, Blocks, Taluks and Districts in HRML

Sl. No.	Name of the Panchayat	Name of the Taluk	Name of the Block	District	Priority Category
1.	Munnar	Devikulam	Devikulam	Idukki	High
2.	Devikulam	Devikulam	Devikulam	Idukki	High
3.	Kanthalloor	Devikulam	Devikulam	Idukki	High
4.	Vattavada	Devikulam	Devikulam	Idukki	High
5.	Edamalakudi	Devikulam	Devikulam	Idukki	High
6.	Mankulam	Devikulam	Devikulam	Idukki	High
7.	Marayoor	Devikulam	Devikulam	Idukki	High
8.	Chinnakkanal	Udumbanchola	Devikulam	Idukki	High
9.	Santhanpara	Udumbanchola	Devikulam	Idukki	High
10.	Baisonvally	Udumbanchola	Adimali	Idukki	
11.	Konnathady	Udumbanchola	Adimali	Idukki	
12.	Adimali	Devikulam	Adimali	Idukki	
13.	Pallivasal	Devikulam	Adimali	Idukki	
14.	Vellathuval	Devikulam	Adimali	Idukki	
15.	Nedumkandam	Udumbanchola	Nedumkandam	Idukki	
16.	Pampadumpara	Udumbanchola	Nedumkandam	Idukki	
17.	Rajakkad	Udumbanchola	Nedumkandam	Idukki	
18.	Rajakumari	Udumbanchola	Nedumkandam	Idukki	
19.	Senapathy	Udumbanchola	Nedumkandam	Idukki	
20.	Udumbanchola	Udumbanchola	Nedumkandam	Idukki	
21.	Karunapuram	Udumbanchola	Nedumkandam	Idukki	
22.	Kamakshi	Udumbanchola	Idukki	Idukki	
23.	Mariapuram	Udumbanchola	Idukki	Idukki	
24.	Vathikudy	Udumbanchola	Idukki	Idukki	

25.	Ayyappancoil	Udumbanchola	Kattappana	Idukki	
26.	Chakkupallam	Udumbanchola	Kattappanak	Idukki	
27.	Erattayar	Udumbanchola	Kattappana	Idukki	
28.	Kanchiyar	Udumbanchola	Kattappana	Idukki	
29.	Upputhara	Udumbanchola	Kattappana	Idukki	
30.	Kattappana	Udumbanchola	Kattappana	Idukki	
31.	Vandanmedu	Udumbanchola	Kattappana	Idukki	
32.	Kuttampuzha	Kothamangalam	Kothamangalam	Ernakulam	High
33.	Vengoor (Pongunchuvadu)	Kunnathunadu	Koovapady	Ernakulam	
34.	Athirapilly	Mukundapuram	Chalakudy	Thrissur	High

Annexure 5

Panchayat-wise Demographic Details of the HRM L

Sl No.	Panchayat	Number of households	Population	Sex ratio	Child Sex ratio (0-6 years)	% SC	% ST	% workers
1.	Marayoor	2730	11027	1005	976	30	27	51
2.	Kanthalloor	2723	10985	984	1099	26	20	56
3.	Vattavada	1292	5102	930	939	14	31	58
4.	Devikulam*	0	0	0	0	0	0	0
5.	Munnar	16249	68205	979	978	54	4	50
6.	Edamalakudi*	0	0	0	0	0	100	0
7.	Mankulam	2422	9607	953	960	9	16	44
8.	Adimali	8712	36314	981	910	10	16	41
9.	Pallivasal	4216	17554	966	943	23	0	47
10.	Vellathuval	6037	26309	998	997	6	1	41
11.	Konnathady	7222	31529	978	911	3	1	43
12.	Rajakkad	3481	14984	995	903	2	0	46
13.	Baisonvally	3202	14155	977	1017	7	4	49
14.	Chinnakanal	3095	12949	969	888	39	6	50
15.	Santhanpara	4405	17315	986	924	24	1	58
16.	Rajakumari	3975	16303	989	953	6	1	49
17.	Senapathy	3083	12818	980	1010	7	1	48
18.	Udumbanchola	4863	18325	981	1095	14	3	57
19.	Vathikudy	6401	28301	980	971	3	3	43
20.	Mariapuram	2864	12675	960	1005	4	0	45
21.	Kamakshy	4519	20021	984	987	4	0	44
22.	Erattayar	4247	19097	970	924	5	0	41
23.	Nedumkandam	9301	39165	1005	958	6	1	44
24.	Pampadumpara	5247	22548	1017	987	12	1	45
25.	Karunapuram	6057	26033	1010	934	7	0	41
26.	Vandanmedu	7033	28718	1003	949	14	2	52
27.	Kattappana	9000	39608	995	966	7	1	42
28.	Kanchiyar	5468	22878	1007	1027	6	5	43
29.	Ayyappancoil	3522	14668	1007	974	9	2	45
30.	Chakkupallam	4940	20380	996	1018	11	2	49
31.	Upputhara	7002	28953	1013	946	15	7	44
32.	Kuttampuzha	5991	25110	975	949	8	14	45

33.	Vengoor (Pongunchuvadu)	109	394	-	-	-	100	-
34.	Athirapilly (Adichilthotti, Kappayam, Vettivittakadu)	133	432	-	-	-	100	-
Total		159541	672462					

*Newly formed Panchayats, earlier under Munnar GP

Annexure 6

Decadal growth rate of population in the landscape (1981-91 and 1991-2001)

Panchayat	1981-1991	1991-2001
Adimaly	21.06	20.88
Ayaappancoil	-5.14	7.32
Bisonvalley	40.16	6.79
Chakkupallam	6.61	15.05
Chinnakanal	12.86	16.08
Devikulam*	---	--
Edamalakudy*	--	--
Erattayar	-0.20	2.52
Kamakshy	14.20	-1.98
Kanchiyar	-0.35	8.82
Kanthalloor	26.11	7.01
Karunapuram	-9.07	1.76
Kattappana	21.21	15.77
Konnathady	5.68	5.22
Mankulam*	--	--
Marayoor	37.59	14.98
Mariyapuram	28.04	0.28
Munnar	-0.62	-12.94
Nedumkandam	21.74	5.94
Pallivasal	12.28	5.84
Pampadumpara	30.30	16.78
Rajakkad	-12.07	7.91
Rajakumary	23.84	23.09
Santhanpara	20.20	24.67
Senapathy	14.10	5.82
Udumbanchola	37.24	16.73
Upputhara	13.09	20.49
Vandanmedu	14.06	7.84
Vathikudy	6.58	10.62
Vattavada	28.01	11.20
Vellathooval	9.02	3.33

* Earlier under Munnar.

Decadal variation in Population and Households in Idukki District (2001-2011)

Category	2001	2011	Growth
Population	1129221	1107453	-21768
Male	566682	551944	-14738
Female	562539	555509	-7030
Households	265344	276976	11632

Source: Census 2001 and provisional total 2011

Annexure 7

Area, Density of Population and Effective literacy rate in HRML (Idukki Dt:)

Name of panchayat	Area(sq.km)	Density of Population	Effective Literacy Rate (above 6 years)		
			Total	Male	Female
Admali Block	**522.64**	**241**	**89.37**	**92.69**	**86.02**
Adimali	307.28	118	84.98	88.93	81.01
Baisonvally	38.91	364	89.65	92.51	86.71
Konnathady	65.75	480	93.88	95.9	91.83
Pallivasal	61.12	287	87.23	92.68	81.62
Vellathuval	49.58	531	91.24	94.06	88.41
Devikulam Block	**940.73**	**144**	**76.13**	**83.93**	**68.15**
Chinnakanal	67.32	192	74.64	83.82	65.3
Kanthaloor	111.61	98	67.32	74.01	60.42
Mankulam	128.11	75	83.75	87.23	80.1
Marayoor	104.77	105	65.97	72.64	59.35
Munnar	384.2	178	80.18	88.23	71.95
Santhanpara	81.3	213	73.72	82.72	64.67
Vattavada	63.42	80	59.58	69.57	48.83
Devikulam*	-	-	-	-	-
Edamalakudi*	-	-	-	-	-
Idukki Block	**115.46**	**528**	**93.57**	**95.33**	**91.78**
Kamakshy	32.38	618	94.34	95.79	92.87

Mariapuram	32.18	394	94.4	95.62	93.12
Vathikudy	50.9	556	94.13	95.86	92.36
Kattappana Block	**372.38**	**468**	**89.51**	**92.66**	**86.37**
Ayyappancoil	42.08	349	89.51	93.19	85.86
Chakkupallam	40.71	501	86.61	90.1	83.1
Erattayar	32.37	590	95.16	96.62	93.66
Kanchiyar	64.65	354	91.34	93.42	89.27
Kattappana	52.77	751	91.8	93.72	89.88
Upputhara	71.62	404	89.98	93.77	86.28
Vandanmedu	68.18	421	82.75	88.33	77.23
Nedumkandam Block	**341.9**	**439**	**89.17**	**92.43**	**85.94**
Karunapuram	44.76	582	92.41	94.64	90.23
Nedumkandam	71.95	544	91.64	94.29	89.02
Pampadumpara	44.64	505	91.5	94.2	88.86
Rajakkad	31.03	483	94.74	96.69	92.79
Rajakumari	38.15	427	84.74	89.85	79.61
Senapathy	31.23	410	88.77	92.07	85.38
Udumbanchola	80.14	229	76.16	82.47	69.64
For all Panchayats	**2293.11**	**282**	**88.69**	**92.33**	**85.02**

Source: Census India 2001 * New Panchayats earlier under Munnar

Annexure 8

Panchayat wise Occupational Classification of main workers in the landscape

Panchayat	Cultivators	Agriculture Labours	Household industries	Others	Total
Marayoor	10.9	65.6	0.8	22.7	100.0
Kanthalloor	24.5	64.5	0.4	10.6	100.0
Vattavada	32.7	62.1	0.3	4.9	100.0
Munnar	2.6	0.7	0.6	96.1	100.0
Mankulam	34.3	31.5	1.6	32.6	100.0
Adimali	17.7	29.8	2.9	49.7	100.0
Pallivasal	16.5	26.0	0.9	56.6	100.0
Vellathuval	32.5	25.2	1.3	40.9	100.0
Konnathady	46.6	22.5	2.2	28.7	100.0
Rajakkad	47.9	20.9	1.1	30.1	100.0
Baisonvally	39.8	40.2	0.9	19.1	100.0
Chinnakanal	9.2	34.9	2.8	53.1	100.0
Santhanpara	14.2	62.4	1.0	22.4	100.0
Rajakumari	34.0	46.7	1.5	17.9	100.0
Senapathy	37.7	46.4	1.3	14.6	100.0
Udumbanchola	16.1	66.6	0.8	16.5	100.0
Vathikudy	45.0	25.5	1.5	28.0	100.0
Mariapuram	44.3	20.3	1.2	34.2	100.0
Kamakshy	42.8	18.5	1.2	37.5	100.0
Erattayar	52.7	19.2	3.1	25.0	100.0
Nedumkandam	31.7	32.1	1.5	34.7	100.0
Pampadumpara	34.1	36.3	1.3	28.3	100.0
Karunapuram	30.1	33.6	0.9	35.5	100.0
Vandanmedu	16.6	59.8	1.2	22.5	100.0
Kattappana	24.3	23.9	1.9	49.9	100.0
Kanchiyar	35.6	31.0	1.4	32.0	100.0
Ayyappancoil	17.9	35.0	0.7	46.4	100.0
Chakkupallam	22.9	48.0	1.7	27.4	100.0

Annexure 9

Spatial distribution of workers in the Landscape

Industrial workers	Agricultural workers	Cultivators
Chinnakanal	Baisonvalley	Rajakumary
Erattayar	Rajakumary	Senapathy
Adimaly	Senapathy	Kamakshy
Kanthalloor	Cakkupallam	Baisonvalley
Marayoor	Vandanmedu	Vathikudy
	Kanthalloor	Mariyapuram
	Vattavada	Rajakadu
	Marayoor	Konnathady
	Santhanpara	Erattayar
	Udumbanchola	

Source : District Urbanisation Report Idukki,P.19

Annexure 10

Panchayat wise work participation and sex ratio of workers in HRML

Panchayat	Male work participation rate %	Female work participation rate %	sex ratio of workers
Marayoor	59.7	43.0	723
Kanthalloor	62.4	49.8	785
Vattavada	63.9	50.9	740
Munnar	56.0	44.1	771
Mankulam	61.4	25.1	390
Adimali	57.1	24.2	416
Pallivasal	60.3	32.4	518
Vellathuval	59.7	21.7	364
Konnathady	60.9	24.3	390
Rajakkad	60.2	31.0	512
Baisonvally	62.7	35.0	545
Chinnakanal	54.6	46.0	816
Santhanpara	64.2	50.7	778
Rajakumari	62.8	35.9	566
Senapathy	61.9	33.4	529
Udumbanchola	67.4	47.0	685
Vathikudy	61.2	24.0	385
Mariapuram	62.3	27.1	417
Kamakshy	61.6	25.8	412
Erattayar	58.4	23.2	386
Nedumkandam	59.8	27.6	464
Pampadumpara	59.4	31.0	531
Karunapuram	58.3	23.4	406
Vandanmedu	61.5	42.5	693
Kattappana	58.8	25.4	430
Kanchiyar	61.0	25.4	420

Ayyappancoil	59.5	30.3	512
Chakkupallam	61.7	36.2	584
Upputhara	57.7	29.7	521
Kuttampuzha	59.8	30.8	502

Annexure 11

Distribution of Tribal Population in the HRM Landscape

Sl No	Grama Panchayat	Number of hamlets	Number of Families	Total Population
Idukki District				
Adimali-Block Panchayat		**36**	**2064**	**7956**
1.	Adimali	28	1805	6927
2.	Konnathadi	2	34	147
3.	Bisonvali	4	157	662
4.	Vellathooval	1	54	173
5.	Pallivasal	1	14	47
Devikulam-Block Panchayat		**99**	**3702**	**13628**
6.	Marayoor	23	982	3562
7.	Munnar	1	45	159
8.	Kanthalloor	18	770	2734
9.	Vattavada	5	219	882
10.	Shanthanpara	5	136	524
11.	Chinnakkanal	6	351	1284
12.	Mankulam	13	587	2184
13.	Devikulam	1	49	196
14.	Edamalakkudi	27	563	2103
Nedumkandam-Block Panchayat		**17**	**400**	**1403**
15.	Pampadumpara	1	34	109
16.	Senapathy	3	74	283
17.	Karunapuram	1	7	31
18.	Nedumkandam	3	40	129
19.	Udumbanchola	8	184	630
20.	Rajakumari	1	61	221

21.	Rajakad	0	0	0
Idukki- Block Panchayat		**10**	**191**	**695**
22.	Vathikkudi	7	173	620
23.	Kamakshi	2	10	39
24.	Mariyapuram	-	10	47
Kattappana-Block Panchayat		**31**	**1398**	**5223**
25.	Kattappana	4	70	272
26.	Upputhara	14	652	2452
27.	vandanmedu	4	138	508
28.	Kanchiyar	4	307	1178
29.	Irattayar	1	13	42
30.	Ayappankovil	3	95	349
31.	Chakkupallam	1	113	375
	Ernakulam-District			
Kothamangalam-Block Panchayat		**16**	**1100**	**4103**
32.	Kuttambuzha	16	1100	4103
Koovapady Block		**1**	**109**	**394**
33.	Vengoor	1	109	394
	Thrissur-District			
Chalakudy Block Panchayat		**3**	**133**	**432**
34.	Athirapilly	**3***	**133**	**432**
	GRAND TOTAL	**213**	**9029**	**33829**

Source: GOK (2011) Report of the Baseline Survey of Scheduled Tribes in Kerala

*These 3 settlements are originally under Kuttampuzha Panchayat of Ernakulam District and at present for Tribal Development Administration purpose there were added under Athirapilly panchayat of Thrissur District.

Annexure 12.

List of Policies and legislation relevant to the project

Legislation/ Policy	Brief Description	Relevance in the context of HRML
National legislations related to conservation and sustainable use of biodiversity and production activities		
Biological Diversity Act 2002 Biological Diversity Rules,2004	The Biological Diversity Act provides for the conservation(ex situ and in situ) of biological diversity, sustainable use of its components, and fair and equitable sharing of the benefits arising out of the use of biological resources and knowledge associated with it. More specifically, it provides for the designation of institutions as repositories of biological resources. For implementation, the Act mandates the creation of National Biodiversity Authority (NBA) and also the State Biodiversity Boards. At the LSG level, Biodiversity Management Committees(BMC) shall be constituted for the purpose of promoting conservation, sustainable use and documentation of biological diversity.	A
The Scheduled Tribes and other Forest Dwellers (Recognition of Forest Rights)	Popularly known as Forest Rights Act (FRA), this Act is a milestone in forest governance, administration and conservation. It recognizes and	A

act 2006. The Scheduled Tribes and other Forest Dwellers (Recognition of Forest Rights) Rules, 2007.	vests forest rights and occupation in forestland in forest dwelling Scheduled Tribes who have been residing for generations but whose rights could not be recorded. The Act seeks to set right the historical injustice towards tribes who are integral to the very survival and sustainability of forest ecosystem. Apart from recognising individual rights to hold and live in forestland and community rights for accessing resources from forests, the Act empowers the right holders to protect wildlife, forest, water sources and biodiversity and to ensure sustainability of forest resources by regulating access and preventing destructive practices. The Tribal Ministry is the nodal agency for implementation in which the Grama Sabha (tribal hamlet level body) of the LSG has a major role. The Act also provides for the declaration of Critical Wildlife Habitats which are required to be kept inviolate.	
Environment (Protection) Act, 1986 Environment (Protection) Rules,1986	The Environment (Protection) Act, 1986 authorizes the central government to protect and improve environmental quality, control and reduce pollution from all sources, and prohibit or restrict the setting and /or operation of any industrial facility on environmental grounds. Environment (Protection) Rules lay down provisions for prohibition/restriction on location of industries and carrying on certain operations or processes on the basis of considerations like the biological diversity of an area. These provisions enable the declaration of Ecologically Sensitive Areas(ESA) around PAs. Institutions for monitoring compliance can also be set up under the Act.	A
Environment Impact Assessment Notification, 2006	The objective of the notification and subsequent amendments is to protect and conserve the environment through regulation of the new developments taking place via ensuring environmental compliance causing least/ negligible adverse impacts on the environment. Projects like highways , airports and dams are covered under this notification and the landscape being studded with PAs have a large coverage under this notification.	A
Forest Conservation Act, 1980 (amended in 1988) Forest Conservation Rules,2003	The act deals with mainly to provide regulatory framework for the protection of the forest areas, resources, diversion of forestry land for non-forestry purposes such as industry and mining. The Act requires the state government in question to get approval from the central government before de-gazetting or de-notifying reserved forests, leasing reserved forest lands to private persons or corporations or clearing land for reforestation. Not only the reserved forests and PAs in the landscape but also the HVBAs under the custody of other agencies like Revenue Department and private companies are covered under this act as 'forest' lands.	A
Hazardous Wastes (Management and Handling) Rules, 2003	The objective of Hazardous Waste (Management and Handling) Rules is to control the generation, collection, treatment, import, storage, and handling of hazardous waste. Currently, the production sectors seldom handle any hazardous wastes hence low significance	C

The Air Prevention and control of pollution Act,1981	The Act provides for the prevention, control and abatement of air pollution for the preservation of quality of air.	C
Joint Forest Management Notifications	JFM was formerly launched on June 01 1990, as a government attempt to towards regenerating and sustainably using the forests providing guidelines for the involvement of village communities and voluntary agencies in the regeneration degradation of forests. Although the initial thrust was towards timber production, both communities and forest officials realized that non timber forest produces were far more sustainable and beneficial, provided that harvesting was done in a sustainable manner. The February 2000 guidelines for JFM thus shifted focus from timber to NTFP. These guidelines also extended JFM to standing or well stocked forests, with a motive to promote conservation. The village level institutions such EDC and VSS which will be constituted under this notification is involved in the project components both for capacitating and pilot implementing.	A
The Muncipal solid waste (management and handling) Rules,2000	Solid waste management as mandatory responsibility of local self governments. State government is responsible for coordinating and assisting implementation of the Rules.	A
The recycled plastic (manufacture and usage)Rules,2003	Restricting use of recycled carry bags and containers	B
The factories Act,1948	For health and safety and hazards related to factories	C
The Spices Board Act, 1986.	To provide for constitution of a Board for development of export of spices and for the control of cardamom industry including control of cultivation of cardamom. Cardamom is marketed through an auction process controlled by the Cardamom (Licensing and Marketing)Rules, 1987.	A
The Tea act, 1953	Control of cultivation and export of tea and formation of tea board	A
Water (Prevention and Control of Pollution) Act, 1974	The Water (Prevention and Control of Pollution) Act establishes an institutional structure for preventing and abating water pollution. It establishes standards for water quality and effluent. Polluting industries must seek permission to discharge waste into effluent bodies. The CPCB (Central Pollution Control Board) was constituted under this Act.	B
Wildlife Protection Act, 1972 (amended in 1983, 1986, 1991 and 2001)	The WPA is meant for the protection of wild plants and animals and regulates hunting, trade and collection of specific forest products. Rules of this Act, and subsequent amendments provide for the protection of birds and animals and for all matters that are connected to it whether it be their habitat or the waterhole or the forests that sustain them. The 2001 amendment of the act included several species of fish, corals, sea cucumber and sea shells in Schedule I and III. The said act is highly significant in the context of protection of wildlife in the PA.	A
National Green Tribunal Act, 2010	An Act to provide for establishment of National Green Tribunal for effective and expeditious disposal of cases relating to environmental	A

	protection and conservation of forests and other natural resources including enforcement of any legal right relating to environment.	
National Policies related to conservation and sustainable use of biodiversity and environmental regulation of production activities		
National Conservation Strategy and Policy Statement on Environment and Development, 1992	Policy formulated in response to the need for laying down the guidelines that will help to weave environmental considerations into the fabric of national life and development process. The major objectives of the policy with respect to marine and coastal zones are: ensure that the environment and productivity of coastal areas and marine ecosystems are protected; conserve and nurture the biological diversity, gene pool and other resources through environmentally sustainable development and management of ecosystems, with special emphasis on our mountain, marine and coastal, desert, wetlands, riverine and island ecosystems; and, protect the scenic landscapes, areas of geomorphological significance, unique and representative biomes and ecosystems and wildlife habitats, heritage sites/structures and areas of cultural heritage importance. The mainstreaming of production sector focussing on conservation and protection of natural resources comply with the stated policy.	A
National Environment Policy 2006	The National Environment Policy stresses the need to address shortcomings in conservation of mountain ecosystems through review of the relevant sectoral and cross sectoral policies, and institutional capacity building. It stresses the need for appropriate land use planning and watershed management practices, adoption of 'best practice' norms for infrastructure construction, promotion of organic farming, sustainable tourism with multi stakeholder partnership and regulation of tourist inflows.The integrated or rather advanced concept of mainstreaming of sectoral activities with resource conservation is compliance of NEP.	A
National Forest Policy, 1988	The Government of India in the erstwhile Ministry of Food and Agriculture enunciated a Forest Policy to be followed in the management of State Forests in the country. The principal aim of Policy must be to ensure environmental stability and maintenance of ecological balance including atmospheric equilibrium which is vital for sustenance of all life forms, human, animals and plants. The derivation of direct economic benefit must be subordinated to this principal aim. The management of PAs and reserve forests in the HRML are carried out according to the National Forest Policy.	A
National Wildlife Action Plan, (2002-16)	Adopted in 1983 for the first time, the plan outlines the strategies and action points for wildlife conservation. The outputs of the projects related to strengthening of PA and conservation of HVBAs are derived from the NWAP.	A
National Tourism Policy, 2002	Policy gives foremost importance to sustainability as the 'guiding star'. It comes out strongly against short term gains and over exploitation of	B

	resources. The rapid growth of tourism and similarly eco-tourism are important elements for communities and offer both costs and benefits for the management of destinations. There are no regulations regarding the growth of tourism like carrying capacity or infrastructure growth. As a result of this, and in the face of growing tourism demand, issues of conflict are emerging. One of the major sectors for engagement in the project is the tourism industry.	
National water policy 2012	The objective is to propose a framework for creation of a system of laws and institutions for a plan of action with a unified national perspective.	B
National Policy for farmers 2007	To ensure that farming activity becomes more viable and the economic condition of farmers is improved on a sustainable basis.	B
State Level Polices and Acts related to conservation and sustainable use of biodiversity and environmental regulation of production activities		
Kerala state forest policy 2009	To protect and conserve natural forests and to provide livelihood for forest dependent communities.	A
Kerala State Environment Policy 2009	Seeks to mainstream environmental concerns in all development activities. The Policy has been designed to suit the specific local conditions of the State and provides a framework within which conservation and development can be achieved simultaneously.	
Kerala state water policy 2008	For regulated use and conservation of water resources. Facilitates a resource based approach, user participation and sustainable and equitable water resource management.	B
Kerala state organic farming policy 2010	To make Kerala's farming sustainable, rewarding, competitive and respectable ensuring poison free water, soil and food to every citizen. It seeks to enhance natural soil fertility, ensure water and soil conservation, create domestic market for organic products, avoid use of agro chemicals and other hazardous material, promote biodiversity based ecological farming,conservation and extension of traditional knowledge related to agriculture.	A
Kerala Energy Policy 2002	Encourage power generation from non-conventional energy sources like muncipal waste, agro waste, industrial waste and other biomass, wind, tide, wave, geothermal, solar and mini hydel.	B
Kerala Fisheries policy	Developing fisheries in inland waters by integrated fish farming and game fisheries. Develop fisheries tourism and angling in high ranges by establishing hatcheries of fishes like mahseer.	B
Kerala state disaster management policy,2010	As the State is vulnerable to a multitude of hazards, a proactive, comprehensive and sustained approach to reduce the detrimental effect of disasters on the socio-economic development is envisaged in the Policy. It focuses on reducing vulnerability by planned prevention, mitigation and preparedness. Kerala State Disaster Mangement Authority is the apex decision making body and there is a district level Disaster Management Authority headed by the Collector.	A
Kerala state breeding policy	The policy gives space for conservation programme for native breeds.	C

The Kerala Forest Act,1961 and amendments	A comprehensive legislation along the steps of the Indian Forest Act ,1927 for protection and management of forests in the State.The Act has undergone many amendments. Although the stringent provisions have led to protection of forests, the requirements as per Forest Policy and FRA have not yet been incorporated.	A
The Kerala Preservation of trees Act.,1986	This was enacted for restricting indiscriminate fellings and destruction of trees resulting in considerable soil erosion and destruction and loss of timber wealth. Section 4 of the act imposes restriction on cutting of specified trees.	A
The Kerala Forests (Vesting and management of Ecologically Fragile Lands) Act,2003	An Act to provide for vesting in the Government of ecologically fragile lands in the State with a view to maintaining ecological balance and conserving biodiversity. Any forest land held by any person and lying contiguous to and encircled by a reserved forest or any other forest land owned by the government was defined as ecologically fragile. Unfortunately, this Act due to certain flaws in implementation has catalysed public anger against conservation in the District.	A
Kerala Promotion of Tree Growth in non-forest Areas act- 2005	An act to promote cultivation of trees in non forest areas of the State in order to increase green cover, preserve biodiversity and increase availability of timber and bamboo.	A
Kanna Devan Hills(Resumption of lands)Act	To provide for resumption of lands other than plantations in KDH and distribution of such lands for cultivation.	A
Kerala Grants and Leases (Modification of Rights)Act,1980.	To revise the terms and conditions of the leases and grants that were given by former States.	B
Kerala Forest Produce Transit Rules,1975	For restriction on the transport of timber.	B
Rules for payment of compensation to victims of attack by wild animals 1980	For paying compensation to those who sustain injuries or loss of life.	B
Kerala Protection of river banks and regulation of removal of sand Act 2001	To protect rivers and river beds from large scale dredging of river sand and to protect their biophysical environment system and regulate removal of sand.	C
Kerala Land Conservancy Act,1957	An Act for preventing unauthorised occupation of Government lands which is relevant in the case of protection of HVBAs under Revenue Department.	A
Kerala restriction on transfer of lands and restoration of alienated lands Act,1975	An act for restricting transfer of land by members of scheduled tribes and restoration of possession of lands alienated by such members.	A
Kerala Conservation of paddyland and wetlands Act,2008	This Act aims to conserve padddyland and wetland and to restrict the uncontrolled conversion and reclamation of wetlands in order to promote growth in agriculture sector and sustain the ecological system.	C
Kerala Land Reforms Act,1963	A comprehensive piece of legislation relating to land reforms. It put a ceiling on the extent of land that could be held.	A
Kerala Irrigation and Water conservation Act,2003	Regulations on construction of reservoirs, anicut, diversion of rivers, inter river basin transfer of water,	B
Kerala ground water (control and	(permission for digging of new wells, converting existing well into	A

regulation) Act, 2002	pumping well etc in notified areas)	
Kerala Biodiversity Conservation Rules,2005	Enabling provisions for setting up Kerala Biodiversity Board and Biodiversity Management Committees under Grama Panchayats.	A
Cardamom Rules 1935	Rules for assignment of government lands for cultivation of cardamom. Lands were assigned to farmers as well as tribes.	A
Rules for lease of Government lands for cardamom cultivation,1961.	These Rules formed under the Land Assignment Act,1960 deal with leasing of Government lands in Devikulam and Undumbanchola Taluks of HRML for cardamom cultivation.	A
Kerala Land Assignment Act,1960	A comprehensive legislation for the purpose of regulating assignments of Government lands. It sets the procedures to be followed before assignment.	A
Kerala land assignment rules 1964	It deals with registry of lands and limits the maximum extent of lands that are assigned.	A
Kerala land assignment (regularisation of occupations of forestlands prior to 1-1-1977) special rules 1993	Rules for assignment, settlement and regularisation of forestlands in Cardamom Hill Reserve under occupation prior to 1-1-1977. These lands were converted for non-cardamom cultivation.	B
Kerala assignment of government lands to Scheduled Tribes Rules,2001.	For assigning Government lands (1 to 5 acres) to Scheduled Tribes for house sites, personal cultivation and beneficial enjoyment. The land is heritable but not alienable.	A
Kerala Panchayat Building Rules,2011	Rules for controls and permits for all types of constructions in Panchayat areas.	A
Munnar Special Tribunal Act,2010	For the adjudication of disputes with respect to land in Munnar and surrounding areas. It seeks the transfer of all land related cases pending before various courts and other authorities to the Tribunal set up under the Act.	A
Kerala Tourism (Conservation and Preservation of Areas) Act, 2005	The Act provides for conservation and preservation of tourist areas in the State and empowers the State Government for declaring any area which has tourism importance as 'special tourism zone' and to regulate developmental activities including construction.	A

A- High B – Medium C - Low

Annexure 13

Important iInternational conventions and treaties related to HRML

International Conventions and Treaties	Brief Description	Relevance
Convention on Biological Diversity, 1992	The Convention on Biological Diversity, known informally as the Biodiversity Convention, is an international treaty that was adopted in Rio de Janeiro in June 1992. The Convention has three main goals:1.Conservation of biological diversity; 2.Sustainable use of its components; and 3.Fair and equitable sharing of benefits arising from genetic resources. The convention recognized for the first time in international law that the conservation of biological diversity is "a common concern of humankind" and is an integral part of the development process. The agreement covers all ecosystems, species, and genetic resources. It links traditional conservation efforts to the economic goal of using biological resources sustainably. It sets principles for the fair and equitable sharing of the benefits arising from the use of genetic resources, notably those destined for commercial use.	A
CITES (1973)	CITES (the Convention on International Trade in Endangered Species of Wild Fauna and Flora) is an international agreement between governments which aim is to ensure that international trade in specimens of wild animals and plants does not threaten their survival. CITES was drafted as a result of a resolution adopted in 1963 at a meeting of members of IUCN (The World Conservation Union) and finally agreed at a meeting of representatives of 80 countries in Washington DC. on 3rd March 1973, and on 1 July 1975 CITES entered in force. CITES works by subjecting international trade in specimens of selected species to certain controls wherein all import, export, re-export and introduction of species covered by the Convention has to be authorized through a licensing system. The species covered by CITES are listed in three Appendices, according to the degree of protection they need. Roughly 5000 species of animals and 28000 species of plants are protected by CITES against over-exploitation through international trade. Some of the important coastal and marine species found in the EGREE are covered under the ambit of the Convention. The capacity building intended to provide during the project implementation would also help in increasing the awareness of different stakeholders about CITES.	B
World Heritage Convention, 1972	In 2012, 39 serial sites including four (Eravikulam National Park, Mannavanshola ie.Anaimudi National Park, Chinnar Wildlife Sanctuary and Mankulam) in the HRML were inscribed as World Heritage sites by UNESCO. The Convention sets out the duties of the Parties in identifying potential site and their role in protecting and preserving them. By signing the Convention, each country pledges to conserve not only the World Heritage Sites situated in its territory but also to protect its national heritage. The Parties are encouraged to integrate the protection of cultural and natural heritage into regional planning programmes, set up staff and services at their sites, undertake scientific and technical conservation research and adopt measures which give this heritage a function in the day to day life of the community.	A

Annexure 14

KEY STAKEHOLDERS OF THE PROJECT

No	Stakeholder	Functions and capacities
1	Ministry of Environment and Forests(MOEF)	The MoEF is the nodal agency in the administrative structure of the national Government for planning, promoting, coordinating and overseeing implementation of India's environmental, forestry, land degradation and climate change related policies and programmes. MoEF shall provide the overall project coordination at the national level and facilitate implementation particularly policy reforms and coordination among Ministries. National Board for Wildlife is an important body with statutory powers capable of influencing the Project positively. National Biodiversity Authority (NBA) with a mandate of pursuing the implementation of the Biological Diversity Act, 2002, shall also be another important statutory body from the perspective of the project.
2	Other Union Ministries/Agencies	Other union ministries whose mandate and domain has a bearing on this project are the Ministries of Commerce (including Tea Board and Spices Board); Rural Development; Tribal Affairs(includes Tribal Cooperative Marketing Development Federation of India Ltd.-TRIFED) ; Panchayati Raj; Power, New and Renewable Energy, Agriculture, Road Transport and Highways and Tourism. These central ministries shall contribute to project objectives by aligning sectoral programmes and policies in line with LLLUP and also provide necessary co-financing at the national level
3	Forest Department	The Department of Forests & Wildlife, one of the oldest in the State, shall be the nodal agency at the state level for coordinating and implementing the project.It is the key stakeholder given its mandate for forest protection and biodiversity conservation. The main functions of KFD are to a) conserve and expand the natural forests for posterity, in particular, with regard to water and biodiversity ; b) increase the productivity of forest plantations ; c) increase the tree cover both inside and outside the forests; d) meet the livelihood needs of tribals and other forest dependent communities; and e) sustainably manage biodiversity-rich and sensitive ecosystems such as mangroves, sacred groves, coastal areas, wetlands, homesteads, private plantations etc. which are outside the control of the Forest Department. Capacity to interact with people and to deal with emergent threats like climate change needs to be strengthened.
4	Other State Departments/Agencies	Agriculture Department is another important entity as large area of the project landscape is under agriculture land use. Many of its activities are carried out by LSGs. The Agriculture Department promotes organic farming as per the Organic Farming Policy that promotes gradual withdrawal of chemicals and

		conservation of natural resources and biodiversity. But the Department is still oriented towards maximising production through intensive farming. Tourism Department deals primarily with planning, development, promotion and marketing of tourism potential of the State. Institutions like Kerala Tourism Development Corporation, Kerala Institute of Travel and Tourism Studies and District Tourism Promotion Councils are under the Tourism Department. The focus still remains on increasing visitation levels. Revenue Department controls the district administration and has very close interaction with the general public, as it deals with all matters related to land (land revenue, survey, distribution, implementation of various Acts etc.). It still possesses large tracts of HVBAs, but is unable to protect them as the mandate is different. It is also the nodal agency for natural disaster management. Animal Husbandry Department seeks to increase production potential of livestock and poultry, retain traditional livestock farmers, promote fodder production, conserve local breeds and control zoonotic diseases. Most of its activities are carried out through LSGs. The Fisheries Department aims to promote, facilitate and secure long term sustainable development, conservation and utilization of the rich fisheries resources. It strives to enhance fish production in inland water bodies through schemes like Matsyakeralam. But the focus still remains only production as evidenced through its priority for introduction of fast growing exotics (whose breeding technology has been mastered unlike indigenous species). The State planning Board (under Department of Planning) enables the Government to formulate development plans based on a scientific assessment of the resources of the State. The Land Use Board functions to assist the Government to frame policies for optimum land use and natural resources management in the State. With the decentralisation of powers to LSGs, the Department of Local Self Governance has an important role to play in the formulation of policy and implementation of developmental works at the grass roots level. The Environment Department is important as it deals with environment protection, awareness creation, climate change and river protection. It controls the State Biodiversity Board and Pollution Control Board. The Department of Education administers all the educational institutions and can have an enabling role as a conduit for developing the concept of the landscape among students. The Department of Water Resources endeavours to ensure that water, the vital resource, will continue to be sustainable for future generations to come in the context of physical, environmental and social background. The Scheduled Tribe Development Department looks after the welfare and development of the tribes. They are mandated to implement the FRA. The Public Works Department has a role as infrastructure development which has a direct bearing on the landscape. Other state level departments and agencies shall contribute to project objectives by aligning sectoral programmes in line with LLLUP and also provide necessary co-

		financing at the state level.
5	District Administration	Headed by the District Collector[1], and include functionaries responsible for different aspects of district governance such as district planning (District Planning Officer), agriculture (Deputy Director, Agriculture), tribal development (Integrated Tribal Development Officer), livestock (District Animal Husbandry Officer), soil & water engineers, officials of the Department of Social Justice. These district level functionaries are responsible for planning and implementing sectoral programmes in the project landscape and will form primary stakeholders in the project. The Collector holds regular meetings of all the functionaries along with the elected representatives for co-ordinating their activities.
6	Panchayat Raj Institutions	At the District level there is *District Panchayat*; at the block level there are *Block Panchayats*, and at the village level there are *Gram Panchayats*. These three levels of local government constitute the third tier of governance and are responsible for the preparation of plans for economic development and social justice and also for the implementation of schemes at the grassroots level (Ex.NREGA). They will be actively involved in the project. Apart from developmental and welfare activities, they are also responsible for protection of the environment and implementation of Acts like FRA. *Kudumbasree* , a remarkably successful women empowering project co-ordinated at district level and functioning through LSGs is a major stakeholder with extensive reach at grass root level.
7	Research and Educational Institutions	Research institutions –national, regional and local need to be involved in the Project for research, innovation, education, implementation and monitoring. Wildlife Institute of India, Indian Council of Agriculture Research (ICAR),National Centre for Biological Sciences(NCBS), College of Forestry, Kerala Agriculture University, Cardamom Research Centre, United Planter's Association of South India(UPASI),Research and Development Department (KDHP), Kerala Forest Research Institute(KFRI), Tropical Botanical Garden and Research Institute ,School of Social Sciences Mahatma Gandhi University, Kerala State Council for Science, Technology and Environment(KSCSTE), Centre for Water Resources Development and Management (CWRDM), Centre for Earth Science Studies (CESS), Periyar Foundation, Institute of Management in Government (IMG), Kerala Institute for Research, Training and Development Studies of Scheduled Castes and Scheduled Tribes (KIRTADS) and Kerala Institute of Travel and Tourism Studies (KITTS) are institutions of excellence in research and capacity building relevant to the project and also have a presence in the region. These institutions can broaden the transdisciplinary nature of the

[1] District Collectors are officers of the Indian Administrative Service and in charge of the administration of the district. They are entrusted the task of handling law and order, revenue collection, taxation, the control of planning and handling of natural and man-made emergencies.

		Project and ensure that the land use and sector management measures are grounded in sound science. Kerala Institute of local Administration (KILA) is an important institution for strengthening the capacity of LSIs and also for mainstreaming biodiversity and resource conservation into their activities. The Project intends to develop a network of these organizations for mobilizing knowledge, technology and expertise.
8	Production Sector	Production sector is another important stakeholder and partner for the project as they have significant dependence on natural resources and sustainable use is vital for their own existence in the long run. Tea, cardamom and tourism are the major private production sector agencies in the project landscape. Reed industry is represented by Hindustan Newsprint Ltd.(HNL) and Kerala State Bamboo Corporation (KSBC), both in the public sector. Kerala Forest Development Corporation (KFDC) has stakes in plantations and tourism. Right at an early stage, the project will develop collaboration and promote proactive engagement with the production sector. The private sector is largely represented through tea companies (mostly corporate in nature), cardamom federations/associations (representing a number of scattered cardamom growers) and hoteliers associations and tour operators(organizations like Kerala Travel Mart Society). Partnerships can be built with institutions like UPASI(planters), KTM Society (tourism), KDHP Co.Ltd., and cardamom growers for imparting biodiversity and sustainability concerns into their practices. Moreover, entrepreneurs who are willing to invest in innovative green technologies like renewable energy, waste management and value addition of organic products are also important stakeholders.
9	Local Communities and community institutions	Local communities especially tribes are key stakeholders as they are highly vulnerable to natural resource depletion affecting their livelihood. They will be the main beneficiaries of project interventions through enhanced community capacities to plan and manage natural resources. Programmes like NREGA are primarily implemented through them. The community institutions targeted are grass root level organizations like Kudumbasree, VSS/EDC/ULO (supported by the Forest Department for participatory forest management),FDAs, CRC and Oorukoottams(for implementation of FRA). In addition to being project beneficiaries, they are also a critical repository of traditional knowledge
10	NGOs/NGIs	These stakeholders form a major catalyst group for the success of the Project. High Range Wildlife and Environment Preservation Association, Munnar Environment and Wildlife Society, Gurukula Botanical Gardens, Vattakanal Trust, World Wide Fund for Nature, Wildlife Trust of India, Ashoka Trust for Research in Ecology and the Environment (ATREE), Nature conservation Foundation, Hornbill Foundation etc. are some of the NGOs that promote conservation awareness, ecorestoration, participatory monitoring and conduct outreach programmes. In addition, there are other individuals who have contributed enormously for developing knowledge about the landscape

		and also, in disseminating this knowledge among a large cross section of the public. Audio-visual and print media are important partners for highlighting the objectives of the Project and also the progress of implementation.
11	Political workers	The highly politicised atmosphere in the State provides the right ambience for including the political workers as important stakeholders. Though ecologically literate to an extent, all political parties need to have an understanding and appreciation of conservation at the level of landscapes.

Annexure 15

Indicative list of diagnostic studies

No.	Biodiversity/Habitat	Duration (months)
1.	Plant-animal community studies in various landscape elements (birds and butterflies)	36
2.	Identification of indicator species for special conservation efforts	12
3.	Studies on micro habitats (sholas) – bryophytes, pteridophytes etc. – comparison between disturbed/human impacted and undisturbed/ pristine sholas.	24
4.	Documentation and compilation of existing information on various taxa (flora and fauna), and identify critical gaps.	12
5.	Studies on patch dynamics- patch sizes, species composition, patch location	36
6.	Movement and home range estimation of Nilgiri tahr in meta populations using radio-telemetry	36
7.	Ecosystem requirements of selected species like Great Hornbills.	24
8.	Study on the impact of invasive species on ecological communities	36
9.	Study on status, distribution and micro habitat preference of balitorine loaches	24
10.	Fish community structure in relation to physical and chemical settings of the waterscape in different stream orders.	24
11.	Restoration protocol for riparian species	12
12.	Site specific ecorestoration protocol based on existing community requirements	24
13.	Predicting animal abundance and movement in HRML	24
14.	Stream ecology assessment and restoration plans	24
15.	Land use and management plans for production landscapes	12
16.	Water recharge and utilization in plantations	12

17.	Participatory protection and monitoring of endangered plants and animals in HVBAs using local tribes.	48
	GIS/ Baseline	
18.	Time series analysis using satellite imagery, aerial photos and toposheets	12
19.	GIS mapping- geospatially referenced data on selected habitats, status of selected species and connectivity .	12
20.	GIS based threatscape analysis	12
	Socio-economic	
21.	Valuation of ecosystem services for Mankulam and CHR (PES)	24
22.	Tourism- carrying capacity study in Munnar	12
23.	Marketing institutions and livelihood options	12
24.	Hill Area Studies- Patterns of tourism development, tourism impacts and mainstreaming BD conservation and livelihoods in tourism strategy.	12
25.	Creation of benchmark socio-economic data base for concurrent evaluation.	12
26.	Social change among tribes-trajectory of development (focus on Edamalakkudy)	24
	Legal and institutional	
27.	Matching institutions and technology for reduction in biomass use	12
28.	Facilitating marketing and mechanism for identifying geographical indicators for products like cardamom, lemon grass, Marayur jaggery etc.	12
29.	Analysis of socio-political and legal issues and perception studies especially of CHR	12
30.	Assessment of ongoing development projects and existing institutional arrangements in compatibility to the Project	6
	Socio-ecological	
31.	Functional diversity of insect community in human dominated, fragmented landscapes and cost –benefit analysis of api and meliponiculture.	24

32.	Status, distribution and artificial propagation of mahseer for livelihood enhancement.	24
33.	Human-WL interaction in human dominated landscapes-quantification, seasonality, perception	36
34.	Dependence of sectors on natural resources and its impact (water, firewood , Sand, Granite etc.)	12
35.	Impact of cash crops on natural resources and changes in life styles(lemon grass, sugarcane,cardamom)	12
36.	Impact of PA management activities (roads,trek paths, firelines etc.) on BD	12
37.	Studies on pattern of usage of pesticides and their impact on the ecosystem of High Ranges of Western Ghats, India under different cropping systems (including residues, effect on fauna and environment)	12
	Knowledge	
38.	Documenting traditional ecological knowledge	12
39.	Documenting conservation practices and initiatives at the level of communities and individuals and possibility of grafting them to Project.	6
40.	Locality specific curriculum development	6
41.	Establishment of a Resource management and ecorestoration centre with knowledge base (herbarium, photographs, specimens, literature, publication etc.,) for the conservation of the High Ranges of Western Ghats, India	24
	History	
42.	Detailed review of ecological and developmental history of various sectors in the LS.	12
	Climate change	
43.	Developing key indicators and a framework for adaptive management for biodiversity conservation in HRML.	12
44.	Carbon services potential under forest community rights as part of Forest Rights Act	12
45.	Hydrologic and carbon ecosystem services of natural and ago-	36

	forestry ecosystems	
46.	Studies on the weather pattern of the High Ranges of Western Ghats, India (Data collection, compilation and interpretations) for prediction of possible changes in the future	24
47.	Probable impact of CC on flora and fauna: Bryophytes, Pteridophytes, balsams, birds like black and rufous flycatcher, white bellied shortwing etc.	36
48.	Shola regeneration studies	24
49.	Peat studies or fossil pollen studies for understanding evolutionary history	24

Annexure 16

Indicative interventions in various sectors

Sl no.	Sector	Indicative interventions
1	Protected Areas	• Rationalization of boundaries and expansion of PA network • Revisiting Management Plans • Up gradation of protection infrastructure • Establish and strengthen monitoring protocols • Capacity strengthening of staff and EDCs • Nature education for immediate stakeholders • Fixing carrying capacity for tourist visitation • Computerized ticketing system for Eravikulam National Park • Address livelihood issues through ecodevelopment • Identification of knowledge gaps-inventories and studies • Removal of invasive species(Ex.Euphatorium) • Plantations in PAs-bringing back to original vegetation • Initiate new grassland management techniques
2.	High Value Biodiversity Areas / Forest Fragments	• Improve protection infrastructure (sandal smuggling, encroachment, poaching) • Survey, demarcation and documentation of HVBAs • Identify and demarcate unique ecosystems and inventory of species (RET and endemics) • Study and conserve unique phenomena (Ex. elephant congregation at Anakulam) • Revisit Working Plans and Biodiversity Conservation Plans • Sustainable agricultural practices in enclosures-Incentives, subsidies and awareness • Retrofitting measures for roads, canals etc. • Identify and protect connectivity/corridor values • Enhanced protection for sholas/grasslands under various agencies/ departments • Removal of invasives (Mikenia) • Assess watershed value and ecosystem services • Improved technology for sandal protection • Capacity building of staff and stakeholders
3.	Commercial tree plantations	• Larger espacement for eucalyptus plantations in low rainfall areas like Vattavada(5mtx5mt) • Wattle and Eucalyptus of Government agencies in HVBAs to be converted to original vegetation (through participatory watershed

		management, social mapping etc.) • Failed teak plantations into original vegetation
4.	Tea industry	• Energy efficiency – assistance for identification / adoption of 'Proven New Technologies' • Identification of improved technology for waste management (ex.plastic waste for tarring roads), biomass gasification • Identification and mapping of all water sources and forest fragments(sholas, grasslands,rocky outcrops etc.) • Assistance for conservation of natural ecosystems and shola regeneration • Support for environment management certification (Rainforest Allianz) and marketing of organic tea. • Enabling policy for responsible/sustainable tourism options. • Creating buffer zones (inside plantations) in bio diversity rich areas. • Management plan for all tea estates. • Collaborative bio diversity monitoring studies in tea estates.
5	Cardamom farms	• Revival of Cardamom for Rainforest Conservation (CRC) initiative by involving Revenue and Agriculture departments, Spices Board etc. • Market interventions- free trade, minimum support price, internal markets and networks, import restrictions etc. • Explore potential for carbon trading and payment for ecosystem services(ex. cheaper electricity) • Branding as shade cardamom. • Certification/incentives for sustainable biodiversity rich farms • Conservation of swamps in larger estates and creation of check dams (community decision and policy interventions required). • Encourage different varieties of cardamom as well as trees. • Energy efficiency in processing by improved technology and centralized facilities. • Participatory land use plan for cardamom sector. • Package of practices for safe and judicious use of pesticides • Survey of cardamom leases and *pattas* for clarity about ownership/custodianship of cardamom areas • Do away with dual control. • Supply of native tree species that are in demand • Encourage indigenous bee keeping for pollination • Study impact of intensive production on soil, water and communities • Training for participatory biodiversity monitoring and documentation. • Tree cutting and quarrying in border areas falling under revenue to be controlled to prevent hot winds from TN
6	Tourism and urban development	• Carrying capacity assessment and strategies for visitor • management

		• Promote online booking for tourism activities • Encourage 'plantation visit' and home stays • Promoting hiking and cycling • Earmarking areas for dining, parking and public conveniences • Vendor inclusive management in tourist destinations • Beautification and upkeep of tourism destinations sponsored through hotels and tour operators • Accreditation for eco-friendly hotels and trained local guides • Address legal and policy issues in plantation tourism • Regulation on visitation in ecologically sensitive areas • Enhanced role of Panchayats in tourism management • Garbage disposal strategy and action plan for Munnar and other Panchyats • Beautification of Munnar(Green Munnar Project) • Establishment of a Biodiversity Park in Munnar (Eucalyptus plantation at Devikulam) • Formulation and implementation of building code (for aesthetic ambience and sustainable tourism) • Preservation of physical cultural resources in Anchanad valley • Decongesting crowded destinations and information on alternate destinations
7	Reed extraction	• Undertaking eco-restoration programmes for improving reed breaks (e.g. Mikania removal, fire management etc.) • Linking reed extraction to NREGA programme to ensure additional wage benefits to collectors • Introducing technological interventions for harvesting and to reduce the wastage in collection • Improving the knowledge base on the ecology of reed breaks • Capacitate the Kerala State Bamboo Corporation on value addition • Harmonize the Working Plan prescriptions on reed management in tune with biodiversity conservation. • Explore the possibility of promoting reed extraction under the community rights of the Forest Rights Act. • Promoting scientific extraction by harmonizing the harvesting regime to avoid resource mis-management and depletion.
8	Heterogeneous cultivation	• Soil conservation using biological bunds. • Resource documentation and mapping using satellite data (land utilisation, water bodies, plantations, roads etc) • In situ biodiversity conservation: (eg. allowing other species to come up inside mature rubber plantations as under growth) • Characterization and conservation of agricultural crop diversity in the region

		• Promoting organic farming with assured niche marketing, especially fruits, vegetables and flowers tie up with the tourism (ex.Mankulam Panchayat). • Characterization of indigenous fish populations; enable their multiplication inside the water bodies. • Identify intense H/W conflict regions and mitigation measures (ex. engineering solutions, cropping patterns, perception management etc.) • Restriction on solar fencing in private areas(ex.Chinnakanal) • Early warning system for elephant areas (mobile phones, • indicator lights) • Promote integrated and sustainable farming practices (ex. indigenous bee keeping, native fish farming, farm forestry, animal husbandry, home stays etc.) • Encourage collective farming for organic products (Ex.Kudumbasrees)
9	Tribal hamlets	• Completion of road to Edamalakkudy(bridges, retaining walls etc.) • Branding Edamalakkudy produces free from all chemical inputs and their marketing. • Assessing the impact of shifting cultivation practiced in Edamalakkudy • Traditional cultivation in tribal settlements to be encouraged (paddy, vegetables and ragi apart from cardamom,pepper etc.) • Water and soil conservation measures(trenches etc.), agriculture tools, trainings . • Use water bodies for native fish culture by the tribals for the tribals and exclusive fishing rights to tribes under FRA • Expedite process of community rights under FRA • Branding and marketing of cardamom, lemon grass oil, jaggery,NTFP • Water conservation in Marayur, Kanthalloor, Vattavada Panchayats • Alternate energy sources-Solar technology and capacity for maintenance, mini hydels, wind. • Rehabilitation of tribals involved in sandal offences • Energy efficiency in lemon grass oil extraction in Anchanad valley (ex.solar technology). • FRA implementation and community rights along with sustainable use • VSS sale counter/information centre/dormitory to be built in centre of Marayur (in place of old dilapidated structures) • Tribal lands to have a cluster approach for housing and • Agriculture for solving elephant problems • Capacity building for panchayats- members, engineers, secretaries • Additional support for strengthening PFM implementation (sociologist, ecologist etc) • Skill up gradation to marginal communities for enabling them to enter

		emerging sectors • Encourage wind breaks in tribal settlements (appropriate species) • Technical support for voluntary relocation of Variam and Uriampetty in Malayattoor Division. • Discourage planting of exotics in tribal area _ one time permanent removal under VSS / EDC supervision / as fuel for lemon grass distillation.
10	River valley projects	• Discourage introduction of exotics in PAs and HVBAs • Dialogue on varying Water level in Thattekkad
11	Other forest areas	• Study connectivity issues • Intensive use • Identify areas for activities like ecotourism

Annexure 17

LIST OF HIGH VALUE BIODIVERSITY AREAS TO BE ADDED TO PA SYSTEM

No	Name of HVBA	Forest Division	Extent of HVBA (Ha)	Potential Area for addition to PA(Ha)	Name of PA to which addition is to be made	Description of the areas to be added
1	Manthanshola and adjoining areas	Marayoor	200	200	Anaimudishola National Park	Sholas and grasslands lying on the western side of Anaimudi National Park. Source of water to agricultural lands below.Falls under Revenue Department
2	Koodakkad Reserve	Marayoor	3200	500	Eravikulam National Park	Area lying on the eastern side of National Park consists of sholas and failed plantations in grasslands. Function as calving areas of tahr. Main source of water to Marayoor village.
3	Sandal Reserves (Natchivayal, Vannanthura and 51 Extension)	Marayoor	1200	250	Chinnar Wildlife Sanctuary	Unique sandal bearing forests and dry forests (near Thoovanam).
4	Thirthalar Reserve	Marayoor	800	200	Anaimudishola National Park	Continuous Sholas
5	Anaimudi Reserve Forest	Munnar	10600	3000	Eravikulam National Park.	Extensive grasslands, sholas and montane evergreen forests lying on western flank of National Park. Ecologically continuous to tahr habitats of National Park.
6	Kannan Devan Reserved Forest	Munnar	7000	200	Eravikulam National Park	8th Mile shola continuous to the Park.
				1500	Anaimudishola National Park	Iddlimotta areas (Tertian plateau) with

						sholas and grasslands planted up with wattle
				300	Pampadumshola National Park	Sholas and grasslands planted with eucalyptus on the western boarder of Park.
7	Mankulam Reserve Forest	Mankulam	9000	1000	Eravikulam National Park	Grasslands and montane forests continuous to Rajamallay area of National Park.
8	Interspersed lands of varying extents in Kannan Devan Hills	Munnar	4000	-----	------	Many fragments of grasslands, sholas, rocky outcrops etc.
9	Malayattoor Reserve Forest	Munnar	6200	1000	Thattekkad Bird Sanctuary	Portions of the forest (Urulanthanni, Kolumba) abutting southern portion of the Sanctuary
10	Malayattoor Reserve Forest	Malayattoor	37100	------	--------	Mostly reed breaks and low altitude forests and rocky escarpments
11	Cardamom Hill Reserve, Pallivasal Unreserve, Chinnakanal Unreserve (Ex.Kozhikadushola, Kaduashola)	Munnar	1800	------	---------	Mostly sholas on the lying on the ridges in Revenue lands.
12	Nagarampara Reserve Forest	Kottayam	3500	3500	Idukki Wildlife Sanctuary	Evergreen forests and savannas
	TOTAL		**84600**	**11650**		

Annexure 18

Incremental Cost Matrix

Benefits/ Outcomes	Baseline (B)	Alternative (A)	Increment (I = A-B)
Domestic Benefits	Existing management effectiveness of PA system is sub-optimal due to small size, non-represeantion of full set of biodiversity values and existing and emerging threats.	PA system expanded by 11,600 ha and give better coverage to representative biodiveisty including critical corridors; High Value Biodiversity Areas come under better conservation foucs; and over all management capacities of conservation sector strengthened.	Increased institutional capacity to plan and implement better conservation governance programmes through knowledge generation, guidance on management planning, execution and monitoring largely provided through soft skills, demonstration of best practices and facilitation of cross-sectoral dialogues.
	Biological Diversity in HRML provides livelihood support to local people, but the capacities for effective sustainable management of natural resources are weakening and livelihoods are shrinking.	Improved practices and sustainable management of wild resources along with better market mechanism and governance model would strengthen livelihood opportunities of local communities in HRML.	Enhanced ability of stakeholders in government institutions, local communities and NGOs to conserve biodiversity through sustainable use.
	The production sectors and other resource consumption based sectors have limited focus, capacities and technology for addressing environmental conservation in their sectoral activities.	The key production sectors and other resource consumption based sectors develop strategies and capacities and also incorporate biodiversity concerns in their sectoral activities.	Enhanced capacities of production sector for mainstreaming biodiversity considerations into operations and practices and protection/ conservation of biological diversity for sustainable development.
	Knowledge, skill and capacity of the stakeholders of different sectors in HRML are not sufficient to practice sustainable use of resources.	Necessary skill and capacity of different stakeholders are improved for fostering sustainable natural resource utilization.	Effective protection and sustainable utilization of biological resources.

Benefits/ Outcomes	Baseline (B)	Alternative (A)	Increment (I = A-B)
Global Benefits	*Inadequate management effectiveness of the PA system:* a) PAs are too small and do not adequately cover representative biodiversity; and b) management measures in PAs are sub-optimal in terms of addressing the emerging threats.	1. Coverage of PAs in the project landscape expanded by approximately 11,600 ha over the baseline. 2. PA functions improved to account for existing and emerging threats including human-animal conflicts (covering 50,00 ha). 3. Wildlife populations ranging into PA's adjacent landscape (> 400,000 ha) secured—thus indirectly sustaining their ecological integrity.	1. PA systems cover more representative areas of global biodiveristy significance (e.g. *shola*-grasslands). 2. Population status of several globally significant species maintained or increased – e.g. *1. Nilgiri tahr; 2. Grizzled giant squirrel; 3. Tiger;4: Leopard 5: Nilgiri marten 6: Clawless otter 7: Asian elephant;8:Gaur* 3. The prospects of discovering species new to science particularly from lesser known life forms. 4. Production of knowledge about multiple use management of biodiversity rich areas. 5. Expansion of PA network and coverage of more globally significant biodiversity under PA systems. 6. Reduced forest degradation and improved vegetal cover contribute to significant carbon sequestration and improving ecosystem functions.
	Limited protection accorded to biological diversity outside the PA systems: Extensive areas of HVBAs and forest fragments face growing threats from unsustainable use and land use change—threatening vital animal movement corridors, habitat loss and degradation.	1. Landscape Level Land-Use and Sectoral Plans developed and a functional cross-sectoral institutional mechanism established for the sustainable management of HRML. 2. Key HVBAs and forest fragments in the project landscape identified, mapped, conservation/ eco-restoration plan prepared and implementation support provided by reorienting baseline investments.	1. Extensive areas of HVBAs and forest fragments (totaling 84,600 hectares) brought under improved conservation management and function as stepping stone corridors/

Benefits/ Outcomes	Baseline (B)	Alternative (A)	Increment (I = A-B)
		3. Conservation sector staff capacitated on improved conservation practices, collaborative governance, stakeholder engagement, eco-restoration, etc (applicable to PA staff too).	'escape routes' ensuring species and genetic flow across the whole of southern Western Ghats. This is particularly important to ensure the survival of high altitude species threatened by climate change (e.g. Black and rufous flycatcher). It is also critical to ensure the survival of species such as tiger and elephant which need large home ranges. 2. Restored HVBAs and forest fragments act the foci for the revival of lost habitats of several threatened and globally significant species (e.g. Great Indian hornbill, *Impatiens* spp). 3. Avoided forest cover loss and augmented ecorestoration contribute to significant carbon sequestration and improving ecosystem functions. 4. The prospects of discovering species new to science particularly from lesser known life-forms.

Benefits/ Outcomes	Baseline (B)	Alternative (A)	Increment (I = A-B)
	Production sectors do not adopt sustainable practices: a) economic production activities have limited focus, capacities and technologies that are less detrimental to ecology; b) production sectors have limited market opportunities for adopting ecologically sustainable activities.	1. Formulation of biodiversity-friendly Sector Plans for mainstreaming biodiversity considerations into production sector practices. 2. Production sector stakeholders capacitated on biodiversity mainstreaming concepts and approaches. 3. Focused implementation support and transfer of knowhow (e.g.energy efficiency options in curing operations) to key production sectors as in designing and implementing biodiversity-friendly production practices. 4. Business models, market mechanisms and branding developed to incentivize sustainable resource use.	1. Production sectors develop capacities for mainstreaming biodiversity considerations into their operations and practices across 200,000 ha area—reducing the negative ecological foot print on biodiversity and sustaining critical wildlife blocks. 2. Production sector operations have adverse minimal impacts on the regional ecology and functionality of key ecosystems improves. 3. Adoption of environmentally sound production practices (e.g. energy efficiency options, waste management etc.) leads to reduction in GHG emission. 4. Production of ecologically benign goods and services (e.g. tea, cardamom and tourism) for the consumption of global communities.
	Community institutions fail to sustainably govern land and resource use: Community capacities for effective management of natural resources are weakening and livelihoods shrinking.	1. Local self governments and community institutions incorporate improved practices for managing wild resource use to ensure sustainability. 2. Market mechanisms developed (certification for sustainably produced farm products and NTFPs) for sustainable use of natural resources. 3. A holistic governance model based on natural resources developed for the tribal Panchayat at Edamalakkudy.	1. Community incomes augmented, socio-economic situation improved – providing a utilitarian incentive for conservation and improving conservation status and security. 2. Uptake, replication and mainstreaming of community models on

Benefits/ Outcomes	Baseline (B)	Alternative (A)	Increment (I = A-B)
			improved resource management into legal, policy and programme framework. 3. Improved conservation status of heavily utilized species (i.e. medicinal plants) and conservation of local varieties. 4. Increasing the adaptive capacity and resilience and women and other marginalized communities.
	Baseline (US$; est. over 5 years)	**Alternative**	**Increment**
Outcome 1: Effective governance framework for multiple-use mountain landscape management in place.	GoK's sector-based programmes/ schemes for: - routine research – USD 2 million - enhanced productivity – 1 million - biotechnology – USD 500,000 - GIS applications –USD 500,000 - meteorological studies – USD 1 million Sub total baseline: USD 5 million	The Alternative will include the following add-on measures to strengthen the enabling environment for mainstreaming - Knowledge generation and managemen – USD 517,100 - Landscape Level Land Use Plan - USD 52,400 - Biodiversity friendly sector plans – USD 65,200 -Cross-sectoral institutional mechanism – USD 83,900 - Policies and legistaions harmonized – USD 9,500 - Replication strategy on landscape approach – USD 22,000 Sub total Alternative: USD 750,100	GoK-Dept of Env, ForestsLine Departments, private sector, local self governments ---------- GEF ---------- Sub total Increment ----------
Outcome 2: Multiple-use mountain landscape management is applied for ecological security of HRML	GoK's sector-based programmes/ schemes for village/ settlement level activities to further sectoral objectives; production sector investments - PA management – USD 15 million	The Alternative will include the following add-on measures to strengthen the capacity of institutions to further mainstreaming objectives - Capacities developed among conservation and production sector	GoK-Dept of Env, Forests, Science, Technology ---------

Benefits/ Outcomes	Baseline (B)	Alternative (A)	Increment (I = A-B)
	- forestry operations – USD 25 million - - agricultural support – USD 30 million -- plantation operations – USD 250 million - tourism operations – USD 25 million Sub total baseline USD 350 million	staff for applying landscape approaches to biodiversity conservation into sectoral operations – USD 303,000 - Management effectiveness of PA system strengthened to address existing and emerging threats to PA systems – USD 1,370,000 - Biodiversity considerations are mainstreamed into sector plans and practices – USD 787,600 - Biodiversity mainstreaming demonstrated in key production sectors – USD 1,040,000 Sub total Alternative – USD 3,500,600	GEF --------- Sub total Increment ----------
Outcome 3: Strengthened capacities for community based sustainable use and management of wild resources	- resource management- USD 10 million - tribal development- USD 5 million - land development – USD 25 million Sub total baseline – USD 40 million -------	The Alternative will include the following add-on measures to make community livelihoods and natural resource use more sustainable - Community based organizations (Panchayats, JFMCs, Self Help Groups (SHGs)) have adequate capacities to plan sustainable resource use – USD 310,000 - Support to sustainable resource use practices accentuate positive resource dependency – USD 972,000 - Community-based natural resource management governance model for the unique tribal local self-government (Edamalakudy Panchayat) – USD 396,700 Sub total Alternative – USD 1,678,000	GoK,Dept of Env, Forests, Science, Technology ---------- GEF --------- Sub total Increment --------

Benefits/ Outcomes	Baseline (B)	Alternative (A)	Increment (I = A-B)
Project Management	Sub total baseline	Sub total Alternative	GoK-Dept of Forests & Wildlife, (contribution to proj. mgmt.) --------- GEF (contribution to proj. mgmt.)
			--------- Sub total Increment ----------
	TOTAL BASELINE ----------	TOTAL ALTERNATIVE ----------	TOTAL INCREMENT --------- TOTAL COFIN --------- TOTAL GEF ----------

Terms of Reference for key project staff

Project Manager (PM)

Duration: **Full-time during the course of the project**
Location: **New Delhi**

Duties and responsibilities:

- PM will report to the NPD and UNDP CO and shall assist in supervising and coordinating the project to ensure its results are in accordance with the Project Document and the rules and procedures established;
- PM shall assume the overall responsibility for the day-today project management - both organizational and substantive matters – budgeting, planning and general monitoring of the project and ensure adequate information flow, discussions and feedback among the various stakeholders; ensure adherence to the project's work plan, prepare revisions of the work plan, if required;
- PM shall all ensure proper handling of logistics related to project workshops and events; prepare GEF quarterly progress reports, as well as any other reports requested by the Executing Agency and UNDP; prepare, and agree with UNDP on, terms of reference for national and international consultants and subcontractors;
- PM shall guide the work of consultants and subcontractors and oversee compliance with the agreed work plan; maintain regular contact with UNDP Country Office, State Implementing Partner and the National Project Director on project implementation issues of their respective competence;
- PM shall monitor the expenditure, commitments and balance of funds under the project budget lines, and draft project budget revisions; assume overall responsibility for meeting financial delivery targets set out in the agreed AWP, reporting on project funds and related record keeping;
- PM shall liaise with project partners to ensure their co-financing contributions are provided within the agreed terms;
- PM shall assume overall responsibility for reporting on project progress vis-à-vis indicators in the logframe;
- PM shall also undertake any other actions related to the project as requested by UNDP or the NPD.

Qualifications and skills:

- Post Graduate degree in the field of environment & management, sustainable development or related field
- Outstanding communication, project management and organizational skills
- At least 5 years of work experience in relevant field.
- Familiarity with the working environment and professional standards of international organizations.
- Working experience with GOI institutions
- Experience in working with NGOs and civil society, and with participatory approaches
- Proficiency in English and computer literacy

Project Coordinator (PC)

Duration: **Full-time during the course of the project**
Location: **Munnar**
Duties and responsibilities:

- Assist the SPD in supervising and coordinating the project to ensure that its results are in accordance with the Project Document and the rules and procedures established
- S/he shall report to the State Project Director.
- PC shall assume the primary responsibility for daily project management in the State - both organizational and substantive matters – budgeting, planning and general monitoring; ensure adequate information flow, discussions and feedback among the various stakeholders of the project;
- PC shall ensure adherence to the project's work plan, prepare proposals for revisions of the work plan, if required; assume overall responsibility for the proper handling of logistics related to project workshops and events in the state;
- PC shall prepare GEF progress reports for onward submission to NPMU as well as any other reports requested by the SPD, NPD and NPMU.
- PC shall provide logistics to the work of consultants and subcontractors and oversee compliance with the agreed work plan; maintain regular contact with NPMU, LLPMU/HRSDS, other stake holders and the State Project Director on project implementation issues;
- PC shall monitor the expenditures, commitments and balance of funds under the project budget lines, and draft project budget revisions; assume overall responsibility for meeting financial delivery targets set out in the agreed AWP, reporting on project funds and related record keeping; liaise with project partners to ensure their co-financing contributions are provided within the agreed terms; ensure collection of relevant data necessary to monitor progress against indicators specified in the logframe;
- PC shall assume overall responsibility for reporting on project progress vis-à-vis indicators in the logframe and undertake any other actions related to the project as requested by SPD.
- Qualifications and skills:
- Post Graduate degree in the field of environment & management, sustainable development or related field
- Outstanding communication, project management and organizational skills
- At least 5 years of work experience in relevant field.
- Familiarity with the working environment and professional standards of international organizations.
- Working experience with state and central governments
- Experience in working with NGOs and civil society, and with participatory approaches
- Proficiency in English and computer literacy

Financial-cum- Administrative Assistant (FAA)

Duration: **Full-time during the life of the project**
Location: **Munnar**
Duties and responsibilities:

- FAA shall assist the SPD/ LLPMU/HRSDS in the overall administrative and financial matters of the project at the State level.
- FAA shall be responsible for all administrative (contractual, organizational and logistical) and accounting (disbursements, record-keeping, cash management) matters under the project.
- S/he will be responsible for preparing periodic financial statements and compiling the annual project activities and achievement of planned project outputs.
- FAA shall provide general administrative and financial support to the project so as to ensure the smooth running of the landscape level project management unit; provide logistical support to the project staff and consultants in conducting different project activities;
- FAA shall monitor the budget expenditures by preparing payment documents, and compiling financial reports; maintain the project's disbursement ledger and journal; keep files with project documents, expert reports; control the usage of non expendable equipment (record keeping, drawing up regular inventories);
- FAA shall draft and finalize correspondence of administrative nature; arrange duty travel; fax, post and e-mail transmissions, and co-ordinate appointments;
- FAA shall also perform any other administrative/financial duties as requested by the SPD and organize and coordinate the procurement of services and goods under the project.

Qualifications and skills:

- University degree
- Fluency in written and spoken English and Malayalam
- Outstanding time-management, organizational and inter-personal skills
- At least 5-year experience in office administration, preferably with externally aided projects
- Good computer skills
- Experience of working with participatory projects

Office Assistant (OA)

Duration: **Full-time during the course of the project**
Location: **Munnar**
Duties and responsibilities:

- Provide all logistic support to SPD and LLPMU/HRSDS on drafting, computer assistance, file management, registry, arranging meetings, etc.

- S/he shall report to the State Project Director.
- Assist the SPD and LLPMU/HRSDS in the effective implementation of the project.

Qualifications and skills:

- Graduate degree
- Good communication, and organizational skills
- At least 3 years of work experience in relevant field.
- Good computer skills
- Working experience with GOI institutions.

Terms of Reference for Subject Specialists

Conservation Biologist (CB)

Duration: **Full-time during the course of the project**
Location: **Munnar**
Duties and Responsibilities:

- CB will provide technical support to project implementation at the landscape level particularly in the effective and quality delivery of conservation related activities.
- CB shall assist the other technical specialists in the preparation of Landscape Level Land Use Plan, Sector Plans, all research studies related to biodiversity, climate change, etc.
- CB shall assist the LLPMU/HRSDS in the revision of the Management Plans and Working Plans and its implementation.
- CB shall undertake the capacity building training programme of the conservation sector.
- CB shall assist the other specialists in the preparation of Natural Resource Management Plan, village micro-plans, etc
- CB shall undertake ecological monitoring as envisaged in the project
- CB shall provide technical support and guidance to the LLPMU/HRSDS and other project Consultants in coordinating and conducting different project activities related to conservation sector (trainings, workshops, stakeholder consultations, arrangements of study tour, etc.)
- CB shall advise the LLPMU/HRSDS in coordinating with the State Government, Consultants, other relevant agencies and stakeholders on the implementation of the project on technical matters related to conservation sector.
- CB shall keep regular contact with project experts and Consultants to inform them about the project technical details and changes and shall also review the reports and other documents for technical content with respect to conservation sector.
- S/he will also provide technical support to the development, implementation and/or evaluation of the project activities in the focal area.
- CB shall work under the overall guidance and supervision of the SPD and be part of the LLPMU/HRSDS.

Qualifications and skills:

- Post Graduate degree in the field of natural resource management or related field
- Outstanding communication, project management and organizational skills
- At least 3 years of work experience in relevant field.
- Familiarity with the working environment and professional standards of international organizations.
- Working experience with GOI institutions involved in sustainable natural resource management
- Experience in working with NGOs and civil society, and with participatory approaches
- Proficiency in English and computer literacy
- Proficiency in GIS application

Socio-economic and Livelihood Specialist (SELS)

Duration: **Full-time during the course of the project**
Location: **Munnar**
Duties and Responsibilities:

- SELS will provide technical support to project implementation at the landscape level particularly in the effective and quality delivery of socio-economic/ livelihood activities.
- SELS shall assist the technical specialists in the preparation of Landscape Level Land Use Plan, Sector Plans, all research studies related to biodiversity, climate change, etc.
- SELS shall conduct frequent socio-economic monitoring of the project area with a view to generate analytical information about the project implementation.
- SELS shall provide technical support and guidance to the LLPMU/HRSDS and other project consultants in coordinating and conducting different project activities related to socio-economic sector (trainings, workshops, stakeholder consultations, arrangements of study tour, etc.)
- SELS shall assist the LLPMU/HRSDS in the revision of the Management Plans and Working Plans and its implementation.
- SELS shall undertake the capacity building training programme of the livelihood sector.
- SELS shall assist the specialists in the preparation of Natural Resource Management Plan, micro-plans.
- SELS shall advise the LLPMU/HRSDS in coordinating with the State Government, Consultants, other relevant agencies and stakeholders on technical matters related to implementation of the project with respect to socio-economic sector.
- SELS shall keep regular contact with project experts and consultants to inform them about the project technical details and changes and shall also review the reports and other documents for technical content with respect to socio-economic sector.
- S/he will also provide support to the development, implementation and/or evaluation of the project activities in the focal area.
- The SELS will be responsible for advising project partners on the suitability of activities, livelihood strategies, policy change measures etc.
- SELS shall work under the overall guidance and supervision of the SPD and be part of the LLPMU/HRSDS.

Qualifications and skills:

- Post Graduate degree in the field of social sciences/ economics or related field
- Outstanding communication, project management and organizational skills
- At least 3 years of work experience in relevant field.
- Familiarity with the working environment and professional standards of international organizations.
- Working experience with GOI institutions involved in sustainable development/ community empowerment/ natural resource management
- Experience in working with NGOs and civil society, and with participatory approaches
- Proficiency in English and computer literacy

Communication and Outreach Specialist (COS)

Duration: **Full-time during the course of the project**
Location: **Munnar**
Duties and Responsibilities:

- COS will provide technical support to project implementation in the landscape particularly in ensuring cross-sectoral coordination, participation of various stakeholders (including the production sectors), etc in project activities and effective and quality delivery of communication and outreach activities. .
- COS shall work under the overall guidance and supervision of the SPD and be part of the LLPMU/HRSDS.
- COS shall be focusing primarily on stakeholder engagement, particularly private production sectors in the project umbrella.
- COS shall provide technical support and guidance to the LLPMU/HRSDS and other project consultants in developing proper communication strategy while conducting different project activities (trainings, workshops, stakeholder consultations, arrangements of study tour, preparation of knowledge products, etc.)
- COS shall advise the LLPMU/HRSDS in coordinating with the State Government, Consultants, other relevant agencies and stakeholders on the implementation of the project with respect to communication and outreach activities.
- COS shall keep regular contact with project experts and consultants to inform them about the project details and changes and shall also review the reports and other documents for correctness of form and contents.
- S/he will also provide support to the development, implementation and/or evaluation of the project activities in the focal area.
- S/he shall also document the project process on a regular basis.

Qualifications and skills:

- Post Graduate degree.
- Outstanding communication, project management and organizational skills
- At least 3 years of work experience in relevant field.
- Familiarity with the working environment and professional standards of international organizations.
- Working experience with GOI institutions involved in sustainable development/ community empowerment/ natural resource management

- Experience in working with NGOs and civil society, and with participatory approaches
- Proficiency in English and computer literacy
- Familiarity with production of audio visual and printed materials.

Roles and responsibilities of consultants providing technical expertise under the project

Output	Name of the position	National/ international	Period	Task
Output 1.1: Strengthened knowledge generation and dissemination system.	Research Gap Analysis specialist	National	4 weeks	Research gap Analysis Specialist shall conduct an assessment of existing research gaps in HRML and propose priority research studies to be carried out.
Output 1.1 : Strengthened knowledge generation and dissemination system.	Specialists for other studies identified under Research Gap Analysis	National	430 weeks	Undertake relevant studies identified under Research Gap Analysis.
Output 1.1 : Strengthened knowledge generation and dissemination system.	Tchnical coordinator	National	54 months	To supervise the preparation and generation of knowledge products and guide the cross-sectoral planning process
Output 1.2: Landscape Level Land Use Plan prepared for HRML	Lead specialist for preparation of Land Use Plan.	National	50 weeks	Lead Specialist shall prepare the Land Use Plan for HRML.
Output 1.2: Landscape Level Land Use Plan prepared for HRML	Conservation Biologist(CB) , LLPMU/HRSDS	National	2months	CB shall assist the Lead Specialist in the preparation of the Landscape Level Land Use Plan for HRML.
Output 1.2: Landscape Level Land Use Plan	Socio-economic and Livelihood Specialist (SELS), LLPMU/HRSDS	National	2 months	SELS shall assist the Lead Specialist in the preparation of the Land Use Plan for HRML.

Output	Name of the position	National/ international	Period	Task
prepared for HRML				
Output 1.2: Landscape Level Land Use Plan prepared for HRML	Communication and Outreach Specialist (COS), LLPMU/HRSDS	National	2 months	COS shall assist the Lead Specialist in the preparation of the Land Use Plan for HRML.
Output 1.2: Landscape Level Land Use Plan prepared for HRML	Specialist for compendium of best practices on mainstreaming.	National	2 weeks	Shall prepare a compendium of national and international best practices in mainstreaming mountain biodiversity in production sectors.
Output 1.3: BD friendly sector plans prepared.	Sector specialists for preparation of sector plans.	National	30 weeks	Sector specialists shall lead preparation of BD friendly Sector Plans for key sectors (tea, cardamom, commercial forestry, tourism, Protected Areas etc.)
Output 1.3: BD friendly sector plans prepared.	Conservation Biologist(CB) , LLPMU/HRSDS	National	2 months	CB shall assist sector specialists in preparation of BD friendly sector plans.
Output 1.3: BD friendly sector plans prepared.	Socio-economic and Livelihood Specialist (SELS), LLPMU/HRSDS	National	2 months	SELS shall assist sector specialists in preparation of BD friendly sector plans
Output 1.3: BD friendly sector plans prepared.	Communication and Outreach Specialist (COS), LLPMU/HRSDS	National	2 months	COS shall assist sector specialists in preparation of BD friendly sector plans
Output 1.4: Cross sectoral landscape level institutional platform is in place.	Legal expert for drafting constitution of HRSDS.	National	5weeks	Legal expert shall prepare rules, bye laws and operation manual for HRSDS.
Output 1.4: Cross sectoral landscape level institutional platform is in place.	Conservation Biologist(CB) , LLPMU/HRSDS	National	1 month	CB shall assist Legal expert in preparation of rules, bye laws and operation manual for HRSDS and support functioning of HRSDS during project period.
Output 1.4: Cross sectoral landscape level institutional platform is in	Socio-economic and Livelihood Specialist (SELS), LLPMU/HRSDS	National	1 month	SELS shall assist Legal expert in preparation of rules, bye laws and operation manual for HRSDS and support functioning of HRSDS during project

Output	Name of the position	National/ international	Period	Task
place.				period.
Output 1.4: Cross sectoral landscape level institutional platform is in place.	Communication and Outreach Specialist (COS), LLPMU/HRSDS	National	1 month	COS shall assist Legal expert in preparation of rules, bye laws and operation manual for HRSDS and support functioning of HRSDS during project period.
Output 1.4: Cross sectoral landscape level institutional platform is in place.	International specialist for independent mid term evaluation.	International	4 weeks	International specialist shall lead independent mid term evaluation of project.
Output 1.4: Cross sectoral landscape level institutional platform is in place.	National specialist for independent mid term evaluation of project.	National	6 weeks	National specialist assists international specialist for independent mid term evaluation.
Output 1.4: Cross sectoral landscape level institutional platform is in place.	International specialist for independent final evaluation.	International	6 weeks	International specialist shall lead independent final evaluation of project.
Output 1.4: Cross sectoral landscape level institutional platform is in place.	National specialist for independent final evaluation.	National	6 weeks	National specialist assists international specialist for independent final evaluation.
Output 1.5: Replication strategies developed for mountain landscapes	National specialist for developing replication strategy	National	5 weeks	National specialist shall work on a replication strategy for similar approaches across other mountain areas.
Output 1.5: Replication strategies developed for mountain landscapes	Conservation Biologist (CB), LLPMU/HRSDS	National	1 month	CB shall assist the national specialist on replication strategy.
Output 1.5: Replication strategies developed for	Socio-economic and Livelihood Specialist (SELS), LLLPMU/HRSDS	National	1 month	SLES shall assist the national specialist on replication strategy.

Output	Name of the position	National/ international	Period	Task
mountain landscapes				
Output 1.5: Replication strategies developed for mountain landscapes	Communication and Outreach Specialist (COS), LLPMU/HRSDS	National	1 month	COS shall assist the national specialist on replication strategy.
Output 1.6: Policies and legal framework reviewed and harmonised.	Legal specialist for developing strategy for harmonising policy and legal framework.	National	15 weeks	Law specialist shall look into existing laws and policies of different sectors in HRML and develop strategies for harmonisation.
Output 1.6: Policies and legal framework reviewed and harmonised.	Conservation Biologist (CB), LLPMU/HRSDS	National	1 month	CB shall assist the law specialist in developing strategies for harmonisation.
Output 1.6: Policies and legal framework reviewed and harmonised.	Socio-economic and Livelihood Specialist (SELS),LLPMU/HRSDS	National	1 month	SLES shall assist the law specialist in developing strategies for harmonisation
Output 1.6: Policies and legal framework reviewed and harmonised.	Communication and Outreach Specialist (COS), LLPMU/HRSDS	National	1 month	COS shall assist the law specialist in developing strategies for harmonisation
Output 2.1: Capacities for applying landscape approaches developed among conservation and production sector staff.	Conservation Biologist (CB), LLPMU/HRSDS	National	1 month	CB shall provide support for capacity building programmes for conservation and production sector staff.
Output 2.1: Capacities for applying landscape approaches developed among conservation and	Socio-economic and Livelihood Specialist (SELS),LLPMU/HRSDS	National	1 month	SELS shall provide support for capacity building programmes for conservation and production sector staff.

Output	Name of the position	National/ international	Period	Task
mountain landscapes				
Output 1.5: Replication strategies developed for mountain landscapes	Communication and Outreach Specialist (COS), LLPMU/HRSDS	National	1 month	COS shall assist the national specialist on replication strategy.
Output 1.6: Policies and legal framework reviewed and harmonised.	Legal specialist for developing strategy for harmonising policy and legal framework.	National	15 weeks	Law specialist shall look into existing laws and policies of different sectors in HRML and develop strategies for harmonisation.
Output 1.6: Policies and legal framework reviewed and harmonised.	Conservation Biologist (CB), LLPMU/HRSDS	National	1 month	CB shall assist the law specialist in developing strategies for harmonisation.
Output 1.6: Policies and legal framework reviewed and harmonised.	Socio-economic and Livelihood Specialist (SELS),LLPMU/HRSDS	National	1 month	SLES shall assist the law specialist in developing strategies for harmonisation
Output 1.6: Policies and legal framework reviewed and harmonised.	Communication and Outreach Specialist (COS), LLPMU/HRSDS	National	1 month	COS shall assist the law specialist in developing strategies for harmonisation
Output 2.1: Capacities for applying landscape approaches developed among conservation and production sector staff.	Conservation Biologist (CB), LLPMU/HRSDS	National	1 month	CB shall provide support for capacity building programmes for conservation and production sector staff.
Output 2.1: Capacities for applying landscape approaches developed among conservation and	Socio-economic and Livelihood Specialist (SELS),LLPMU/HRSDS	National	1 month	SELS shall provide support for capacity building programmes for conservation and production sector staff.

Output	Name of the position	National/ international	Period	Task
place.				period.
Output 1.4: Cross sectoral landscape level institutional platform is in place.	Communication and Outreach Specialist (COS), LLPMU/HRSDS	National	1 month	COS shall assist Legal expert in preparation of rules, bye laws and operation manual for HRSDS and support functioning of HRSDS during project period.
Output 1.4: Cross sectoral landscape level institutional platform is in place.	International specialist for independent mid term evaluation.	International	4 weeks	International specialist shall lead independent mid term evaluation of project.
Output 1.4: Cross sectoral landscape level institutional platform is in place.	National specialist for independent mid term evaluation of project.	National	6 weeks	National specialist assists international specialist for independent mid term evaluation.
Output 1.4: Cross sectoral landscape level institutional platform is in place.	International specialist for independent final evaluation.	International	6 weeks	International specialist shall lead independent final evaluation of project.
Output 1.4: Cross sectoral landscape level institutional platform is in place.	National specialist for independent final evaluation.	National	6 weeks	National specialist assists international specialist for independent final evaluation.
Output 1.5: Replication strategies developed for mountain landscapes	National specialist for developing replication strategy	National	5 weeks	National specialist shall work on a replication strategy for similar approaches across other mountain areas.
Output 1.5: Replication strategies developed for mountain landscapes	Conservation Biologist (CB), LLPMU/HRSDS	National	1 month	CB shall assist the national specialist on replication strategy.
Output 1.5: Replication strategies developed for	Socio-economic and Livelihood Specialist (SELS), LLLPMU/HRSDS	National	1 month	SLES shall assist the national specialist on replication strategy.

Output	Name of the position	National/ international	Period	Task
production sector staff.				
Output 2.1: Capacities for applying landscape approaches developed among conservation and production sector staff.	Communication and Outreach Specialist (COS), LLPMU/HRSDS	National	1 month	COS shall provide support for capacity building programmes for conservation and production sector staff.
Output 2.3: Improved interventions for securing HVBAs	Specialists for mapping of HVBAs	National	14 weeks	To map the HVBAs of HRML
Output 3.1: Capacity strengthening of community based organizations for sustainable resource use.	Conservation Biologist (CB), LLPMU/HRSDS	National	20 months	CB shall support capacity strengthening activities (biological aspects).
Output 3.1: Capacity strengthening of community based organizations for sustainable resource use.	Socio-economic and Livelihood Specialist (SELS), LLPMU/HRSDS	National	20 months	SELS shall support capacity strengthening activities (socio economic aspects).
Output 3.1: Capacity strengthening of community based organizations for sustainable resource use.	Communication and Outreach Specialist (COS), LLPMU/HRSDS	National	20 months	COS shall support capacity strengthening activities (nature awareness and out reach programmes)
Output 3.2: Support to communities in HRML for sustainable resource use practices.	Conservation Biologist (CB), LLPMU/HRSDS	National	20 months	CB shall give support to communities for sustainable resource use practices.

Output	Name of the position	National/ International	Period	Task
Output 3.2: Support to communities in HRML for sustainable resource use practices.	Socio-economic and Livelihood Specialist (SELS), LLPMU/HRSDS	National	20 months	SELS shall give support to communities for sustainable resource use practices.
Output 3.2: Support to communities in HRML for sustainable resource use practices.	Communication and Outreach Specialist (COS), LLPMU/HRSDS	National	20 months	COS shall give support to communities for sustainable resource use practices.
Output 3.3: Support to Edamalakkudy Panchayat for sustainable resource management governance model.	Conservation Biologist (CB), LLPMU/HRSDS	National	6 months	CB shall provide support to Edamalakkudy Panchayat on sustainable resource governance model.
Output 3.3: Support to Edamalakkudy Panchayat for sustainable resource management governance model.	Socio-economic and Livelihood Specialist (SELS), LLPMU/HRSDS	National	6 months	SELS shall provide support to Edamalakkudy Panchayat on sustainable resource governance model.
Output 3.3: Support to Edamalakkudy Panchayat for sustainable resource management governance model.	Communication and Outreach Specialist (COS), LLPMU/HRSDS	National	6 months	COS shall provide support to Edamalakkudy Panchayat on sustainable resource governance model.
Project Management	National Project Manager	National	54 months	Project Manager shall coordinate the project at national level.
Project Management	State Project Coordinator	National	54 months	State Project Coordinator shall supervise and coordinate project implementation

Output	Name of the position	National/ international	Period	Task
				with state and central governments and other stakeholders.
Project Management	State Financial cum Administrative Assistant	National	54 months	Shall assist Project Coordinator in financial and administrative aspects of project at state level.
Project Management	Office Assistants (2)	National	108 months	Shall provide necessary office assistance for implementation of project at state level

Annexure 20

SO I & SO II Tracking tools (kept separately)

GEF-4 Tracking Tool for GEF Biodiversity Focal Area Strategic Objective Two: Mainstreaming Biodiversity Conservation in Production Landscapes /Seascapes and Sectors

I. Project General Information

1. Project Name: India High Range Landscape Project: Developing an effective multiple use management framework for conserving biodiversity in the mountain landscape of the High Ranges, Western Ghats, India.
2. Project Type (MSP or FSP): FSP
3. Project ID (GEF):
4. Project ID (IA):
5. Implementing Agency: UNDP
6. Country: India
7. Name of reviewers completing tracking tool and completion dates:

	Name	Title	Agency
Work Program Inclusion	Dr.S.K.Khanduri	National Project Director	MoEF
	V.Gopinathan	State Project Director	Kerala Forest and Wildlife Department
	James Zacharias	National Consultant Team Leader	
Project Mid-term			
Final Evaluation/ project completion			

8. Project duration: Planned 5 years Actual _____ years
9. Lead Project Executing Agency: Ministry of Environment and Forests (MoEF)
10. GEF Strategic Program:
    - ✓☐ Strengthening the policy and regulatory framework for mainstreaming biodiversity (SP 4)
    - ☐ Fostering markets for biodiversity goods and services (SP 5)
11. Production sectors and/ or ecosystem services directly targeted by project:

Please identify the main production sectors involved in the project. Please put "P" for sectors that are primarily and directly targeted by the project and "S" for those that are secondary or incidentally affected by the project.

Agriculture	S
Fisheries	S
Forestry and Wildlife	P
Tourism	P
Mining	S
Transportation	S
Other (please specify):	
Tea	P
Cardamom	P
Tribal livelihoods	P

II. Project Landscape Coverage

12. What is the extent (in hectares) of the landscape or seascape where the project will directly or indirectly contribute to biodiversity conservation or sustainable use of its components? An example is provided in the table below.

Area Coverage	Total hectares targeted at the following intervals during the project cycle:		
	At project start	At Mid-term Evaluation	At Final Evaluation
Landscape area directly covered by the project (ha)	1,21,700		
Landscape area indirectly covered by the project (ha)	1,88,300		

Explanation for indirect coverage numbers:

The landscape area is 3,10,000 ha out of which PAs (37,100 ha) and HVBAs (84,600 ha) will be directly covered by the project. The remaining area of 1,88,300 ha of lands under cardamom, tea, agriculture, tourism etc. will be indirectly impacted by the project through awareness, capacity development, demonstration, marketing support and outreach.

13. (b) Are there Protected Areas within the landscape covered by the project? If so, names these PAs, their IUCN or national PA category, and their extent in hectares.

	Name of Protected Areas	IUCN and/or national category of PA	Extent in hectares
1.	Eravikulam National Park	Category II	9,700
2	Anaimudishola national park	Category II	9,040
3	Pampadumshola National Park	Category II	3,200

4	Mathikettanshola National Park	Category II	750
5	Chinnar Wildlife Sanctuary	Category IV	130
6	Kurinjimala Wildlife Sanctuary	Category IV	1,280
7	Idukki Wildlife sanctuary	Category IV	2,500
8	Thattekkad Bird Sanctuary	Category IV	10,500

14. (c) Within the landscape covered by the project, is the project implementing payment for environmental service schemes?
No, the project will not be implementing such a scheme. However, as part of the capacity development and knowledge management activities, emphasis will be placed on valuation of ecosystem services. This will provide the technical information and background for potential establishment of such a scheme in the future.

III. Management Practices Applied

15. Within the scope and objectives of the project, please identify in the table below the management practices employed by project beneficiaries that integrate biodiversity considerations and the area of coverage of these management practices. Please also note if a certification system is being applied and identify the certification system being used. Note: this could range from farmers applying organic agricultural practices, forest management agencies managing forests per Forest Stewardship Council (FSC) guidelines or other forest certification schemes, artisanal fisherfolk practicing sustainable fisheries management, or industries satisfying other similar agreed international standards, etc.

Note to table below: Under this project, the first step for promoting mainstreaming of biodiversity conservation considerations into production sector activities will be the development of a landscape-level, biodiversity-friendly Land Use Plan. This will look at current land use in the project area and will then provide a plan for how land uses by the different sectors can be made more compatible with the conservation needs of the HRML. Once background studies and assessments are completed and the Land Use Plan (including sector-by-sector plans) is prepared, specific changes to management practices of the production sectors will become clear. Management practices of many sectors are ad hoc that do not warrant baselines and monitoring protocols. Therefore, at this stage, the table below is only indicative.

	Specific management practices that integrate BD	Name of certification system being used	Area of coverage foreseen at start of project	Achievement at Mid-term Evaluation of Project	Achievement at Final Evaluation of Project
1	Conservation sector (PAs): Eco-restoration of areas under exotic plantations and invasives and	Management Effectiveness	Around 5,000 ha.		

	Specific management practices that integrate BD	Name of certification system being used	Area of coverage foreseen at start of project	Achievement at Mid-term Evaluation of Project	Achievement at Final Evaluation of Project
	heavily degraded areas due to grazing, encroachments etc.[2]	Evaluation Scorecard (developed by WII)			
2	Tribal Livelihoods: Sustainable NTFP management system defined under the micro plan; sustainable grazing regime, sustainable fuel wood extraction	NA	10,000 ha		
3	Production Sectors:				
3a	Tea: ex. Identification, protection and eco restoration of fragments, energy efficiency, sustainable practices for production of tea.	Rain forest alliance certification	5000 ha		
3b	Cardamom: ex. Promotion of organic aquaculture practices, branding as 'shade cardamom' etc.	Organic certification	2,000 ha		
3c	Forestry: Identification, demarcation and protection of HVBAs and eco restoration of areas under exotic plantations of wattle and eucalyptus.	Management Effectiveness Evaluation Scorecard.	84,600 ha		
4	Tourism: ex. Energy and water consumption, waste management etc.	Responsible Tourism Initiative Certification.	200 ha		

IV. Market Transformation

16. For those projects that have identified market transformation as a project objective, please describe the project's ability to integrate biodiversity considerations into the mainstream economy by measuring the market changes to which the project contributed.
Not applicable.

V. Policy and Regulatory frameworks

For those projects that have identified addressing policy, legislation, regulations, and their implementation as project objectives, please complete the following series of questions: 17a, 17b, and 17c.

[2] During the first year of the project, management plans of PAs and working plans of Forest Divisions will be revised that may recommend additional management interventions. These will be documented and included in this tracking tool when available.

17. (a) Please complete this table at CEO endorsement for each sector that is a primary or a secondary focus of the project. Please answer YES or NO to each statement under the sectors that are a focus of the project.

The entry-point for this project is at the landscape level in the project site. In this landscape, the project will aim to strengthen multiple use and biodiversity mainstreaming by developing a Landscape Level Land Use Plan and individual sector plans for key sectors. This site-level experience will provide important lessons that can progressively be integrated into national policy and regulatory frameworks.

Statement: Please answer YES or NO for each sector that is a focus of the project.	Sectors targeted by the project					
	Tea	Cardamom	Conservation	Tourism	Forestry	Tribal Livelihood
Biodiversity considerations are mentioned in sector policy	Yes	Yes	Yes	No	Yes	No
BD considerations are mentioned in sector policy through specific legislation	Yes	Yes	Yes	No	Yes	No
Regulations are in place to implement the legislation	Yes	Yes	Yes	No	Yes	No
The regulations are under implementation	Yes	Yes	Yes	No	Yes	No
The implementation of regulations is enforced	No	No	Yes	No	Yes	No
Enforcement of regulations is monitored	No	No	Yes	No	No	No

17. (b) Please complete this table at the project mid-term for each sector that is a primary or a secondary focus of the project.

Statement: Please answer YES or NO for each sector that is a focus of the project.	Sectors targeted by the project					
	Tea	Cardamom	Conservation	Tourism	Forestry	Tribal Livelihood
Biodiversity considerations are mentioned in sector policy						
BD considerations are mentioned in sector policy through specific legislation						
Regulations are in place to implement the legislation						
The regulations are under implementation						
The implementation of regulations is enforced						
Enforcement of regulations is monitored						

17. (c) Please complete this table at project closure for each sector that is a primary or a secondary focus of the project.

Statement: Please answer YES or NO for each sector that is a focus	Sectors targeted by the project			

of the project.	Tea	Cardamom	Conservation	Tourism	Forestry	Tribal Livelihood
Biodiversity considerations are mentioned in sector policy						
BD considerations are mentioned in sector policy through specific legislation						
Regulations are in place to implement the legislation						
The regulations are under implementation						
The implementation of regulations is enforced						
Enforcement of regulations is monitored						

All projects please complete question 17(d) at the project mid-term evaluation and at the final evaluation, if relevant:

17. (d) Within the scope and objectives of the project, has the private sector undertaken voluntary measures to incorporate biodiversity considerations in production? If yes, please provide brief explanation and specifically mention the sectors involved. An example of this could be a mining company minimizing the impacts on biodiversity by using low-impact exploration techniques and by developing plans for restoration of biodiversity after exploration as part of the site management plan.

VI. Other Impacts

Please briefly summarize other impacts that the project has had on mainstreaming biodiversity that have not been recorded above.

Annex 21.

Environmentaland Social Screening Summary

Name of Proposed Project: India High Ranges Landscape Project (PIMS 4651)

A. Environmental and Social Screening Outcome

☐ Category 1. No further action is needed

☒ Category 2. Further review and management is needed. There are possible environmental and social benefits, impacts, and/or risks associated with the project (or specific project component), but these are predominantly indirect or very long-term and so extremely difficult or impossible to directly identify and assess.

☒ Category 3. Further review and management is needed, and it is possible to identify these with a reasonable degree of certainty. If Category 3, select one or more of the following sub-categories:

☒ Category 3a: Impacts and risks are limited in scale and can be identified with a reasonable degree of certainty and can often be handled through application of standard best practice, but require some minimal or targeted further review and assessment to identify

and evaluate whether there is a need for a full environmental and social assessment (in which case the project would move to Category 3b). See Section 3 of the Review and Management Guidance.

☐ Category 3b: Impacts and risks may well be significant, and so full environmental and social assessment is required. In these cases, a scoping exercise will need to be conducted to identify the level and approach of assessment that is most appropriate. See Section 3 of Review and Management Guidance.

B. Environmental and Social Issues (for projects requiring further environmental and social review and management)

Environmental impacts: The project explicit objective is to repair and maintain the ecological integrity of the High Ranges Mountian Landscape in the Western Ghats of India by championing a radical shift in the governance approach that promotes cross-sectoral coordinated planning, execution and compliance monitoring so that ecosystem integrity and life-support functions of the region are restored/ maintained for posterity. The project will secure important PAs and outlying areas of high biodiversity areas while also reducing negative impacts of production sectors' operations and practices (including those of local communities livelihood practices) by making them more biodiversity conservation compatible. As such the project is expected to have no significant environmental impacts. **Social impacts:** One of the important focus of the project at the community level is to work on a resource governance approach that will effectively implement community forest rights under the Forest Rights Act (FRA) -- which will endow tribal communities with community level rights for management of natural resources (forest) in their areas. This approach is expected to safegaurd tirbal communities rights against vested external powerful interests. Gender aspects of community level natural resource management including traditional gender roles and how the project will impact such roles have been carefully considered and intergrated in the project design.

C. Next Steps (for projects requiring further environmental and social review and management):

The project plans to undertake limited community-based livelihood development activities as part of its overall approach to reduce impacts from production sectors on biodiversity. The project will ensure that these are located outside the PAs and high biodiversity rich areas whilst also ensuring such activities are environmentally sustainable. The design of management model for the FRA implementation will involve intensive consultation with local tribal communities so that their concerns, views and interests are taken on board. The model will also be put to a appriasal and clearance process at the community level so that it is acceptable to the community tribal groups while also meeting the standards and requirements under the FRA. In terms of gender issues, the project will ensure to build on the good understanding of gender roles in natural resource management at the community level and take steps to address adequately gender dimensions relevant to the project. The project will also ensure that all stakeholders including local community groups and community based institutions are adequately represented on project coordination and decision making structures at the local level so that decisions made on resource allocation and planning are carried out in a participatory and inclusive manner.

D. Sign Off

_____

Project Manager: doley.tshering

Signed Date: 2013-08-07

ENVIRONMENTAL AND SOCIAL SCREENING CHECKLIST

Name of Proposed Project: India High Ranges Landscape Project (PIMS 4651)

QUESTION 1

Has a combined environmental and social assessment/review that covers the proposed project already been completed by implementing partners or donor(s)?

Answer to Question 1:. . . . . .No

QUESTION 2

Do ALL outputs and activities described ONLY fall in the Project Document fall within the following categories?

1. Procurement (in which case UNDP's Procurement Ethics and Environmental Procurement Guide need to be complied with)

2. Report preparation

3. Training

4. Event/workshop/meeting/conference (refer to Green Meeting Guide)

5. Communication and dissemination of results

Answer to Question 2:. . . . . .No

QUESTION 3

Does the proposed project include activities and outputs that support upstream planning processes that potentially pose environmental and social impacts or are vulnerable to environmental and social change (refer to Table 3.1 for examples)? (Note that upstream planning processes can occur at global, regional, national, local and sectoral levels)

Evaluation Result of Checklist Table 3.1:. . . . . .Yes

TABLE 3.1 EXAMPLES OF UPSTREAM PLANNING PROCESSES WITH POTENTIAL DOWNSTREAM ENVIRONMENTAL AND SOCIAL IMPACTS	
1. Support for the elaboration or revision of global- level strategies, policies, plans, and programmes. For example, capacity development and support related to international negotiations and agreements. Other examples might include a global water governance project or a global MDG project.	No
2. Support for the elaboration or revision of regional-level strategies, policies and plans, and programmes. For example, capacity development and support related to transboundary programmes and planning (river basin management, migration, international waters, energy development and access, climate change adaptation etc.).	No
3. Support for the elaboration or revision of national-level strategies, policies, plans and programmes. For example, capacity development and support related to national development policies, plans, strategies and budgets, MDG-based plans and strategies (e.g. PRS/PRSPs, NAMAs), sector plans.	No
4. Support for the elaboration or revision of sub-national/local-level strategies, polices, plans and programmes. For example, capacity development and support for district and local level development plans and regulatory frameworks, urban plans, land use development plans, sector plans, provincial development plans, provision of services, investment funds, technical guidelines and methods, stakeholder engagement.	Yes

QUESTION 4

Does the proposed project include the implementation of downstream activities that potentially pose environmental and social impacts or are vulnerable to environmental and social change? **Evaluation Result of Checklist Table 4.1:** . . . . . .Yes

TABLE 4.1 ADDITIONAL SCREENING QUESTIONS TO DETERMINE THE NEED AND POSSIBLE EXTENT OF FURTHER ENVIRONMENTAL AND SOCIAL REVIEW AND MANAGEMENT	
1. Biodiversity and Natural Resources	
1.1 Would the proposed project result in the conversion or degradation of modified habitat, natural habitat or critical habitat?	No
1.2 Are any development activities proposed within a legally protected area (e.g. natural reserve, national park) for the protection or conservation of biodiversity?	No
1.3 Would the proposed project pose a risk of introducing invasive alien species?	No
1.4 Would the proposed project pose a risk of introducing invasive alien species?	No
1.5 Does the project involve the production and harvesting of fish populations or other aquatic species without an accepted system of independent certification to ensure sustainability (e.g. the Marine Stewardship Council certification system, or certifications, standards, or processes established or accepted by the relevant National Environmental Authority)?	No
1.6 Does the project involve significant extraction, diversion or containment of surface or ground water? For example, construction of dams, reservoirs, river basin developments, groundwater extraction.	No
1.7 Does the project pose a risk of degrading soils?	No
2. Pollution	
2.1 Would the proposed project result in the release of pollutants to the environment due to routine or non-routine circumstances with the potential for adverse local, regional, and transboundary	No

impacts?	
2.2 Would the proposed project result in the generation of waste that cannot be recovered, reused, or disposed of in an environmentally and socially sound manner?	No
2.3 Will the propose project involve the manufacture, trade, release, and/or use of chemicals and hazardous materials subject to international action bans or phase-outs? For example, DDT, PCBs and other chemicals listed in international conventions such as the Stockholm Convention on Persistent Organic Pollutants, or the Montreal Protocol.	No
2.4 Is there a potential for the release, in the environment, of hazardous materials resulting from their production, transportation, handling, storage and use for project activities?	No
2.5 Will the proposed project involve the application of pesticides that have a known negative effect on the environment or human health?	No
3. Climate Change	
3.1 Will the proposed project result in significant greenhouse gas emissions? The Environment and Social Screening Procedure Guidance provides additional guidance for answering this question.	No
3.2 Is the proposed project likely to directly or indirectly increase environmental and social vulnerability to climate change now or in the future (also known as maladaptive practices)? You can refer to the Environment and Social Screening Procedure Guidance to help you answer this question. For example, a project that would involve indirectly removing mangroves from coastal zones or encouraging land use plans that would suggest building houses on floodplains could increase the surrounding population's vulnerability to climate change, specifically flooding.	No
4. Social Equity and Equality	

4.1 Would the proposed project have environmental and social impacts that could negatively affect indigenous people or other vulnerable groups?	No
4.2 Is the project likely to significantly impact gender equality and women's empowerment ?	No
4.3 Is the proposed project likely to directly or indirectly increase social inequalities now or in the future?	No
4.4 Will the proposed project have variable impacts on women and men, different ethnic groups, social classes?	Yes. Positive impacts are envisaged.
4.5 Have there been challenges in engaging women and other certain key groups of stakeholders in the project design process?	No
4.6 Will the project have specific human rights implications for vulnerable groups?	No
5. Demographics	
5.1 Is the project likely to result in a substantial influx of people into the affected community(ies)?	No
5.2 Would the proposed project result in substantial voluntary or involuntary resettlement of populations? For example, projects with environmental and social benefits (e.g. protected areas, climate change adaptation) that impact human settlements, and certain disadvantaged groups within these settlements in particular.	No
5.3 Would the proposed project lead to significant population density increase which could affect the environmental and social sustainability of the project? For example, a project aiming at financing tourism infrastructure in a specific area (e.g. coastal zone, mountain) could lead to significant population density increase which could have serious environmental and social impacts (e.g.	No

destruction of the area's ecology, noise pollution, waste management problems, greater work burden on women).	
6. Culture	
6.1 Is the project likely to significantly affect the cultural traditions of affected communities, including gender-based roles?	No
6.2 Will the proposed project result in physical interventions (during construction or implementation) that would affect areas that have known physical or cultural significance to indigenous groups and other communities with settled recognized cultural claims?	No
6.3 Would the proposed project produce a physical "splintering" of a community? For example, through the construction of a road, powerline, or dam that divides a community.	No
7. Health and Safety	
7.1 Would the proposed project be susceptible to or lead to increased vulnerability to earthquakes, subsidence, landslides, erosion, flooding or extreme climatic conditions? For example, development projects located within a floodplain or landslide prone area.	No
7.2 Will the project result in increased health risks as a result of a change in living and working conditions? In particular, will it have the potential to lead to an increase in HIV/AIDS infection?	No
7.3 Will the proposed project require additional health services including testing?	No
8. Socio-Economics	
8.1 Is the proposed project likely to have impacts that could affect women's and men's ability to use, develop and protect natural resources and other natural capital assets? For example, activities that could lead to natural resources degradation or depletion in communities who depend on these	No

resources for their development, livelihoods, and well-being?	
8.2 Is the proposed project likely to significantly affect land tenure arrangements and/or traditional cultural ownership patterns?	No
8.3 Is the proposed project likely to negatively affect the income levels or employment opportunities of vulnerable groups?	No
9. Cumulative and/or Secondary Impacts	
9.1 Is the proposed project location subject to currently approved land use plans (e.g. roads, settlements) which could affect the environmental and social sustainability of the project? For example, future plans for urban growth, industrial development, transportation infrastructure, etc.	No
9.2 Would the proposed project result in secondary or consequential development which could lead to environmental and social effects, or would it have potential to generate cumulative impacts with other known existing or planned activities in the area? For example, a new road through forested land will generate direct environmental and social impacts through the cutting of forest and earthworks associated with construction and potential relocation of inhabitants. These are direct impacts. In addition, however, the new road would likely also bring new commercial and domestic development (houses, shops, businesses). In turn, these will generate indirect impacts. (Sometimes these are termed "secondary" or "consequential" impacts). Or if there are similar developments planned in the same forested area then cumulative impacts need to be considered.	No

Annex 22:

Capacity Development Score Card

This scorecard has been designed specifically for this Project, as a tool to measure success in terms of developing over all capacity to mainstream biodiversity conservation considerations into production sectors. While, the tool is conceptually based on the UNDP Capacity Development Scorecard, it is different in its substantive focus and the indicators. This is because the UNDP Capacity Development Scorecard is meant to assess the development of capacities vis-à-vis the management of protected areas, whereas this project is about biodiversity mainstreaming into the plans and activities of all production sectors including PAs operating in the HRML.

Table 1 tries to be as objective as possible in its selection of indicators. Each indicator is scored from 0 (worst) to 3 (best), with an explanation of what each score represents for the particular indicator. The tool then estimates the baseline situation/ score for each indicator (cell marked in yellow), and then identifies the target situation/ score (marked in green). Tables 2 through 6 provide a quantitative summary of the total possible scores, baseline scores, target scores, baseline score as a percentage of the total possible score, and the target score as a percentage of the total possible score.

In assigning scores, the term "production sector activities in the HRML" is assumed to include the following: conservation and commercial forestry, agriculture, fisheries, tea and cardamom management, tourism, and subsistence livelihoods. "Production sector institutions" covers all institutions that play some role in planning and management of the production sector activities (production sectors as defined above) in the HRML. This includes state government institutions (such as departments of agriculture, tribal development, rural development, tourism), local government, and Village Level Institutions (e.g., SHGs, EDCs). During project development, the Capacity Scorecard has been applied at a general level to all production sectors/ actors operating in the HRML. However, during the 1st 6 months of project implementation, it will be applied separately to different sectors, and within each sector, separately to state, private sector and community institutions. Further, once Sector Plans are prepared by mid-term, the project will have a more realistic assessment of targets.

Table 1: Scorecard

Strategic Area of Support	Capacity Level	Indicator	Scores							
			Worst (score 0)		Marginal (Score 1)		Satisfactory (Score 2)		Best (Score 3)	
1. Capacity to conceptualize and formulate policies,	Systemic	There is a strong and clear legal mandate for mainstreaming	There is no legal framework for biodiversity mainstreaming into		There is a partial legal framework for biodiversity mainstreaming into		There is a reasonable legal framework for biodiversity mainstreaming but it	2	There is a strong and clear legal mandate for biodiversity mainstreaming into	3

Strategic Area of Support	Capacity Level	Indicator	Scores							
			Worst Score 0		Marginal Score 1		Satisfactory Score 2		Best Score 3	
legislations, strategies and programmes		biodiversity into production sector activities in the HRML as evidenced by the number of legal instruments and policy initiatives.	production sector activities		production sector activities, but it has many inadequacies		has a few weaknesses and gaps		production sector activities	
2. Capacity to implement policies, legislation, strategies and programmes	Systemic	There are adequate skills for mainstreaming biodiversity into production sector activities in the HRML	There is a general lack of skills		Some skills exist but in largely insufficient quantities to guarantee effective biodiversity mainstreaming	1	Necessary skills for effective biodiversity mainstreaming into production sector activities do exist but are stretched and not easily available		Adequate quantities of the full range of skills necessary for effective biodiversity mainstreaming into production sector activities are easily available	3
2. Capacity to implement policies, legislation, strategies and programmes	Systemic	There is an oversight mechanism with clear responsibility to monitor and enforce biodiversity mainstreaming into production sector activities in HRML	There is no oversight at all		There is some general oversight on environmental compliance but it lacks capacity to specifically monitor and enforce compliance with biodiversity considerations	1	There is a reasonable oversight mechanism in place providing for regular review of biodiversity considerations but it lacks transparency (e.g. is not independent, or is internalized)		There is a fully transparent oversight mechanism in place providing for regular review of biodiversity considerations	3
3. Capacity to engage and build consensus among all	Systemic	Biodiversity-compatible Strategic Plan for HRML (incl.	There is no political will at all, or worse, the prevailing political will runs		Some political will exists, but is not strong enough to make a difference	1	Reasonable political will exists, but is not always strong enough to fully support		There are very high levels of political will to support biodiversity	3

Strategic Area of Support	Capacity Level	Indicator	Scores							
			Worst (Score 0)		Marginal (Score 1)		Satisfactory (Score 2)		Best (Score 3)	
stakeholders		sectoral plans) have the political commitment they require	counter to the interests of biodiversity mainstreaming into sectoral plans				biodiversity mainstreaming into sectoral plans		mainstreaming into sectoral plans in HRML	
3. Capacity to engage and build consensus among all stakeholders	Systemic	Biodiversity-compatible Strategic Plan for HRML (incl. sectoral plans) have the public support they require	The public has little interest in a Strategic Plan for HRML (incl. sectoral plans) and there is no significant lobby for it	0	There is limited support for Biodiversity-compatible Strategic Plan (incl. sectoral plans)		There is general public support for Biodiversity-compatible Strategic Plan (incl. sectoral plans) and there are various lobby groups such as environmental NGO's strongly pushing for them	2	There is tremendous public support in the country for Biodiversity-compatible Strategic Plan (incl. sectoral plans)	3
4. Capacity to mobilize information and knowledge	Systemic	Production sector institutions have the biodiversity information they need to develop and monitor biodiversity-compatible sectoral plans for HRML	Information is virtually lacking		Some information exists, but is of poor quality, is of limited usefulness, and is not always available at the right time	1	Much information is easily available and mostly of good quality, but there remain some gaps in quality, coverage and availability		Production sector institutions have the biodiversity information they need to develop and monitor sectoral plans	3
5. Capacity to monitor, evaluate, report and learn	Systemic	Society monitors the state of biodiversity mainstreaming into sectoral plans in	There is no dialogue at all		There is some dialogue going on, but not in the wider public and restricted to specialized circles	1	There is a reasonably open public dialogue going on but issues that particularly magnify the conflict		There is an open and transparent public dialogue about the state of biodiversity mainstreaming into	3

Strategic Area of Support	Capacity Level	Indicator	Scores							
			Worst (Score = 0)		Marginal (Score = 1)		Satisfactory (Score = 4)		Best (Score = 5)	
		HRML					between economic activities and biodiversity considerations are not discussed		sectoral plans in HRML	

Table 2: Quantitative summary of Total Possible Scores

Strategic Areas of Support	Systemic
1. Capacity to conceptualize and formulate policies, legislations, strategies and programme	3
2. Capacity to implement policies, legislation, strategies and programmes	6
3. Capacity to engage and build consensus among all stakeholders	6
4. Capacity to mobilize information and knowledge: Technical skills related specifically to the requirements of GEF SO-2 and SP-4	3
5. Capacity to monitor, evaluate and report and learn at the sector and project levels	3
Total	21
Note: "-" means no indicator was selected for that level.	

Table 3: Quantitative summary of Baseline Scores

Strategic Areas of Support	Systemic
1. Capacity to conceptualize and formulate policies, legislations, strategies and programme	2
2. Capacity to implement policies, legislation, strategies and programmes	2
3. Capacity to engage and build consensus among all stakeholders	1
4. Capacity to mobilize information and knowledge: Technical skills related specifically to the requirements of GEF SO-2 and SP-4	1
5. Capacity to monitor, evaluate and report and learn at the sector and project levels	1
Total	**7**
Note: "-" means no indicator was selected for that level.	

Table 4: Quantitative summary of Target Scores

Strategic Areas of Support	Systemic

1. Capacity to conceptualize and formulate policies, legislations, strategies and programme	3
2. Capacity to implement policies, legislation, strategies and programmes	6
3. Capacity to engage and build consensus among all stakeholders	5
4. Capacity to mobilize information and knowledge: Technical skills related specifically to the requirements of GEF SO-2 and SP-4	3
5. Capacity to monitor, evaluate and report and learn at the sector and project levels	3
Total	20
Note: "-" means no indicator was selected for that level.	

Table 5: Quantitative summary of Baseline Scores as a % of Total Possible Scores

Strategic Areas of Support	Systemic
1. Capacity to conceptualize and formulate policies, legislations, strategies and programme	40%
2. Capacity to implement policies, legislation, strategies and programmes	33%
3. Capacity to engage and build consensus among all stakeholders	15%
4. Capacity to mobilize information and knowledge: Technical skills related specifically to the requirements of GEF SO-2 and SP-4	35%

Strategic Areas of Support	Systemic
5. Capacity to monitor, evaluate and report and learn at the sector and project levels	30%
Total	
Note: "-" means no indicator was selected for that level.	

Table 6: Quantitative summary of Target Scores as a % of Total Possible Scores

Strategic Areas of Support	Systemic
1. Capacity to conceptualize and formulate policies, legislations, strategies and programme	80%
2. Capacity to implement policies, legislation, strategies and programmes	80%
3. Capacity to engage and build consensus among all stakeholders	80%
4. Capacity to mobilize information and knowledge: Technical skills related specifically to the requirements of GEF SO-2 and SP-4	80%
5. Capacity to monitor, evaluate and report and learn at the sector and project levels	80%

Total	

Note: "-" means no indicator was selected for that level.

Brief summary of activities carried out during PPG phase

Introduction:

The GEF-UNDP-MoEF project – *Developing an effective multiple-use management framework for conserving biodiversity in the mountain landscape of the High Ranges, Western Ghats, India* aims to conserve a key mountain ecosystem in the Western Ghats by consolidating existing conservation practices and also additionally by mainstreaming biodiversity conservation into production sector operations and practices. The project site (High Ranges Mountain Landscape (HRML) in the Munnar region of the Kerala portion of Western Ghats), with the presence of several key protected areas, forest production sectors, communities including tribals, and private production sectors (e.g. tea and cardamom), stands out as the most ideal landscape for trying out mainstreaming approach towards conservation. Further, the project will also support the efforts of the state government in consolidating the conservation priorities of the High Ranges; one of the richest biomes in the whole of Western Ghats. The PPG team for the preparation of the Full Sized Project (FSP) consisted of a Lead Policy & Project Development Specialist *(LPPDS)*, Biodiversity and Landscape Specialist (BLS) and Community Development Specialist & Resource Economist (CDSRE).

Important activities carried out during PPG phase:

A) Lead Policy & Project Development Specialist *(LPPDS)*:

During PPG period, a number of field visits, meetings and consultations with various stakeholders and key participants took place. Firstly, collection, collation, review and analysis of historical, scientific and social data and information from various sources and libraries of Kerala Forest Research Institute, School of Social Sciences, Forest Department, KDHP etc. were carried out. All available studies, reports and scientific publications about the landscape apart from working plans, management plans, sectoral plans (like Management Plan of the corporate tea company, Kannan Devan Hills Plantation Ltd.), tourism development plan (tourism department), LSG development plans, MS Swaminathan report (Measures to mitigate agrarian distress in Idukki Dt.) etc. were thoroughly perused. Policy and legal frameworks and institutional capacity of various stakeholders were also analysed as part of this.

In total, there were 40 field visits made to all PAs, HVBAs, potential areas to be added to PAs, tribal settlements, Human-wildlife conflict areas like Chinnakanal (Anayirangal) and Marayur, tea plantations, cardamom plantations, reed breaks and other components of the landscape. The focus was on assessing the status of biodiversity management and the level of existing and emerging threats. Fruitful discussions were also held with individuals like Planning Board member, Member of Parliament, Member of legislative assembly, forest officers, district collector, other department officials, panchayat functionaries, KILA officials, tea managers, cardamom farmers, scientists, tribals, ecorestoration experts, political workers, NGOs, resort owners, tour operators, taxi drivers, NGIs, professors, academics etc. Consultations were also conducted with various stakeholders after explaining the basic objectives of the project to them. The outcomes of important consultations are briefly mentioned:

1. **Tea company managers and scientists (22-9-2012 and 22-1 2013)**: Managers of tea, representatives of High Range Wildlife Preservation Association and scientists of R&D took part in the meeting at Munnar.

    -Collaboration in mapping of all the fragments inside the plantations like shoals, grasslands, swamps etc.
    -Reduction of H/W conflict
    -Awareness activities
    -Rainforest alliance certification for tea.

-Support in tourism management
-Support in waste management.
-Collaboration with R&D of the company in scientific studies on conservation of landscape
-Exploring possibility of reducing energy consumption (eucalyptus as firewood)

2. Tribal communities (9th and 10th Oct.2012)

Extensive interaction with tribal communities began with a two day visit to the tribal panchyat of Edamalakudy along with local DFO. Various activities of the VSS were also studied. Various issues like food security, developmental aspirations, road building, institutional strengths and weaknesses, NTFP management, marketing mechanism, housing, energy options, health etc. were also discussed with the tribals.

3. Human-wildlife conflict (11-10-2012)

Discussions were held with the people of Chinnakanal at Devikulam regarding issue of elephant depredation. Participants included Panchayat president, forest officials, cardamom planters, scientists, tribals and social scientists. The DFO addressed the stakeholders and highlighted the need for working out a solution to the issue of elephants in Anayirangal. He also pointed to the fact that if properly addressed, the problem of elephants can be converted to opportunity. He also wanted them to focus on co-existence. Options for mitigating conflicts were discussed. Some of the suggestions that were floated are:

-Resurvey of allottees who have land elsewhere.
-Land is being illegally handed over to outsiders
-Private individuals are using solar fencing.
-Alternate land be given elsewhere/or in Chinnkanal itself (President, Panchayat)
-Block elephant routes from KDH and Mathikettan
-Evolve a cluster approach after a detailed study of land given.
-Live with elephants with elephant-friendly land-use.
-Early warning systems on elephant location (Valparai model)
-Elephants will never move out (Kani, Chempaakatholu)
-Make use of the opportunity for income generation through tourism.

4. Researchers and scientists (7-1-2013)

A consultation was held in Trichur on with researchers who have worked in the Landscape. The research gaps were identified and studies to be taken up during Project period were identified. (Annexure 15)

5. Forest officers of the landscape (14-1-2013)

Divisional Forest Officers and Wildlife Wardens of all Divisions in the landscape (5 territorial and 2 wildlife) attended the meeting at Munnar. The following aspects were discussed in detail.

-Protection of sandal (new technology)
-Strengthening PFM
-Ecorestoration of grasslands and sholas
-Revitalizing CRC (cardamom for rainforest conservation)
-Supply of seedlings to cardamom planters
-Survey and demarcation of cardamom lease and patta
-Support for visitor management
-Project Implementation arrangements
-Institutional support
-Implementation of FRA
-H/W conflict mitigation

6. Cardamom farmers:

Two consultations were held with cardamom planters, at Munnar (21st and 22nd July 2012) and Vandanmedu (14-2-2013). Following are the critical issues in the cardamom sector:

- Compensate those who are willing to change to sustainability
- Common cardamom drying facilities
- More firewood is required as productivity has gone up many folds because of the local variety *Njallani.*
- Cropping is taking place all round the year.
- Shortage of fuel for curing -Provide cheap firewood
- Subsidized electricity use (currently industrial charges)
- Change in attitude of Forest Department and Spices Board
- Stress on marketing (small amounts in rural households also). Now only in 10 cities.
- Branding as shade cardamom (as against shade-less cardamom)
- Strengthen/rejuvenate CRC (take 1 or 2 ULOs)
- Planting more trees (diverse)
- Whether firewood can be grown and cut?
- Product diversification (like essential oil, high value product like cardamom seeds, mouth-freshners etc.)
- Area under cardamom has expanded recently, provide incentives. (small tea estates converted to cardamom)
- Consortium of growers to be organized.
- Petroleum coke as alternative to Firewood
- Some planters trying mixed planting (various varieties along with *njallani*). Production 400kg/acre. Pesticide use once in 40 days only.
- Average expenditure /acre is 1.25 lakhs per yer.
- Acute labour shortage
- Crop damage by wildlife
- No technical sequential packages for timely advice and guidance
- Influence of chemical fertilizer and pesticide agents
- Non viability of earlier native varieties.
- Lack of clarity about tenurial rights in cardamom areas
- Presence of new invasive species
- Loss of diversity and density of trees
- Decreasing water availability.
- No free trade opportunity and support price.
- Illegal felling in abandoned/absentee estates
- Mining in cardamom areas

7. Tourism industry (16-2-2013)

Representatives of hotel and tourism industry, taxi drivers, vendors, EDC members, forest officials, Kerala Forest Development Corporation, HRWEPA, KDHP Company, Hydel Tourism, Kerala Travel Mart, District Tourism Promotion Council, NGOS etc. attended the meeting at Munnar.

-KTM to collaborate with Project
-Information kiosks to be set up
-Ecocertification for hotels
-Support for waste management
-Revival of green Munnar project

8. Log Frame Analysis workshop (12-3-2013)
A one day log frame analysis workshop was organised in which all the stakeholders participated. They include tribes, NGOs, political workers, MLA, panchayat members, forest officials, tea sector, cardamom planters, scientists, VSS and EDC members, tourism industry, other government departments like agriculture, fisheries, tribal development, cardamom board, Hindustan Newsprint Ltd., reed workers, taxi drivers , NGOs, UNDP officials etc. The outcome of the workshop is given in Annexure 16.

9. Meetings with Senior Forest Officers (23-7-2013), UNDP and Government of India
The draft project document was discussed with the senior forest officers at Trivandrum and the suggestions made were incorporated. Apart from field related activities, discussions were held with UNDP officials at Delhi and Hyderabad (during COP).Field visits along with UNDP staff were also conducted.

B) Biodiversity and Landscape Specialist (BLS)

Data collection:

To get the development history of the landscape, old documents on the High Ranges available in the library of the Kannan Devan Tea (TATA Tea) Company were reviewed. The company was recording the climate data (mainly rain fall and temperature) for more than one century in almost all the estates which enabled to draw inferences on the change in climate in the past one century in the High Ranges.
Extensive review of literature was conducted at the library at the Forest Department head quarters at Trivandrum, where the old and new working plans and management plans are available. The working plans of Munnar, Malayattur and old Kottayam division were helpful to set a background of the project area.

Field visits and Consultations:

Participated in a workshop on Cardamom areas held at Munnar on 21-7-2012. Detailed discussions held during the sessions revealed the current ecological situation in cardamom areas. The nature of the vegetation has already been changed. Drought resistant and high yielding varieties are being preferred by the planters. These varieties need more sunlight which in turn forced the farmers to open up the canopy of the shade trees. The native shade trees are also being replaced by fast growing exotic species which caused erosion of biodiversity.

28- 9- 2012: Visited the HVBA of Mankulam forest areas and various tribal settlements.
29-9-2012: Visited Marayur and held consultations with various stakeholders. The members of the local self government and representatives from the tribal hamlets in Marayur and Chinnar wildlife sanctuary participated in the discussions. The challenges in protection of the sandal forests, human-animal conflict, issues in cultivating and processing lemon grass, the impact on water availability in the area dominated by eucalyptus cultivation etc. were discussed. Visited the Kanthallur area where man- animal conflicts are reported and also to have a first- hand knowledge of the extent and impact of eucalyptus plantations.
23-10-2013 to 28-10-2012: Field visits to the Cardamom Hills Reserve, shola fragments of Munnar, Marayur, Kanthallur, Anamudishola National Park and Chinnar wildlife sanctuary. Stake holder meeting was held at Kozhimala where the chief of the Mannan tribe resides. Visited various parts of CHR like Nedumkadam, Kattapana, Santhampara and surveyed along the interstate boundary mainly for information of flora and fauna and the situation in the cardamom estates and probable corridors. Visited Chinnakanal and had a meeting in the Tribal (Muthuvan) hamlet at Chembazhuthur. The area is a wildlife corridor between Suryanelli forests and Mathikettan National Park. Elephants are using

this corridor on a regular basis. As per a policy decision, the government land has been assigned to the tribal people from outside and now Chinnakanal is an area with serious problems of human-animal conflict. The areas with potential high value biodiversity also were visited. The Mannavanshola which is part of the Anamudishola National Park was visited. This area is unique as it holds the largest existing *shola* forests in the entire High Ranges. Many neighbouring areas are also equally vital in conserving the biodiversity but unfortunately left out from the PA network. These are potential high value biodiversity areas to be considered in the Project.

19-11-2012 to 25-11-2012: Field Visit to various parts of the Project Area. Held discussions with the scientists of R&D wing of the Kannan Devan Hills Company on *shola* regeneration practices. Visited Kuttiyar valley, Pambadumshola, Kurinjimala sanctuary, Vattavada, Kovilur, Pazhathottam, Idiyavarashola, Chilanthiyar, Swamiyalakudy, Kudalarkudy, Mannavanshola, Manthan shola,Kanthallur, Marayur etc. The potential High Value biodiversity areas in this region were identified. Black wattle, an invasive alien species was threatening the sholas by way of invading and suppressing the shola vegetation of the high altitudes. In the Idiyavara and Mannavan shola, for the last 5-6 years, forest department was selectively removing the invaded wattle. The result was found to be very encouraging. The *shola* species is growing in abundance indicating the potential for restoration of the natural vegetation. Visited Thattekad sanctuary and Kuttampuzha- Edamalayar areas in the lower valleys. Discussions were held with the stakeholders and forest staff to probe the possibilities of establishing wildlife corridors between the sanctuary and neighbouring forests of Malayattur and Munnar divisions.

8-12-2012- to 9-12-2012: Took part in bird survey in the Munnar – Mathikettan area.

22-12-2012 to 26-12- 2012: Field work in the Project area mostly in fragmented areas and HVBAs.

Periodical discussions held at Trivandrum with the Secretary, Director and other staff members of the Department of Environment, Govt. of Kerala for their inputs in topics of climatic change in the High Ranges, middle elevation and low elevation forests in the Project area.

The Kerala State Remote Sensing and Environment Department was consulted for resource, vegetation and infrastructure maps of the Project area.

Discussions with UNDP and MOEF officials also took place in Delhi as well as in the State.

Periodic interactions also were held with experts in the field of botany, fishes, amphibians, and dragonflies.

C) Community Development Specialist & Resource Economist (CDSRE).

Contacted and consulted number of key stakeholders in the landscape with visits to local bodies, held meetings with key officials and conducted various stakeholder consultations. The information and data collected both from government as well as private sectors as well as through stakeholder consultations were analyzed in detail.

Collection and review of relevant literature:

More than 80 research papers, books, articles, theses, reports and documents related to the High Range Landscape and people were collected and referred to understand the current situation and issues. The literature could be broadly classified as socio-economic, historical, cultural, agro-ecological, flora and fauna, climate change, land use, indigenous communities, resource use, human-animal conflict, tourism, policy and so on. Apart from understanding the background and situation, it also supplemented in understanding the gaps in the existing data related to socio-economics, communities and resource economics of the project landscape resource economics of the target area. For the data on population, literacy, land holdings, are largely depended on the decadal census reports published by the Govt. of India. Online sources such as Information Kerala Mission, Websites of Local bodies were also utilized.

Field Trips

Number of field trips were made to various tribal settlements, villages and agricultural and plantation areas in order to observe the trends and changes mentioned in various literature. Field trips to

Neriamankalam, Adimali, Mankulam, Anakulam, Edamalakudi, Maraiyoor, Chambakadu, Kanthalloor, Vattavada, Chinnakanal, Nedumkandam, Vandanmedu, Pampadumpara are the significant ones which provided detailed insights on communities, livelihoods and agro-ecological, conservation and resource economic issues.

Following are some of the selected tribal settlement Visits, Discussions and Observations:

- Sevalankudi Muduva settlement, Mankapara Muduva settlement
- Elephant problem areas of Anakulam
- Gaur problem areas of Kanthaloor
- Agriculture and Forest dependency in Kozhimala
- Issues of cardamom cultivation and conservation issues in Nedumkandam
- Encroachment and Human-elephant conflict situation in 301 colony
- Chempakathozhukudi and Singh Kandam issues
- Hill agriculture situation in Vattavada and Kovilur
- Elephant movements and tourism in Mattupatti
- Gaur movement issues and local responses in Marayoor
- Anamudi shola tourism and Kanthalur – agriculture, tourism and eucalyptus
- Chinnar – Champakad settlement, grazing, agriculture and EDC

Stakeholder Meetings

Held meetings with the representatives of local communities and stakeholders to identify issues and options for alternative livelihoods development and to prepare comprehensive livelihood development strategy for the region.

Major Stakeholder Meetings

Dates	Location	Group	Institution Involved
22.07.12	Munnar	Cardamom Cultivators, Tribal VSS	Forest dept, Cardamom association, VSS, Farmers
27.09.12	Mankulam	RO, forest staff, VSS/ cultivators	Forest dept /Panchayat /VSS
28.09.12	Anakulam	RO, forest staff, panchayat, VSS/cultivators, church representatives	Forest dept/Panchayat, Local church, VSS, cultivators
29.09.12	Maraiyoor	Sub-Collector, DFO, Panchayat reps	VSS, Panchayat, Forest Dept
02.10.12	Munar	KDHP managers	KDHP
09-11 Oct 2012	Edamalakudi	Tribals/VSS	Forest dept/Panchayat
11.10.12	Devikulam - Chinnakanal	DFO, Forest staff, VSS, cultivators, settlers	Forest dept/Panchayat/VSS
24.10.12	Vattavada/Kanthaloor	Cultivators/VSS	Forest dept
25.10.12	Chinnar	EDC	Forest dept
14.11.12	Adimaly	Tribals/panchayat/agri	Tribal welfare dept
17.01.13	Munar	Tour/resort operators	Forest dept / Association/ Tourism Dept
14.02.13	CHR (Vandanmedu)	Cardamom cultivators/settlers	Forest dept/Panchayat/Cardamom growers association

Consultation Meetings

- Concerned officers heading relevant departments, Panchayat leaders who have understanding on the issues of the landscape and experience in implementing projects and other key persons were consulted for collecting various data and information.
- Interacted with selected working labourers and retired/dropout labourers of KDHP Company to understand their current dependency on forest area and the landscape.
- Held meetings with the tea managers and scientists of R& D to collect necessary data on labour, socio-economic profiles of the labour population, current welfare measures, future mechanization plans etc. Discussion with members of local bodies also provided much information on the landscape. Besides, these meetings aided in understanding the population profile, vendor shops, tourism inflow, income and expenditure trends, existing and proposed plans including NREGA, SHGs and so on.
- Apart from the stakeholder and meetings with officials and key persons in the landscape, periodical meetings and review with the UNDP team also took place in Delhi and the state.

Some of the issues that cropped up during meetings are given below:

Mankulam

- About 60-70% of settlers have no pattayam for their lands. Due to this fact, they cannot avail any agricultural or bank loans
- Agriculture is profitable mostly with those who have lands with road accessibility. Others face difficulty in marketing their products
- Labour shortage for work
- Increasing cost of processing and maintenance.
- Crop damage is also a problem for many formers by wild pigs, bonnet macaques, porcupine, sambar deer and elephants in certain localities. Due to these factors many left as fallow their lands.
- Majority of the lands have rocks beneath the shallow surface soil. Due to this factor, wells are quite rare in this region
- A good number of land owners moved to cities aiming for education of their children and other amenities. Their lands are left as fallow. Many do not know the exact boundary of their lands. The fallow lands also facilitate movements of wild pigs and other animals to the adjoining cultivated lands
- Lack of sufficient transportation facilities and road accessibility is a major problem for both tribal and non-tribal settlers. Good portion of their earnings they have to spend in hiring vehicles for education of their children and for treatment purposes.
- There was only one tribal colony, the Sevalankudy. Now it has grown and split into six settlements.

Economic status of agriculturists is decreasing in Mankulam so they are shifting from Mankulam to other places. Children of settlers are getting better education and the younger generation is not interested to become agriculturists like their parents. They prefer to do jobs in government and private sectors in the towns. The Agriculturists need a development policy for them with the help of line departments

Anakkulam:

- At Anakulam, lack of proper road and transport facilities hinter their development

- Recent invasion of elephants into the cultivation areas, crossing the river is posing a threat
- Efforts to manage Anakulam as an eco-tourism spot
- Rain fall is decreasing year by year
- Fertility of soil decreased and usage of chemical fertilizers for agriculture is increasing

Chinnakanal:

- Chembagathozhukudi, Tank kudi and Pachapulkudi Muduvans stopped cultivation of traditional crops, ragi and cereals, almost five years back. Only few households keep the seeds and the viability is decreasing.
- Cardamom cultivation is increasing in the Muduva lands
- Though elephant movement is not a major problem for them, due to the increasing occupancy of resettlement in (501 resettlement colony) a traditional elephant habitat, human-elephant conflict is increasing
- Other tribes are encroaching the fallow lands of Mudvans (near Singukandam)

Marayur:

- In Marayur area tribals raised the issue of not being able to avail the govt subsidies and schemes for agriculture and other sectors
- Drinking water shortage and lack of road facility for emergency is also there in many areas, particularly in Alampatty area
- Crop damage by elephant, pigs and gaur human attack incident is increasing
- Many new ration cards of Tribals are in APL category, that impact their cost of day to day consumption
- Marayur, Alampatty and Chinnar tribals are supplied seeds (BT seeds?) from Tamil Nadu traders for community beans cultivation, future issues.
- Marayur, Eachampatti and Kanthalloor areas outside eucalyptus planters influence local EDCs for coup roads so that new road networks are developed
- Some of the Muduvas venture into cultivation of potato and other cool season vegetables in their landholdings
- Tribals getting 30 kg rice per month from govt and majority are not going for NTFP or other wild edible collection.

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