GOVERNMENT OF KERALA
KERALA STATE PLANNING BOARD

FOURTEENTH FIVE-YEAR PLAN
(2022-2027)

WORKING GROUP ON
TOWARDS A SUSTAINABLE MANAGEMENT
OF FORESTS IN KERALA

REPORT

AGRICULTURE DIVISION
MARCH 2022

FOREWORD

Kerala is the only State in India to formulate and implement Five-Year Plans. The Government of Kerala believes that the planning process is important for promoting economic growth and ensuring social justice in the State. A significant feature of the process of formulation of Plans in the State is its participatory and inclusive nature.

In September 2021, the State Planning Board initiated a programme of consultation and discussion for the formulation of the 14th Five-Year Plan. The State Planning Board constituted 44 Working Groups, with more than 1200 members in order to gain expert opinion on a range of socio-economic issues pertinent to this Plan. The members of the Working Groups represented a wide spectrum of society and include scholars, administrators, social and political activists and other experts. Members of the Working Groups contributed their specialised knowledge in different sectors, best practices in the field, issues of concern, and future strategies required in these sectors. The Report of each Working Group reflects the collective views of the members of the Group and the content of each Report will contribute to the formulation of the 14th Five-Year Plan. The Report has been finalised after several rounds of discussions and consultations held between September to December 2021.

This document is the Report of the Working Group on "Towards a sustainable management of forests in Kerala". The Co-Chairpersons of Working Group were Dr. T. K. Kunhamu and Dr A. V. Raghu. Dr.R.Ramakumar, Member of the State Planning Board co-ordinated the activities of the Working Group. Sri.S.S.Nagesh, Chief, Agriculture Division was the Convenor of the Working Group and Dr. Reji D.Nair,Research Officer, Agriculture Division was Co-Convenor. The terms of reference of the Working Group and its members are in Appendix 1 of the Report

Member Secretary

PREFACE

As part of formulation of the 14th Five Year Plan, the Kerala State Planning Board had constituted working groups of experts in all the major sectors. In Agriculture and Allied Sectors, 6 working groups were constituted viz. Agriculture and Cooperation, Animal Husbandry and Dairy, Inland and Marine Fisheries, Forest and Environment, Water Resources and Regional Packages. To discuss and frame policies in each of these sectors, the working groups were further divided into 28 Expert Sub-Groups (ESG) with specific mandates.

Each Expert Subgroup held at least three meetings beside one focused group meeting before finalising the report. We, the Co-Chairs, place our deep appreciation and gratitude to all the esteemed members of the ESG for their valuable contributions in preparing the report. We are extremely grateful to Dr. V. K. Ramachandran, the Honourable Vice-Chairperson, Kerala State Planning Board, Dr. R. Ramakumar, Member, Kerala State Planning Board and Sri. S. S. Nagesh, Chief, Agriculture Division for their consistent guidance and suggestions in preparing the report. The drafting team put in commendable work in bringing together all the views and opinions of the members. We sincerely hope the recommendations in the report can lead to important changes in the public policy on sustainable management of forests in the State.

Dr A. V. Raghu
Expert co-chairperson

Dr. T. K. Kunhamu
Official co-chairperson

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HIGHLIGHTS

- The 14th Five Year Plan offers a comprehensive outlook for enhancing the multifunctionality of the forests with due emphasis on their ecological resilience to climatic and biophysical extremes, and the theme is 'Forests for Resilience'.
- The focus is shifted from the earlier timber-centered approach onto NTFPs and services.
- Seven wide-reaching programmes have been proposed to enable this shift effectively.

TOWARDS A SUSTAINABLE MANAGEMENT OF FORESTS IN KERALA

EXECUTIVE SUMMARY

INTRODUCTION. A close analysis of past forest management systems in Kerala reveals a significant focus on the long-term output of a narrow set of commodities and services, especially timber, and a lack of clarity on measures that favour forest multi-functionality. Despite the realization of the ecological basis of forest management, the implementation has proceeded at a snail's pace. Wide gaps still exist in incorporating the ecological dimensions with forest management practices. This is particularly important at a time when the potential of our forests to deliver ecological services is fast dwindling. The situation has been compounded by alarming changes in the climate and associated vulnerabilities which call for enhancing the ecological resilience of our forests.

The sustainable management of forests and wildlife calls for a landscape-level approach since the forests and agricultural landscape of the state are inseparably linked and share valuable common resources.

THEME. The 14th Five Year Plan document has been designed with a comprehensive outlook for enhancing the multifunctionality of the forests with due emphasis on their ecological resilience to climatic and biophysical extremities. Hence, the theme of the 14th Five-year Plan (FYP) is "Forests for Resilience".

PROGRAMMES. The following key programmes will be implemented under the 14th FYP.

Programme 1. Enhancing climatic resilience and hydrologic regime through improved forest management including eco-restoration
The floods of 2018 and 2019 had far-reaching impacts on the social, economic, human, and ecological infrastructure of Kerala's forests. This has resulted in extensive loss of vegetative cover, landslides, erosion of humus-rich topsoil, and consequent degradation affecting the water retention potential of the forest floor.

Efforts will be made to assess the extent of damage in the landslide affected forests and contiguous non-forest areas in terms of soil depletion, loss of vegetal cover, topographic changes etc., and identification of the major drivers of landslides or floods. Also, attempts will be made for the eco-restoration of climatically and ecologically vulnerable areas both in the forests and connected hilly tracts in the agro-ecosystems with the active involvement of LSGs, BMCs, etc.

Appropriate measures will be taken for the extension of riparian buffers in forests and agro-ecosystems. Other focus activities under this programme include the eco-restoration of industrial plantations to natural forests and the rationalization of teak plantations.

Programme 2. Augmenting ecosystem health and multi-functionality of natural forests
A transdisciplinary landscape-level watershed protection approach will be followed with a comprehensive action plan for watersheds both in forest and agro-ecosystems. Action will be taken to develop watershed-based master plans and hydrological frameworks following a "ridge-to-valley" approach. Other measures suggested for improving natural forest health

includes activities for improving natural forest regeneration and vegetal cover through measures such as voluntary relocation of private settlements from forests, resumption of unused forests, and eco-restoration of existing unproductive teak plantations to natural forests. Efforts will be made for the development of eradication strategies for invasive species and exploring the possibility of linking it with the livelihood of forest dependent communities. Initiatives will be made for discouraging solid waste dumping in forests and the 'Project Green Grass' programme aiming at cleaning the forests from solid waste will be extended to more regions.

Programme 3. Biodiversity Conservation and Management of Wildlife and Protected Areas

The main focal areas for the conservation of biodiversity and protection of wildlife habitats will be the prevention of "honey-combing" due to human habitations inside forest enclosures and consequent fragmentation, as well as stopping the degradation of vital habitats and wildlife corridors. The existing proposals for new Protected Areas shall be actively taken up and all processes including stakeholder consultations will be completed in a time-bound manner.

Other activities under this programme include securing previously identified elephant and other wildlife corridors and habitat improvement programmes for specific threatened species. An e-database of captive elephants prepared using DNA fingerprinting technology shall be used effectively in combating the illegal transportation of captive elephants. Special attention will be paid to the rejuvenation of all the National Parks and Wildlife Sanctuaries which were closed to tourists during the COVID- 19 pandemic.

Programme 4. Forest based livelihood, socio-cultural dimensions, and Sustainable Ecotourism

Livelihood, socio-cultural dimensions. There are many gaps in our current understanding of NTFPs collected from the forests, their classification, socioeconomic value, technical packages, trade, market mechanisms, and the policy and legal contexts for their sustainable use. Efforts will be made for unlocking the potential of NTFP-based forest livelihoods. Also, community-based participatory resource harvesting and monitoring approaches will be implemented. Other activities include the delineation of resource collection areas for each community, development of site-specific sustainable harvesting protocols and sustainable marketing facilities for raw and value-added NTFPs, and a transparent benefit-sharing mechanism that involves the Gram Sabha and CFRMCs/EDC/VSS. Efforts will be made for the provision for minimum support price for NTFPs and to establish local facilities for their storage and value addition.

Other suggested initiatives include skill development programmes for forest-related communities/alternate livelihood sources, forest fire management through community participation, and establishing an effective mechanism for the payment of ecosystem facilities.

Ecotourism. Nature-based ecotourism destinations managed by the Kerala Forest Department will be made more ecologically sustainable with due focus on the education, interpretation, and livelihood of local people. The major activities envisaged under

ecotourism initiatives include the formulation of an eco-tourism policy for the state, safety audits of all ecotourism centers, development of road map linking all the eco-tourism destinations both within and outside the forests, and frequent training and capacity building programmes to forest-based communities involved in ecotourism. Action plans will be made for human resource creation through training and curriculum development. Also, scientific approaches shall be explored for the effective marketing of ecotourism with the support of the Tourism Department.

Programme 5. Participatory Forest Management

Participatory Forest Management strategy in Kerala should change its pace with the changing socio-political and economic scenario. The various sub-programmes suggested for strengthening the PFM sector include the establishment of a PFM 2.0 strategy for revamping the PFM in tandem with the activities of different departments, establishment of central training facility to provide periodic training for the members of PFM institutions and forest department officials, linking biodiversity management committees with PFM at the Panchayath level, formation of range-level PFM cells and development of apps and tools for their efficient functioning.

Programme 6. Production forestry. Extension beyond forest boundaries

Plantations in the forest sector in Kerala has undergone a serious decline in productivity owing to a multitude of factors. Adherence to scientific production protocols will be followed for enhancing the productivity and product quality in this sector. Modern silvicultural practices, nursery technologies and approaches along with quality planting material production will be promoted.

Considering the vast potential of trees in the ToF sector in contributing to the demand for timber in the state, production forestry will be extended beyond the forest boundaries. The social forestry wing will be revamped to effectively monitor and manage the tree resources outside the forests. Other activities include the strengthening of programmes such as the Mission Forestry Club and Vidyavanam, revitalization of traditional home gardens, promotion of agroforestry/farm forestry, enhancing urban green spaces with urban forestry initiatives, and institutionalization of the ToF sector by deploying technically qualified forestry professionals at LSGs. Efforts will be made to simplify the tree cutting and timber transit rules. Also, institutional credit and insurance cover will be facilitated to promote tree cultivation. The participatory approach will be promoted for the development and distribution of quality planting materials and its management at the local level.

Programme 7. e-Governance in Forestry, research priorities and outreach

The rapidly changing climatic, socio-economic, and ecological scenario warrants transformation in the forestry sector as well. The forest department should be amply equipped with the necessary infrastructure, modern facilities, and trained manpower to face recurring challenges. Operationalization of an end-to-end MIS solution which is fully integrated with spatial data (GIS), advanced communication facility for fast networking and alertness, modern control rooms for firefighting and crime control, cybercrime cell/forensic unit for handling wildlife-related and other crimes, GIS- and drone-based land cover change

studies are the other facilities suggested under this programme. Initiatives will be made for strengthening effective conservation communication following state-of-the-art technology in the field. Nature education programmes will be made more effective with exclusive programmes for various sections of people.

Priority research initiatives suggested including hydrologic and geomorphic studies in natural forest areas, impact of climate change on forest functions, ecology and regeneration dynamics of natural forests, studies on productivity decline in plantations, evaluation of indigenous fast growing tree species, studies on plantation nutrition and silvicultural stand management strategies.

1.INTRODUCTION

The importance of forests in offering nature-based solutions (NBS) in the economic, ecological, social, and cultural spheres in Kerala is more relevant today than ever before. The conception of forests as an ecological entity with multifunctionality necessitate paradigm shifts in their management, and robust scientific approaches must be adopted for their sustenance. Such measures assume considerable importance in the context of the fast-changing agro-climate of Kerala. The pivotal role of the Western Ghats and associated forest resources in the overall agrarian prosperity and environmental stability of the state reiterates the need for their conservation and rational utilization. Over time, the functional attributes of forests have shifted from single-commodity-based tangible benefits to multifunctionality with the principal focus on the ecological paybacks to the society.

While advancing the United Nations Decade of Ecosystem Restoration (2021-2030), there has been a global consensus that restoration serves as the most effective nature-based solution (NBS) for climate change mitigation. Forest and landscape restoration is crucial for biodiversity and the maintenance of well-integrated and healthy ecosystems that sustainably deliver a range of provisioning, regulating and cultural ecosystem services. Obviously, this calls for sustainable forest management (SFM) strategies that consider forests as an integral part of inter-connected landscapes to better strengthen their functions in sustaining the livelihoods and welfare of the people in the state. Any management intervention made in the forest should facilitate the maintenance of their functional connectivity. Restoration, conservation, and rational use of the forest resources become imperative in the context of the United Nations Convention on Biological Diversity, United Nations Convention to Combat Desertification, and United Nations Framework Convention on Climate Change. This is essential to meet the objectives and targets of the Sustainable Development Goals, the Global Forest Goals, the Paris Agreement, Post-2020 Biodiversity Framework, the New York Declaration, and the Bonn Challenge.

Despite their importance, the forests of the state have been subjected to considerable human intervention. Furthermore, recurring climatic extremities have seriously impacted the ecological resilience of the forests in adapting to such changes. The repeated floods of 2018, 2019, and 2021 marked a period of climatic turbulence in the history of Kerala. A closer analysis of the trail of events that led to the unprecedented devastation in the State brought to the fore the issue of the hydrological security of Kerala. Here, it is to be noted that the importance of water security was emphasized in the 13th Five Year Plan, the theme of which was "Water for a Thirsty Kerala". The idea of hydrological security seeks immunity from both the excesses of seasonal rains and the scarcity of water in the subsequent summer.

From a macro perspective, four factors are impacting the water scenario of Kerala.

1. Built-up area. Out of the total geographical spread of 38,863 km2, the total built-up area (houses, buildings, roads, pavements etc.) in Kerala comes to around 6000 km2. These are surfaces made impermeable to water infiltration forever.
2. Reservoirs. Majority of the 90 odd reservoirs of the state are facing acute siltation

issues. The conventionally assumed role of reservoirs as water impounding structures during times of excess rains and providers of sustained water during the drought has significantly reduced due to this.

3. Wetlands. The swamps, wetlands, and paddy fields of Kerala were the floodplains and storage areas of excess runoff. However, these were drastically and almost irretrievably lost during the last four decades on account of the developmental pressure. For instance, the extent of paddy fields in Kerala is just one-fifth of what it used to be three decades ago.
4. Forest ecosystems. Forests are the source of all river systems of Kerala. They perform two vital functions such as interception of high-intensity rainfall and facilitating flow regulation in the rivers with forested watershed areas. This has an important bearing on the cycles of flood and drought. However, it is estimated that at present, the ability of the forests to perform this important hydrological function is only about 30 to 40 percent of what is possible if the forests are green, healthy, and intact. This is due to fragmentation and degradation. Factors that cause the degradation and fragmentation of forests of Kerala inter alia include uncontrolled forest fire, grazing, encroachment, monoculture plantations, linear intrusions like roads, canals etc.

Of the four macro-factors affecting the water budgeting of Kerala, considerable intervention may not be possible in the case of the first three factors. However, the fourth aspect may be exploited for improving the hydrological security of the State. Any improvement in the hydrological functionality of the forests from the current 30-40% to 60-70% or more, could be the best approach for improving water governance in Kerala. In essence, this means addressing and removing factors that cause forest fragmentation and degradation.

FOREST WEALTH OF KERALA

Proximity to the tropics, copious rainfall, relatively high humidity, and fertile soil are among the factors responsible for the highly diverse forest ecosystems in Kerala. The total extent of forests in Kerala is 11,524.411 km2 (29.85% of the geographical area of the state) of which an extent of 9,339.186 km2 is reserved forests; 284.218 km2 is proposed reserve and an extent of 1,900.979 km2 is under vested forests & ecologically fragile lands. These range from tropical evergreen, semi-evergreen, moist deciduous, dry-deciduous, and shola-grasslands to mangrove forests. Of the total forest area under the control of the Kerala Forest Department, natural forests form 78.38%, plantations 13.46% and the remaining 8.16 % is under lease and forest land diverted under the Forest Conservation Act, 1980. Forests are the source of all the 44 rivers apart from providing other ecosystem goods and services. There are around 1000 human settlements (both tribal and non-tribal) and private estates located as 'enclosures' within the forests in remote far-flung locations. There are 4,84,839 tribal individuals belonging to 36 tribal communities living in 725 settlements that constitute 1.45% of the total population (3.338 crores) of the state.

The wildlife wing of the Forest Department manages 3,213.2 sq. km of forests under the Protected Area network, which includes five National Parks (NPs), 17 Wildlife Sanctuaries (WLS), two Tiger Reserves (TRs), and one Community Reserve (Kadalundi-Vallikkunnu).

There are several High-Value Biodiversity Areas (HVBAs), such as New Amarambalam, Kulathupuzha, Siruvani-Muthikulam, Goodrickal, Malayattor, Camel's Hump Mountains, Chembra, Elambileri, Aranamala, Kattimattam, Vellarimala, Vavulmala, and Thirunelli.

The congenial agro-climate of Kerala supports luxuriant vegetal cover with high biodiversity, not only in the forest lands but also elsewhere. Trees outside forests contribute the lion's share (80%) of total wood demand while the contribution from the plantations under the forest department is very small (<2%). Home gardens and rubber plantations are the major source of wood. Besides, wood imports from other countries and other states together account for about 16.5%. Owing to changing land-use trends in Kerala, old rubber plantations are being replaced by other commercially viable plantation cash crops and fruit trees. The forest cover in the state is given in Table 1.

FOREST REVENUE

Forests contribute substantially to the non-tax revenue of the State. The major source of forest revenue is timber. E-auction of timber has been facilitated since 2014-15. To improve the living standards of indigenous population residing in the forest area, the Forest Department has vested the collection of minor forest products with these communities at no cost. The revenue from forest products for the past few years are given below.

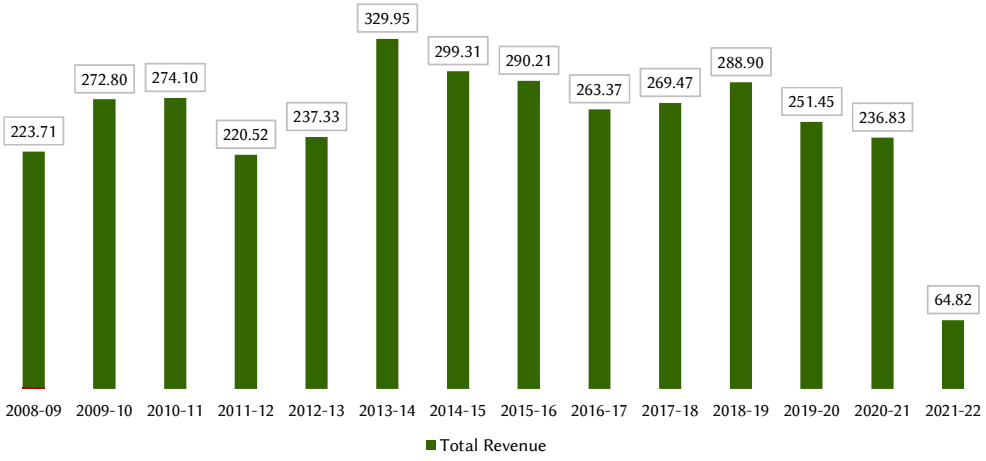


Figure 1. Revenue from Timber & Other Forest Produce (All figures Rs in crores)

As in every aspect of human life, there was a slow-down in the sale of timber during the COVID – 19 pandemic which has significantly affected the revenue during2019-20 and 2020-21.

Table 1. Forest cover in recorded forest area and trees outside forests in Kerala.

Class	Area (km2)
Very dense forest	1,935
Moderately dense forest	9,508
Open forest	9,701
Total Forest Cover	21,144
% of the State's geographical area	54.42
Recorded Forest Area	11,309
% of the State's geographical area	29.11
Forest Cover inside the Recorded Forest Area	9,637
Forest Cover outside the Recorded Forest Area	11,507
Tree cover	2,936
Extent of TOF	14,443

CHALLENGES IN FOREST MANAGEMENT IN KERALA

Of late, large tracts of forests have been converted to commercial tree plantations (such as teak and eucalyptus plantations), cash crops (such as cardamom, coffee, tea, rubber, and pepper), and areas for cattle-ranching. Interventions such as road construction, river-valley projects, urbanization, and mass tourism have also reduced the forest cover. Poverty and economic backwardness among forest-dependent communities continue to exert pressure on forest resources. Besides, encroachment, wildfire, proliferation of invasive species, poaching, mining, excessive firewood collection, non-compatible land use, changes in cropping pattern, "honey-combing" due to human habitations inside forest enclosures, and climate-induced ecosystem malfunctions have further led to the degeneration, fragmentation, and loss of vital habitats. More recently, Kerala has also witnessed extreme and erratic weather events, destructive cycles of drought and flood, human-wildlife conflict, and diminishing livelihoods from forests.

The devastating floods in August 2018 and August 2019 caused major damage to the social, economic, human, and ecological infrastructure of forests. Some effects were the loss of vegetative cover, widespread landslides, erosion of humus and topsoil, degradation, and reduction of overall water retention capacity. The post-disaster needs assessment (PDNA) report prepared by the Government identifies "heightened vulnerability" of forest enclosures and calls for integrated and innovative approaches for forested landscapes. The ability of forests to absorb the intense and incessant rains was significantly reduced in forest enclosures and degraded forests due to the absence of stable multi-canopied vegetation, resulting in flash floods and landslides. Remote and far-flung settlements also suffer from the poor reach and penetration of rural development schemes, poor access to education and healthcare and markets, which creates precarity in their existence and recovery. To compound these, forest enclosures also bear the brunt of human-wildlife conflict causing considerable hardships and unrest among people.

2. SUSTAINABLE FOREST MANAGEMENT THROUGH PLAN PERIODS

Five-year plans (FYPs) have impacted Kerala's forestry sector immensely. The 10th FYP, focused on improving biodiversity conservation, maintenance of ecological balance and environmental stability as envisioned in the National Forest Policy, 1988, and the 11th FYP facilitated changes in the policy framework, institutional development and management system linked to HRD, improved technology etc. The 12th FYP stressed on resource planning and research, biodiversity conservation, and protected area management, while the 13th FYP proposed paradigm shifts in the management of forests towards enhancing the ecological delivery functions of the forests.

Table 2. Proposed outlay and actual allocation in preceding FYPs

	Proposed in FYP (Rs in crore)	Actual Allocation in Budget for the period (Rs in crore)
12th FYP	1408.61	Rs 786.29
13th FYP	2070.97	1366.66

THE 13TH FIVE-YEAR PLAN

The 13th FYP witnessed paradigm shifts in the management of forests more towards enhancing the ecological delivery functions of the forests. The theme of the plan was "Water for thirsty Kerala" which emphasized forest-based water conservation and ecological resilience. It also underscored the subordinate role of forests as the source of timber and other NTFP as compared to its larger role in promoting their multi-functionality. The plan document furnished many strategies for the promotion of tree planting outside the forests and to do away the planted forests in the vulnerable areas within the forest boundaries and their restoration to natural forests. For the first time, this plan allocated funds for promoting tree cover in trees outside forests including home gardens and urban forestry.

Table 3. Financial outlay during the 13th FYP (Rs in crores)

Amount proposed for 13th FYP	Total Budget provision	Shortfall
2070.97	1366.66	704.31

Table 4. Year-wise budgetary allocation during 13th FYP (Rs. in Lakhs)

Scheme	2017-18	2018-19	2019-20	2020-21	2021-22
State Plan Schemes	19,250.00	20,575.00	18,652.01	15513	16638
State share of CSS (40%)	4,589.89	3,854.54	2688.36	2480.71	3312.8
Sub Total	23,839.89	24,429.54	21340.37	17993.7	19951
Central share of CSS (60%)	6,884.84	6,164.41	4241.29	5273.43	4969.2
Total	30,724.74	30,593.95	25581.66	23267.1	24920

Major Achievements During the 13th FYP (2017-2022)

- Policy decision on phasing out monoculture plantations of exotic species and restoration to natural forests (eco-restoration) and starting eco-restoration activities – A policy decision on phasing out monoculture plantations of exotic species and restoration to natural forests has been taken by the Government of Kerala and a plan for eco-restoration by phasing out eucalyptus, acacia and wattle plantations have been prepared and eco-restoration works started. This was declared in the Hon. Governor's address in 2020.
- Declaration of Karimpuzha Wildlife Sanctuary – A new Wildlife Sanctuary by the name Karimpuzha Wildlife Sanctuary, with an area of 227.97 km2 in Malappuram District was declared in 2020.
- Increase in forest cover – The increase in forest cover of Kerala as per the India State of Forest Report (ISFR) 2017, published by the Forest Survey of India was 1043 km2. In its next report in 2019, the increase in forest cover in Kerala was 287 km2. Kerala enjoyed the third place in the country with a net increase in forest cover. The sustained increase in the forest cover in the two consecutive reports of the Forest Survey of India deserves special mention.
- Forest Boundary Consolidation – As part of forest boundary consolidation, around 53,635 cairns have been constructed during the past 4 years. The rate of construction of cairns per year has been ramped up and now more than 10000 cairns are constructed in a year as against 4000 at the beginning of the 13th FYP.
- Coir Pith Root Trainers - Replacing Polythene bags with eco-friendly seedling bags - Each year, the Forest Department raises around 60-70 lakh seedlings for distribution/ planting. Earlier, these seedlings were raised in polythene bags or plastic root-trainer containers. As part of going green, the Department, after exploring various options, had raised one lakh seedlings in coir-pith root trainer containers. This is a turning point in the history of seedling nurseries.
- Proposed Reserve Notification – About 319.504 ha of land has been notified as Proposed Reserve. This is no mean achievement considering the constraints and situation of the availability of land in Kerala.
- Elephant Rehabilitation Centre at Kottoor in Trivandrum – Providing a Rehabilitation Centre for captive elephants is a long-felt need of the State. A project for Rs. 105 crores under the KIIFB were approved and the works for the first phase of the State-of-the-art Elephant Rehabilitation Centre at Kottoor in Trivandrum was completed and inaugurated in February 2021.
- Zoo at Puthur, Thrissur – A Zoo of international standards is being developed in Puthur in Thrissur. This will house the animals which are now stationed at the Zoo in Thrissur where there is an acute shortage of space. The first phase of the new Zoo at Puthur, Thrissur was inaugurated in February 2021.
- Assessing the Survival percentage of seedlings distributed by the Social Forestry Wing – For the first time in history, the Kerala Forest Department had attempted to assess the survival percentage of seedlings distributed by the Social Forestry Wing. Of the seed-

lings distributed in 2016-17, around 55.24% had survived and for those distributed in 2017-18, the survival percentage was 62.53%.

- Standing Committee of State Board for Wildlife – A Standing Committee of the State Board for Wildlife has been formed to speed up the processing of Wildlife Clearance proposals and to avoid pendency.
- E – Data Base for captive elephants- By preparing a comprehensive information system of all the registered captive elephants, based on DNA fingerprinting and data bank profiling, Kerala became the first State in India to have a detailed database of 519 captive elephants. This was prepared with the technical support of the Rajiv Gandhi Centre for Biotechnology.
- Janajagratha Samithies – For effective intervention in mitigation of Human-Wildlife Conflict, 204 Janajagratha Samithies in conflict-prone areas were formed. These Samithies have the elected members of the local bodies concerned as members.
- Crash guard rope fencing – This was a novel idea in mitigating Human-Wildlife Conflict and was introduced in areas under Mankulam Forest Division. Attempted in India for the first time, this technique is cost-effective compared to rail fencing. The technology is now being used in other districts too, with projects under KIIFB now being implemented in Wayanad and Malappuram.
- SMS Alert system as a warning in Human-Wildlife conflict areas – A system of sending warning messages to local people when a wild animal especially a wild elephant is sighted near human habitations has been introduced in 65 locations.
- Training of Kunkie elephants – The service of Kunkie elephants in sending back the wild elephants straying into human habitations back to forests is of extreme importance. More than 6 captive elephants of the Kerala Forest Department have been trained as Kunkie elephants during this period.
- Rapid Response Teams (RRT) to address Human-Wildlife Conflict – Around 15 rapid Response Teams are now working in Human-Wildlife Conflict prone areas to address the issue. They track the wild animals straying into human habitations back to forest areas.
- Increase in ex-gratia payment to victims of Wildlife Attack – The Kerala Forest Department has been taking many measures to reduce the Man-Animal Conflict. But despite the best efforts, at times there are certain unfortunate events of loss of human life, property, and farm produce. In such cases, as per existing rules, the Kerala Forest Department provides compensation for the aggrieved after due scrutiny. The rates of such compensation given to victims of Wildlife Attack has been increased. In the case of human death, the rates have been doubled.
- Posts of Chief Forest Veterinary officer and Asst Forest Veterinary officers created – Addressing the Human-Wildlife Conflict and the management of captive animals need professional veterinary care and for this one post of Chief Forest Veterinary officer and 12 posts of Assistant Forest Veterinary officers have been created.
- Project Green Grass. Kerala Forest Department has launched “Project Green Grass” in the State in a move to keep the forests clean. The project aims at clearing the sol-

id waste from identified locations in forest areas (by involving VSS/ EDC/Voluntary organizations), creating awareness among the tourists, imposing spot fining and other legal measures, adopting technology to monitor waste dumping and so on. During the period 125 waste dumping spots were identified and cleaned. A separate plan was developed for the Munnar Forest Division and removed 1808 tons of waste from that area alone.

- Forest Plus 2.0. Kerala's Thiruvananthapuram landscape is one among the three areas in India identified for implementing the project by the Ministry of Environment, Forest & Climate Change (MoEFCC). This project, started in 2018, with the technical support of the United States Agency for International Development (USAID), aims at developing tools and techniques to strengthen ecosystem-based management by including ecosystem services in forest landscape management and to bring in a larger area under improved management and improve the livelihood of forest-dependent communities. As part of the implementation of this project, the supply chain analysis of major non-timber forest produces and ecotourism activities in the forest fringe villages of Thiruvananthapuram Forest Division is in progress. Baseline studies of ecosystem services provided by the forests of the Thiruvananthapuram landscape are also nearing completion.
- Projects under Rebuild Kerala Development Programme (RKDP). Activities such as voluntary relocation of private settlements from forests, acquisition of private estates within forests and consolidation of mangroves received approval under RKDP for Rs.800.00 crore. The project is underway.
- State Butterfly- "Buddha Mayoori" has been declared as the official butterfly of Kerala State. Kerala is the fourth State in the country to have a State Butterfly.

Gaps In the Implementation of 13th FYP

The plan period of the 13th FYP which started from 2017 was a period of more downs than ups in all spheres of life across the globe, leave alone Kerala. More specifically, we had Cyclone Ockhi in 2017 which had devastating effects in Southern Kerala, 2018 and 2019 saw the floods the scale of which was unimaginable whereas 2020 and 2021 saw the COVID 19 pandemic bringing activities in almost all walks of life to a grinding halt. Hence, though the Plan document for the 13th FYP was a visionary one, it seems that the department could not achieve some of the goals set out in the document. However, it is also to be noted that despite the grim situation, the Department had made some accomplishments as mentioned above.

There was a shortfall both in the budgetary allocation and expenditure compared to what the 13th FYP envisaged. The details are given in Table 5.

The slow-down in progress observed in all developmental programmes consequent to the recurring floods and COVID-19 pandemic was observed in the implementation of the 13th FYP also. This is explicit from the fund allocation and expenditure (Table 5).

Table 5. Year-wise budgetary allocation and expenditure during the 13th FYP

Plan Component	2017-18		2018-19		2019-20		2020-21		2021-22	
	Outlay	Expenditure	Outlay	Expenditure	Outlay	Expenditure	Outlay	Expenditure	Outlay	Expenditure*
State Plan	238	162.6	243.7	141.5	208.7	139	179.3	211.5	201	64.3
CSS	67.5	25.5	56.2	30.17	33	21.3	33.18	28.42	50.7	5.37
Total Outlay	305	188	299.9	171.7	241.7	160.3	212.4	239.9	251	69.7

Despite the allocations for improving ecological health, promoting water yield and biodiversity, the results could not be achieved to the fullest. However, the move to phase out the existing exotic monoculture and the initial steps taken are in tandem with the goals of the 13th FYP and is a welcome move. But this is a time-consuming task that could be done in a phased manner. A conservative estimate made by the Kerala Forest Department shows that the phasing out of exotic plantations would be complete only by 2035.

Despite the visionary proposals in the 13th FYP to enhance the multiple ecosystem functions of the forests, especially water yield and quality through landscape-level approaches, it failed to effectively harness people's participation and the involvement of various connected agencies for its successful implementation. Landscape-level management cannot be achieved overnight and is a long process requiring extensive people's participation. However, the progress in this direction was significantly hampered by the floods and the COVID-19 pandemic.

The proposal to subordinate production forestry to enhancing ecological functions of the forests has been reflected in the phasing out of exotic plantations and reversion of poorly performing plantations to natural forests through eco-restoration activities. However, the progress in the alternate strategy to strengthen tree farming in the agro-ecosystems was at a slow pace. It rarely addressed the compounding issues in this sector such as species prioritization, legal issues in the felling and transit of tree species, lack of institutional guidance, location-specific management of trees in agroecosystems etc.

Yet another gap area was the poor linkage with LSGs in the management of common resources such as rivers and conservation of forest and agrobiodiversity. There is also a need for strengthening ties with forest personnel and local inhabitants for the management of forests in the participatory mode. Social forestry needs to be reoriented as the steering force in addressing all issues related to promotion of trees in the ToF sector. In the light of recurring climate change and the COVID-19 pandemic, there is a need to redesign and implement innovative livelihood sources for forest dependent communities. In the prevailing undesirable agro-ecological ambience, land use needs to be reoriented towards ecologically and economically viable endeavors.

Challenges in implementation of the 13th FYP Programmes

The following are the pertinent challenges in the implementation of 13th FYP.

1. The general slow-down in activities following the floods and COVID 19 pandemic.
2. The introduction of the contractor system for forestry works in 2017 replacing the convener system which was in vogue from 1989 was a major reform.
3. The restrictions placed by the treasury in sanctioning bills in certain months during 2019, 2020, and 2021 had affected the pace of implementation of the projects.
4. The treasury queue bill system introduced during the fag end of 2019-20 placed a large chunk of unpaid bills in the queue and this was sanctioned in 2020-21 against the allotment of 2020-21. This resulted in projecting poor financial progress for the year 2019-20 and a shortage of funds in the first two quarters of 2020-21 and reduced fund availability to take up works sanctioned in the Budget 2020-21.

The delay in the release of the second installment by the Central Government is also causing hurdles. Forestry works are highly seasonal. There are few CSSs like the Forest Fire Prevention Monitoring Scheme (60.40 CSS), where the activities are mostly taken up during the last two quarters since the Forest fire season each year starts in January and ends in May. The central Government releases the second installment only after the UC for the first installment is submitted. In this case, since most of the activities are to be taken up during the fag end of the financial year, the UC for the first installment can be submitted during the fag end of a financial year only, resulting in the non-release of the second instalment. There was a previous decision by the National Steering Committee, in this case, to release the entire allocation as a single instalment but it has not materialized.

3. SUSTAINABLE FOREST MANAGEMENT WITH ECOSYSTEM APPROACH AND EMERGING GLOBAL TRENDS

ECOSYSTEM APPROACH IN SUSTAINABLE FOREST MANAGEMENT

A deeper analysis of Kerala's past forest management systems reveals that it was focused significantly on the sustained yield of a limited set of goods and services (primarily timber), as well as a lack of clarity on approaches favouring the multi-functionality of forests. Despite the realization of the ecological basis of forest management, its implementation transpired at an extremely slow pace. Wide gaps still exist in the integration of forest management with ecological functionalities of the forests. There is a lack of comprehensive action plans that effectively harness these mutually inclusive dimensions. Sustainable forest management (SFM) and ecosystem approach should express similar goals and approaches for forest management, focusing on environmental, social, and ecological sustainability and on generating and maintaining benefits for both present and future generations. The need of the time is to provide support to the actual implementation, building upon existing best practices and tools. In general, SFM involves the application of good practices based on current scientific and traditional knowledge that allow multiple objectives and needs to be met without degrading the forest resource.

Implementation of SFM should be built on society's increasing awareness of environmental, social, and cultural aspects, including participatory processes and gender equality. Interactions with other sectors and the critical roles that forests and trees play in water production, soil conservation, climate-change mitigation, biodiversity conservation and bioenergy are well recognized, as are the significant contributions that forests and trees make to food security, sustainable livelihoods, and the eradication of poverty. Progress towards sustainability is still limited and there is a need, therefore, to increase SFM, reforestation, and forest restoration and to deploy agroforestry systems and other Sustainable Land Management measures holistically.

Emerging Global Trends in Tropical Forest management

In response to the growing realization of forests as a potential finite resource with a multitude of ecosystem delivery functions, there has been considerable focus on developing innovative tools and strategies for the sustainable management of tropical forests.

Management of natural forests

The management of natural forests is focused on integrating economic, social, and environmental objectives based on the principles of SFM and through landscape approaches. Growth modelling and its applications have become an integral part of SFM. Mathematical models have been specifically developed for the optimization of water management problems at the landscape level. Optimization of forest ecosystem resources using mathematical optimization tools is relatively recent. Also, attempts to model multiple ecosystem functions and spatial and temporal distribution of the tropical forest vegetation is critical for designing appropriate management strategies.

Several countries have developed payment schemes for rewarding landowners who adopt practices to sustain or increase the provision of ecosystem services such as water and soil protection, biodiversity conservation, and climate-change mitigation. The cultural services that humans derive from forests include cognitive development, recreation, reflection, spiritual enrichment, and other values. "Forest bathing" as part of ecotherapy is gaining attention in many parts of the world.

REDD+ readiness efforts have added momentum to ongoing efforts to manage forests sustainably. These are supported by different multilateral and bilateral organizations, the Forest Carbon Partnership Facility, and the UN-REDD programs. International funding is available for the implementation phase of REDD+, mainly from the Green Climate Fund and bilateral finance, while another potential source could be through carbon markets. REDD+ strategies may be developed at the national level, but reducing emissions requires an integrated approach that involves all sectors and levels, especially given the long-term objective of lowering emissions. The Forest Carbon Partnership Facility's Carbon Fund was developed to pilot the third phase. Countries like Nepal and Vietnam have prepared emission reduction program documents and have been accepted into the Carbon Fund portfolio.

Partnerships involving governments, non-governmental organizations, communities, forest enterprises, grower associations, and organizations pioneering cutting-edge technologies will need to be forged to enable collaborative work in areas such as environmental monitoring, product innovation, landscape approaches, and climate-change mitigation and adaptation. Involving youth in conservation efforts is also important, particularly as they are highly technologically integrated. Graduates in forestry and allied sectors may have compulsory community and forest service as part of their curricula. Acquiring new technology-based skills relevant to forestry through training is also important. Resources like the Green Climate Fund, a global fund to support the efforts of developing countries to reduce greenhouse gas emissions and adapt to climate change, must also be accessed.

Management of planted forests

Advanced technologies to increase productivity and improve tree growth are increasingly being applied in planted forests as tree improvement programs and genetic modification. Precision forestry is another approach that uses modern tools and technologies to improve forest management and decision-making. Management of plantations using advanced silviculture and density management models help in realistic growth and yield predictions for diverse end use. Precision forestry also involves the application of INM, VAM, fertigation, and other practices. Intensive management of forest plantations increasingly incorporates large-scale precision silviculture to estimate silvicultural, biotic, and abiotic effects on site-specific forest productivity. Approaches for predicting plantation growth and yield under climate change scenarios are also being developed.

Genetic selection, tree breeding, and rapid planting-stock multiplication techniques, combined with refined site management practices, have helped increase the productivity of planted forests. Innovations in wood science have led to newer, more advanced applications; engineered wood, for example, facilitates the construction of tall, massive timber

buildings. Urban forests and other green spaces have been developed in several countries to improve the quality of life for urban residents by regulating climate, storing carbon, removing air pollutants, reducing the risk of flooding, assisting in food, energy, and water security, and improving the physical and mental health of citizens. Many regions are taking considerable effort to green their cities as a means of improving the quality of life for their citizens and attracting investment. Ex. Singapore's Garden City.

Non-wood Forest Products

Sustainable management of non-wood forest products and their role in alleviating poverty and improving the livelihoods of rural communities, especially forest-dependent people require attention. Simple traditional means and sophisticated technologies are being used processing these. This is particularly popular in the health and beauty sector.

Value chains in this product category range from hyperlocal to global. Some value chains that where hitherto of local importance alone have expanded to gain global prominence. In addition, several traditional practices and products are gaining wider acceptance, leading to the development of new value chains.

Emerging technologies for SFM

Research on the biological aspects of forestry, including ecosystem processes, has improved the tools and techniques available for the sustainable management of both planted and natural forests.

The accurate measurement and real-time monitoring of natural resources is a necessary precondition for their effective and efficient management. Advances in earth observation technologies, high-resolution satellite imagery, remote sensing and mobile electronic devices are revolutionizing forest management and the environmental monitoring of forests and landscapes. Technologies using Smartphone- and tablet-based forest management applications, cloud computing, genetic sequencing, semi-autonomous vehicles, nanotechnology have potential uses like data collection, forest inventory, assessment, analysis, real-time monitoring of deforestation, act as biosensors and biomaterials, DNA based timber tracking. Biotechnologies could potentially be used to introduce desirable traits do not present in natural gene pools, such as resistance to certain pests, the bioremediation of polluted water and lands, and tolerance to abiotic stresses such as drought and salinity. There are concerns about the safety of genetically modified trees, particularly the potential long-term environmental impacts due to changes in gene flow. Multidisciplinary approaches to forest research are increasingly needed to address issues such as climate change, water, the livelihoods of forest-dependent indigenous peoples and local communities, and biodiversity conservation. Two major foci of future scientific research are likely to be ecosystem resilience and the bioeconomy. A wide range of technologies, such as drones, laser scanners, environmental sensors, and decision-support tools such as big-data analytics, artificial intelligence, virtual-reality technologies, and autonomous vehicles are part of an oncoming technological wave enabling the development of new, sophisticated approaches and models in forestry.

Innovations in wood science such as cross-laminated timber and new construction and fireproofing technologies allow the construction of tall and massive timber buildings.

Three-dimensional (3D) printing using wood waste (e.g., from construction and furniture) is another technology under exploration in the forest sector. Nanotechnology has the potential to produce new biobased composites and nanomaterials and to achieve improvements in the performance-to-weight ratios of paper and packaging products.

Technological innovations in forest governance

Legality and good governance are the essential elements of SFM. Timber verification is increasing in importance, driven by consumer demand and policy change. Several timber-tracking technologies are being developed, tested, and deployed to track the movement of logs and timber through supply chains, including radio-frequency identification tags, barcodes, and luminescent nanoparticles. DNA-based techniques are also emerging in which cutting-edge genetics and chemical testing are used to detect illegal timber entering global supply chains. Governments are leveraging technologies to improve land mapping and the management of land-ownership information. The aim of Indonesia's One Map geoportal initiative, for example, is to reconcile conflicting land-rights claims. Information and communication technologies are empowering them to participate in the community-based monitoring of forest crimes and forest resource management.

Selling private timber through government channels would be more profitable for farmers. E-commerce and new financial service technologies can benefit the forestry sector immensely. Emerging technologies such as block chain, machine learning, artificial intelligence, Internet of Things, and fifth-generation wireless systems could also be of importance for the forest sector. Forest certification also encourages sustainable forest management through corporate and public procurement policies and national level import regulations.

4. THE 14TH FIVE-YEAR PLAN – THE WAY FORWARD

The thrust on the theme "Water for a Thirsty Kerala" must be taken forward in the next FYP as well. Utilizing the forest ecosystem offers the best possible option for improving water security in the state. Improving the hydrological functionality of forests from the current 30–40% to 60–70% or more will be the best cost-effective approach for improving water governance in Kerala. In essence, this means addressing and removing factors that cause forest fragmentation and degradation. Kerala requires a governance approach in forest-dominated landscapes that does not compromise the ecological functions of forest resources while addressing the developmental and livelihood requirements of people. Hence, the following approaches are proposed.

1. Relocation of private settlements located inside forests
2. Acquisition of private estates located inside forests
3. Securing identified elephant corridors
4. Consolidation of forest boundaries through survey and demarcation
5. Resumption of unused forests areas given on lease
6. Swapping the habitations of forest-dwelling communities as a strategy to address human-wildlife conflict, disaster-risk reduction, and improving access to livelihoods and welfare measures
7. Rationalization of boundaries of Protected Areas (PAs)
8. Consolidation of mangrove forests
9. Restoration of industrial plantations to natural forests
10. Rationalizing teak plantations
11. Unlocking the potential of NTFP-based forest livelihoods
12. Effective implementation of the Forest Rights Act, 2006
13. Addressing human-wildlife conflict
14. Moving towards landscape management

LANDSCAPE LEVEL MANAGEMENT OF FOREST ECOSYSTEMS

Sustainable management of our forests and wildlife calls for a landscape-level approach as the forests and agricultural landscape of the state are inseparably connected and share valuable common resources with usufructuary rights. Ecosystem approach being the cornerstone of nature-based solutions, forest management should be based on sound ecological principles.

A hydrological framework for forest governance calls for a "ridge-to-valley" approach where the watersheds of major rivers become the focus of management planning and action. All the interventions in a landscape (comprising several watersheds) from the source of a river till it joins the sea must be synchronized. For instance, protecting a key water-source from disturbances (production, felling, tourism, or fire) is imperative irrespective of whether it falls in forest or non-forest areas. This calls for an integrated governance approach based on landscape-level considerations. In other words, all the land use within a landscape must be synchronized conservation-friendly practices must be adopted across the landscape. The

landscape approach in managing forests and other ecosystems will help prioritize vulnerable and critical ecosystems and build stability in the context of climate induced extreme weather events in Kerala. The integrated management of all interconnected land-uses in a landscape is going to be an important strategy (with impetus on urban forestry, climate change mitigation and hydrology) for forest governance in the Fourteenth Plan.

Hence, the 14th FYP tries to evolve inclusive forest management strategies at the landscape level by bridging the continuity of forest and agroecosystems and optimizing ecosystem benefits to the society without compromising the economic prospects of the fringe communities and forest dwellers. The UNEP and WHO insist on the restoration of ecosystems as a public health emergency call based on the concept of 'one world one health'. The health and continuity of ecosystems are keystones in building the ecological, economic, social, and political resilience of any community. Hence, the theme of the 14th FYP is "Forests for Resilience".

5. PROGRAMMES ENVISAGED IN 14TH FIVE-YEAR PLAN

The following programmes are designed based on the 14 approaches mentioned in the previous chapter.

1. Enhancing climatic resilience and hydrologic regime through improved forest management including eco-restoration
2. Augmenting ecosystem health and multi-functionality of natural forests
3. Biodiversity conservation and management of wildlife and protected areas
4. Forest-based livelihood, socio-cultural dimensions, and sustainable ecotourism
5. Participatory forest management
6. Production forestry and extension beyond forest boundaries
7. E-governance in forestry, research priorities and outreach

PROGRAMME 1. ENHANCING CLIMATIC RESILIENCE AND HYDROLOGIC REGIME THROUGH IMPROVED FOREST MANAGEMENT INCLUDING ECO-RESTORATION

The floods of 2018 and 2019 have had far-reaching impacts on the social, economic, human, and ecological infrastructure of the forests of Kerala resulting in extensive loss of vegetative cover, landslides, erosion of humus-rich topsoil and consequent formation of large gullies and ravines grossly affecting the water retention potential of the forest floor. The Post-Disaster Needs Assessment (PDNA) report identifies the "heightened vulnerability" of forest enclosures and calls for integrated and innovative approaches for forested and contiguous agricultural landscapes. The absence of stable multi-canopied vegetation has contributed to flash floods and landslides in the state.

Strategies for the Future

Eco-restoration of landslide affected regions

Assessment of the extent of damage in landslide-affected forests and contiguous non-forest areas in terms of soil depletion, loss of vegetal cover, topographic changes etc. and identification of the major drivers of the landslide or floods. Design location-specific effective eco-restoration measures and implement them with the involvement of LSGs, BMCs, and other stakeholders.

The responsibility of eco-restoration in fragile areas should be shouldered by respective Local Self-governments. The collective expertise of institutions such as KFRI, KAU, CWRDM, groundwater department etc. should be utilized for this task. Bamboo, reeds, and native vegetation-based bioengineering measures should be promoted for the stabilization of landslide-prone areas. Financial support from various national and state level agencies should be tapped for improving watersheds.

Extension of riparian buffers in forests and agroecosystems

Heavy flooding in agricultural lands during the recent floods was attributed to the poor resilience of riverbanks. Riverbanks in forested areas are protected due to the presence of natural vegetation, requiring the continuity of buffer strips in both forested and agricultural

landscapes. A tri-zonal vegetal cover 30m in width should be established on either side of the river line. Bioengineering strategies using indigenous riparian vegetation such as bamboos, barringtonia, aatuvanchi, pandanus, perennial grasses etc. may be used for establishing riparian buffers. The revegetation of riverbanks should be under the patronage of respective LSGS. This may be implemented as the projects of Panchayath BMCs with social forestry as implementing department.

Eco-restoration of industrial plantations to natural forests

Kerala has approximately 27,000 ha of industrial plantations (acacia, eucalyptus, tropical pines, and Alnus). Given the diminishing industrial requirements and the need for managing forests to resist climate variabilities, the Government of Kerala has decided that the remaining ones be phased out and restored to natural forests to substantially improve the water retention capacity of forestland.

Rationalization of teak plantations

Kerala has 90,978.1 ha of Teak plantations. This is approximately 59 per cent of the total area under plantations with the forest department and 8 percent of total forest area in the state. It has now been decided that teak plantations in poor or degraded sites without any potential for development into successful plantations shall be restored to natural forests. Similarly, disaster-prone areas (above 30-degree slope), wildlife corridors, riverine areas, and high-value biodiversity areas also need to be restored to natural forests.

PROGRAMME 2. AUGMENTING ECOSYSTEM HEALTH AND MULTI-FUNCTIONALITY OF NATURAL FORESTS

Strategies for the future

Landscape-level watershed protection (Transdisciplinary approach)

A comprehensive action plan will be made for the protection of watersheds in both forest and agro-ecosystems. Land use practices shall be regulated in such vulnerable landscapes. This requires collective and committed cooperation from various agencies. There should be policy initiatives and institutional arrangements for harnessing the collective involvement of different stakeholders. The responsibility for the protection of local watersheds in the agro-ecosystems should be partnered with the LSGs who should seek the support of an expert group constituted for the purpose. The collective participation of the public and various governmental agencies and other stakeholders will be ensured. The Green India Mission is already pursuing a three-tier approach to identifying landscapes, sub-landscapes, and micro-landscapes and this will be mainstreamed. Also, the activities under Forest Plus 2 and Rebuild Kerala Initiative projects will be integrated effectively. Moreover, Kerala needs a land-use policy sensitive to the vulnerability of its landscape units to the increasing extreme climatic events.

Watershed master plan and development of a hydrological framework

Forest governance, based on a "ridge-to-valley" approach where watersheds of major rivers become the focus of management planning and action shall be attempted. This involves integrated management of all interconnected land uses in a landscape. Protection for key water sources from all disturbances (production felling, tourism, or fire) will be implemented

irrespective of whether it falls in the forest or non-forest areas. This will be implemented in a phased manner starting with the most vulnerable watersheds. All the interventions in a landscape (comprising several watersheds) from the source of a river till it joins the sea will be synchronized to planning and implementation. Conservation-friendly land-use practices will be encouraged in such watersheds. Protocols will be developed for the comprehensive improvement of each watershed as regards their ability to improve water quality and yield starting with the most critical watersheds. A GIS-based watershed delineation approach shall be extended to all major forests at the landscape level. Resource mapping and preparation of the present land use map in cooperation with the local LSG and the public may also be attempted.

Enhancing water yield and quality

There has been a considerable decline in the water retention potential of the forests of Kerala. This has been further compounded by intense rains and floods. The vital function rendered by the forests constitutes the regulation of high-velocity intensive rainfall by proper canopy interception and enhanced stem flow, eventually getting soaked in the forest floor. The humus-rich soils absorb the water like a sponge, conserve it in the soil mass, and percolate it down slowly permitting a smooth subsurface flow of rainwater during the entire summer season enabling the recharge of wells and ponds downslopes. However, there has been a substantial decline in the water holding capacity of the soil due to the poor organic carbon content in the topsoil. It is estimated that the water retention potential of our forest soils has come down to one-third of their capacity. Furthermore, heavy rains led to massive loss of topsoil virtually bleaching the forest floor. This is particularly prominent in the steep slopes in the watersheds. A participatory River Health Assessment (RHA) system may be launched with the involvement of trained tribal groups (inside the forest areas) and local youth/School/College students/clubs etc. (outside the forest area). Panchayat BMCs can be given the responsibility to lead such activities at the village level.

Improvement of soil health

Ecologically safe water retention structures such as check dams, graded bunds, gully plugs, and natural terraces in climatically vulnerable areas for effective soil protection shall be explored. Intensive soil conservation measures should be taken up in the watersheds at the landscape level with a focus on erosion control in vulnerable areas. Assessment of soil profiles and development of soil resource status maps with a focus on open and degraded forests should be taken up on a priority basis.

Ecological approach for improving natural vegetation structure

There has been a decline in the ecological successional attributes of our natural forests. Studies in the moist deciduous forests of Kerala reveal considerable disruption in their phytosociology and regeneration dynamics. There is a serious decline in the frequency distribution of each species, disproportionate distribution of species among various social classes (seedling, sapling, immature, mature, over mature), and poor regeneration of most species. The Importance Value Index (IVI) of most of the species in all forest types is below the optimal range. This is going to cause serious depletion in the diversity and structure of our natural forests. To improve the situation, the following are suggested

- The major ecological and anthropogenic drivers that hamper the regeneration status of various plant species (recurrent fires, invasive plants, soil erosion, climate change, etc.) shall be identified and corrective measures to ensure adequate natural regeneration shall be undertaken.
- A phytosociological assessment shall be done before species augmentation activities in all-natural forest types. This will help in the ecological prioritization of species and their required density per ha.

Natural Forest Health Improvement

To improve the health of natural forests, the following measures shall be undertaken:

Improving forest vegetal cover

Large-scale fragmentation of forests is one of the serious issues affecting their ecological continuity. Emphasis shall be given to the extension of forest cover. Voluntary relocation of private settlements from forests and acquisition of private estates within forests shall be accelerated during the next five years to revegetate the gaps in forest land. Resumption of unused forest areas leased to other agencies shall also be attempted. Nearly 55,711.1 ha of forest lands have been leased to public sector units in the past for various purposes including cultivation. Cash crop plantations such as rubber, cardamom, coffee, tea, and other crops exist in such leased-out areas, but large tracts remain unused and maintain the characteristics of original forest formations. Such unused forest areas may be reclaimed. The decision to convert existing plantations into natural forests will be implemented faster. The government's decision to convert unproductive teak plantations into natural forests will be continued and effective eco-restoration strategies will be developed for implementation in all such areas.

Consolidation of forest boundaries through survey and demarcation

Even as forest cover expansion is attempted through voluntary relocation of private settlements from forests and acquisition of private estates within forests, it is also important to protect the existing forest areas from encroachments. Also, apart from the ecological and enforcement-related reasons, the demarcation of forest boundaries is essential for settling the legal disputes relating to forest boundaries. Survey of forest boundaries, demarcation using cairns and kayyala, and cairn construction, wherever feasible, shall be completed during the 14th FYP period.

Eradication of invasive species

Identification and assessment of eradication strategies for invasive species, particularly for most vulnerable and affected forests. The ecological drivers of such invasions shall be identified, and effective measures shall be developed for their elimination. Potential hotspots will be identified, and mapping will be made for vulnerable areas. A case in point is the Senna species invasion in Wayanad.

Relocation of private settlements from inside forests

In the Western Ghats, honeycombing due to human habitations inside forest enclosures and climate-induced ecosystem malfunctions have led to degeneration, fragmentation, and loss of vital habitats and wildlife corridors, thereby increasing human-wildlife conflicts.

Voluntary relocation with prior informed consent and written willingness shall be attempted. Relocating non-tribal private settlements located inside the forests by paying suitable compensation shall be the focus. It is estimated that around 2000 ha of forest enclosures can be converted to natural forests through this process under the Rebuild Kerala Development Programme (RKDP) and others.

Acquisition of private estates

Private estates inside forests were established by clearing dense natural forests, mostly on steep slopes of forested mountains. Restoring them to natural forests shall significantly reduce the likelihood of calamities like landslides apart from improving the hydrological functions of the forests. Restoration of these estates is also expected to reduce the incidence of human-wildlife conflict. It is estimated that around 3000 ha can be restored to natural forests through this process. This shall be taken up in the appropriate schemes.

Discouraging solid waste dumping in forests

Forest areas in the proximity of human settlements are vulnerable to waste pollution. The degradation of these areas is visible, and this can have a negative influence on the environment. The Kerala Forest Department has already launched the Project Green Grass in a move to keep our forests clean. The project aims at clearing solid waste from forest areas by involving VSS/ EDC/voluntary organizations), creating awareness among tourists, imposing spot fining and other legal measures, adopting technology to monitor waste dumping, and so on. Already 125 waste dumping spots have been identified and are cleaned. The project needs to be extended to other areas where there are similar threats.

Scientific planning for improving the health of natural forests

Thiruvananthapuram is one among the three areas in India identified for implementing the project "Forest Plus 2.0" by the Ministry of Environment, Forest & Climate Change (MoEFCC). The project which started in 2018 with the technical support of the United States Agency for International Development (USAID), aims at developing tools and techniques to strengthen ecosystem-based management by including ecosystem services in forest landscape management, bring in a larger area under improved management, and better the livelihood of forest-dependent communities. As part of the implementation of this project, the supply chain analysis of major non-timber forest produces and ecotourism activities in the forest fringe villages of the Thiruvananthapuram Forest Division is in progress. Baseline studies of the ecosystem services provided by forests in the Thiruvananthapuram landscape are underway. The activities initiated under this program need to be continued and expanded to other landscapes in the State during the next plan period.

PROGRAMME 3. BIODIVERSITY CONSERVATION AND MANAGEMENT OF WILDLIFE AND PROTECTED AREAS

The wildlife wing of the Forest Department manages 3,213.2 sq. km of forests under the protected area network, which includes five national parks (NPs), 17 wildlife sanctuaries (WLS), two tiger reserves (TRs), and one community reserve (Kadalundi-Vallikkunnu). There are several high-value biodiversity areas (HVBAs), such as New Amarambalam,

Kulathupuzha, Siruvani-Muthikulam, Goodrickal, Malayattor, Camel's Hump Mountains, Chembra, Elambileri, Aranamala, Kattimattam, Vellarimala, Vavulmala, and Thirunelli.

The main focal point of long-term policies could be avoiding honeycombing because of human habitations inside forest enclosures, and consequent fragmentation, degradation and loss of vital habitats and wildlife corridors leading to an increase in human-wildlife conflicts. Many of the activities that need to be taken up to address this issue have been discussed at length in Programme 2. The existing proposals for new Protected Areas shall be actively taken up and all processes including stakeholder consultations completed in a time-bound manner.

Wildlife management outside forests is also one of the major areas which need to be addressed. More rapid response teams (RRT) and veterinary emergency teams (VET), a larger carnivore rescue center, wildlife rehabilitation centers, wildlife veterinary care centers etc. need to be in place soon. A wildlife forensic lab, which is in the pipeline, shall be completed. The Elephant Rehabilitation Centre at Kottoor, Thiruvananthapuram and the Zoo at Puthur, Thrissur, whose first phase has been completed, need to be made fully functional.

The forest and wildlife protection and enforcement activities are to be strengthened, for which sufficient infrastructure, modern equipment etc. are to be provided. Urban wildlife and related crimes are also concerns which need to be tackled. A holistic approach to mitigate the human-wildlife conflict needs to be attempted.

The institutional structure for managing human wildlife needs to be revisited to include the scope of involvement of local self-governments and social forestry division in it as the conflict is happening outside forest boundaries and the animal population outside protected areas is increasing. It will improve the effectiveness of programmes by the participation of local communities in the processes and reduce the alienation of forest staff from the public.

Strategies for the Future

Securing identified elephant and other wildlife corridors

Identified elephant corridors and other wildlife corridors need to be secured.

Improving the Habitat and health of forests

Relocation of private settlements located inside the forests, acquisition of private estates located inside the forests, swapping the habitations of forest-dwelling communities etc. will improve the quality of the forests thereby resulting in a possible reduction of human-wildlife conflict.

Declaration of new protected areas after due consultations

All procedures including stakeholder consultations for the existing proposals of new protected areas shall be completed.

Habitat improvement programmes for specific species

Presently, there are schemes for habitat improvement for Tahrs and vultures. The possibility of having such schemes for other threatened species can be explored.

Addressing the human-wildlife conflict issue
Studies on the reasons and the best possible site-specific solutions (one or more solutions) and implementation of the comprehensive plan for conflict mitigation.

Captive elephant management
The e-database of captive elephants which has been prepared using DNA fingerprinting technology may be used effectively in combating illegal transportation of captive elephants.

Impact of COVID-19 pandemic and revival
All national parks and wildlife sanctuaries were closed to tourists during the pandemic, resulting in a huge economic setback. The activities of ecodevelopment committees (EDC) also came to a standstill. This area needs a big push and funds may have to be pumped in to revive the same.

PROGRAMME 4. FOREST BASED LIVELIHOOD, SOCIO-CULTURAL DIMENSIONS AND SUSTAINABLE ECOTOURISM

Livelihood, Social, and Cultural Dimensions

Unlocking the potential of NTFP-based forest livelihoods
An increase in the share of the value of NTFPs accruing to the marginalized communities will have a strong impact on poverty as well as the stability of democratic governance in some of the backward areas of the state. Interventions aimed at greater transparency in the commercial value of NTFPs and more equitable sharing of revenue shall incentivize the forest-dependent communities as well as the Forest Department to conserve biological diversity. This scenario is further compounded by problems stemming from recurrent floods and the COVID pandemic. Hence, there is a need for a structured approach to NTFP management from the forests of Kerala.

The livelihood of forest-related communities is always dependent on the forests and their resources. The income of these communities is becoming increasingly dependent on these resources. Earlier, these communities used to depend on these resources for their sustenance and other emergencies. With the emergence of market-driven livelihood activities, there was an overexploitation of these resources which gradually led to the damage of forests, resources, wildlife, and biodiversity. While considering these scenarios, without affecting the sustainability of the forests and resources, the livelihood opportunities of forest-related communities need to be improved with more focus on sustainable forest management activities.

Framework of resilience
Ecological. The strategy should be to ensure resource availability for livelihood of forest dependent communities through ecological restoration. Ecosystem based resource management, assisted regeneration and promotion of cultivation wherever possible.

Economic. The strategy should be to develop economic self-reliance for fringe and forest communities with less resource extraction through bringing full product cycle approach in all innovative products. Skill the tribal societies and other MSMEs at local level to manage a full product cycle.

Social. Ensure participation of Women and other marginalized sections. Facilitate formation of new social spaces such as production units. Women self-help groups, youth resource centers, knowledge documentation of forest dependent communities, etc. must be facilitated.

Political.Strengthen the political system at local level in such a way to ensure informed participation of communities by involving them in research, monitoring, regeneration and then in planning the use of resources. Establish possible linkages between the institutions under BD, FRA, and Panchayati Raj.

Strategies for the future

Firewood collection

Fuelwood collection may be performed as income earning activity or as a subsistence activity. To reduce the dependence on fuelwood and its collection, the promotion of LPG and smokeless chula/improved cookstoves can be encouraged. Related Central and State Goverment schemes should be offered for forest-dependent communities.

Climate change

Climate change has serious impact on the livelihood and socio-economic dimensions of forest dwellers and fringe area communities. There must be focused institutional arrangements for dissipating climate-related information for preparedness. Instead of centralized and state-controlled data collection, a more efficient and cost-effective method of amassing such information relating to weather/climate, agriculture, human-wildlife interactions, spread of invasives etc. can be made via citizen science groups. State may fund and facilitate the development of digital tools and platforms for collation and tools for analyzing.

Management and marketing of NTFP

Forest resource-dependent communities collect Non-Timber Forest Produce (NTFP) by unsustainable methods such as early harvesting, over harvesting, and destructive harvesting due to the pressures of market-driven collection. To overcome this, community-based participatory resource harvesting and monitoring approaches need to be implemented with possible intervention through The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006 or Forest Rights Act (FRA).

Specific action plans are given below.

1. Delineation of resource collection area for each community (under the Community Rights of FRA,2006).
2. Preparation of collection manual for each community under the Gram Sabha, Community Forest Resource Management Committees (CFRMC) or VSS/EDC.
3. Development of site-specific sustainable harvesting protocols.
4. Institutionalization of participatory resource monitoring mechanism for each community under the responsibility of Gram Sabha, CFRMC/VSS/EDC.
5. Use of traditional knowledge and scientific methods to monitor the resources.
6. Special focus to bamboo/reed harvesting, handicraft training with modern mechanization, and its marketing.

7. Development of sustainable marketing facilities for raw and value-added NTFPs and a transparent benefit-sharing mechanism through Gram Sabha, CFRMCs/EDC/VSS.
8. Special focus on the revival of societies under the SC/ST Federation by providing skill development and modernization activities.
9. Removal of exotic plants/invasive species, regeneration of alternative species, value addition and marketing as a prudent employment and livelihood option for forest dwelling communities
10. Certification process for sustainably managed forests and resources.
11. Establishment of central facility (with skilled human resource and technology) or provision for research and extension for periodic inventory of the quantitative, qualitative, and spatial distribution (mapping) of the NTFP resources to reach sustainability and extractive targets, successful restocking of NTFPs in selected localities.
12. Provision for minimum support price for NTFPs
13. Establishment of local facilities for storage and value addition of NTFP

Skill development programmes for forest-related communities/alternate livelihood sources

Apart from traditional livelihoods, new training programmes must be provided to forest dependent communities, especially tribal youth.

Specific action plans are given below.

1. Harnessing existing facilities/funds/schemes to establish the modern vocational training programmes and MSMEs among tribal youth for facilitating livelihood security and socio-economic status.
2. Empower Gram Sabhas, CFRMCs, EDC/VSS, and societies under SC/ST federation to facilitate medicinal plant cultivation with a full product cycle approach with clear planning for forward and backward linkages (Nursery/ cultivation/post-harvest processing/value addition/packing, bottling, and marketing of potential plants).
3. Special focus will be given to the formation of more women self help groups (SHG) among forest dependent communities in convergence with Kudumbashree and their empowerment through vocational training opportunities, women MSMEs, and its development.
4. Promotion of opportunities for tribal youth by facilitating special recruitment programmes in forest and other sectors, development of youth resource centers to promote higher education and better employment.
5. Formation of tribal labour contract societies. Skill training and machinery assistance to undertake forest protection and maintenance works. Also provide opportunities to engage in such skilled jobs outside the forests. Establishment of separate labour and machinery bank at each forest range and local Panchayats.
6. Identifying and promoting suitable agroforestry practices.
7. Incentivization of fringe farmers. Special incentives should be provided to fringe farmers for the promotion of agricultural activities. A transparent institutional mechanism may be evolved for the effective dissemination of incentives.

Forest fire management through community participation
Unregulated forest fires cause damage to the forest and great loss to wildlife, biodiversity, and resources. Community-based participatory protection and conservation activities would help reduce fire damage to a certain extent. NTFP collectors may be used to gather data on fire-prone areas in advance through participatory monitoring activities

Grazing
Local communities who are dependent on livestock compete with forest herbivores for fodder. This also spreads communicable diseases among wild animals and causes loess in medicinal and NTFP species. A well-explained management system for grazing needs to be developed and implemented. The fringe communities will be trained on planting suitable fodder trees and fodder grass and promote the stall feeding of cattle, which can substantially reduce grazing.

Protection and conservation of water sources
The tribal communities inside the forest depend on water sources inside the forest. The status and quality of the water is a concern for them, and it is directly or indirectly connected to their resource availability and collection. Special drives may be taken to ensure the quality of water sources inside the forest with involvement of local self government institutions and Gram Sabhas

Payment for Ecosystem Service (PES)
The people who live downstream and depend on unpolluted water for their day-to-day life owe it to the upstream community who have taken care of the headwaters. This needs to be recognized and appreciated. Provisions should be made for Panchayats, Municipalities, or Corporations to provide incentives to the Gram Sabhas of the upstream community for them having taken care of the headwaters.

Forest-dependent communities and fringe people will be educated on the significance of the forests and the need for their conservation in order to boost self-esteem as well as impart scientific knowledge, which will benefit participatory forest management. Forest department officials too, must be provided scientific training. The state government should have a separate policy package on payment for ecosystem services (PES) to the forest dwellers and the fringe community. Effective modern extension technologies should be in place for sensitizing the communities on ecosystem services and the rationality of payment for forest protection. A mechanism and protocol should be developed to assess and pay for the ecosystem services provided by the fringe and forest dwelling communities.

Sustainable ecotourism
A diversity of ecotourism experiences can be provided with Kerala's rich tropical rainforests, shola forests, hill stations, backwaters, wildlife sanctuaries, river deltas, indigenous culture etc. as major resources and attractions. A few ecotourism destinations have been developed in the state since late 90's. Ecotourism in Kerala is facilitated mostly by the Kerala Forest Department in a participatory mode and ensuring economic benefits to the local forest- dependent community, environmental sustainability and generating revenue for conserving the natural resource. There is a need for a transformative change to expand ecotourism in all

potential areas and connect ecotourism with other forms of tourism including farm tourism and health tourism across landscapes. Since the concerns and significance of ecotourism have ramifications outside the bounds of forest areas, it is necessary to make the ecotourism approach an explicit part of responsible tourism and a fresh policy formulated.

The ecotourism locations managed by the Kerala Forest Department are nature-based and ecologically sustainable, where education and interpretation are major components and where the livelihood of the local people is met. Ecotourism as a sector in the wildlife sanctuaries and national parks of the state can thus be linked to economic development by identifying and assessing its advantages in the development of local economies. The development of ecotourism also offers opportunities for the development of the local economy and developing the stakes of local people in the preservation of natural resources. Ecotourism and economic development are positively correlated and work in tandem to create win-win situations in Kerala. Labour-intensive methods of ecotourism management by incorporating the local community will enhance the distribution of income to the lower strata of the society on the one hand and ensure environmental sustainability on the other.

Specific steps include:

1. Formulation of an eco-tourism policy for the state.
2. Expand ecotourism through multi-stakeholder and multi-sectoral partnerships at the local level and model ecotourism based on social and environmental impact assessments in collaboration with and support of local bodies.
3. Expand ecotourism in other areas owned by the private sector and communities in every panchayat as their signature programme and incentivize the development of such initiatives for advancing local jobs and economies.
4. Foster public-private partnerships and encourage local investment for expanding tourism facilities outside protected areas like home stays and local food supply chain in collaboration with the support of local bodies.
5. Priority shall be to maintain the existing ecotourism centers as attractive destinations rather than opening new ecotourism centers. If a new ecotourism centre is to be opened, it should only be after conducting proper scientific impact study/carrying capacity study.
6. Periodic carrying capacity study and amendment of guidelines and visitor management protocols should be part of ecotourism projects at each destination with adequate fund allocation.
7. Safety audits of all the ecotourism centers shall be carried out at predefined regular intervals.
8. There is a need to develop a road map linking all the eco-tourism destinations both within the forests and outside the forests.
9. It is necessary to work out an incentive structure and institutionalize the same to popularize ecologically sound, responsible tourism.
10. Capacity building in the field of ecotourism in the state. Development of high-quality human resources (training and curriculum development) is an area where the state

should take an active role by including ecological limits and potentials of the state in the curriculum for designing and operating proper ecotourism products.

11. There is a need for clearer regulations, strategies, and action plans beyond the guidelines on ecotourism in the state.
12. Frequent training and capacity building programmes to forest-based communities involved in ecotourism.
13. Design programmes to instill ecological knowledge among the forest dwelling communities.
14. Strengthen interpretation centers at ecotourism destinations with more nature-education elements.
15. Scientific approaches shall be explored for the effective marketing of ecotourism by harnessing the support from the tourism department and other stakeholders in the tourism sector.
16. The possibility of enriching ecotourism initiatives with unique products such as traditional tribal handicrafts, traditional dress code, NTFP collection methods, tribal dance forms, music, food habits, health etc., shall also be explored.
17. Develop e-markets at the state level for tourism products, including all eco-and farm tourism destinations and offer a variety of tourism products and services through these e-markets. These include tribal handicrafts, traditional costumes, niche markets for NTFPs, participation in tribal culture and food systems, local health system, homestays, botanical, and medicinal gardens etc.
18. Develop a certification system to inform customers on the quality of the products and develop monitoring protocols for ecotourism.
19. Mobilize money through ecotourism bond and direct such investments for developing/ and or further improving ecotourism circuits and support the stakeholders along the circuit with micro-credits and capacity building to offer high-quality ecotourism products and services.

PROGRAMME 5. PARTICIPATORY FOREST MANAGEMENT

Kerala has a radically altered and fast changing socio-political and economic scenario at hand compared to that of the early period of institution of PFM. Hence, the PFM strategy needs to be in response to this changing environment. Institutions need to be revamped from their founding conceptions of forming completely self-reliable and timeless communities and refashion these to dynamic and adaptive institutions that can interface with other departments and have legal provisions built in. With the present institutional clustering and hierarchy (with VSS, EDC, and FDAs and the confederation of FDAs in mind), PFM institutions have ample scope for innovation and for establishing cross-institutional linkages. Though the majority of PFM institutions have approved micro-plans and FDAs have valid registrations, these have been set to a 'business as usual' mode of operation and are active only as a passive channel for central funds. While sustainability is a major concern and ecosystem-based approach is on the calling, the turning around of the PFM institutions depend on ensuring the sustainable management of NTFPs by combining the concerns with community forest resource (CFR) rights (of FRA) along with effective marketing and value

addition to suit the changed times of aggregation of the supply and demand data.

Strategies for the future

1. Creation of PFM 2.0 strategy for revamping the PFM in tandem with the activities of various other departments so that the livelihood and sustainable forest management with the ecosystem service-based approach is realized.
2. Establishment of central training facility with a suitable panel of experts to provide periodic training for the members of PFM institutions and forest department officials in imparting the skills necessary for managing the forests.
3. Organization of post CFR activities, preparation of CFR conservation and management plans (CFRCMP), implementation of activities described in the CFRCMP, strengthening Gram Sabhas, CFR management committees (CFRMC), and any community-based organizations need to be in collaboration with the FD/PFM staff.
4. Incorporation of CFRCMP with the forest department's working plan, management plan, and tiger conservation plan and VSS/EDC's micro-plan as per the FRA to sustainably and equitably manage resources through protection, conservation, regeneration, and management activities.
5. Convergence of the activities and interests of CFR with VSS in ST households, to enable these VSSs to contribute to the functioning of the CFR management committees to ensure that the sustainability of the forest areas is taken care of while NTFP-based subsistence and income generation is made possible.
6. Linkage of community level bodies formed under PFM with the respective Grama Sabhas and BMCs at the Panchayath level.
7. Provision of aid for the development of community infrastructure like community halls, mobile, and internet networks, road, water, and power supply.
8. Development of apps and tools for efficient functioning and communication with peer groups and decision-making authorities.
9. Provision of training for department staff and members of the communities on various aspects including technology transfer in the context of controlling forest invasives, regeneration, and re-stocking of NTFP species and vulnerable species, improvement of ecosystem services, disaster management, and climate change amelioration.
10. Facilitation and integration of micro-enterprises under PFM to deliver quality services and goods with branding and quality control.
11. Provisions for insurance and compensation for forest staff, local communities in the event of casualty, property damage, and loss of life during the forest protection action and human-wildlife conflicts.
12. Provision for creating community owned information hubs in the form of green resource centers at the range/ division level.
13. Awareness creation and communication via nature camps, audio (community radios), and visual (mobile exhibitions and movie screening) modes with the aid of social media.
14. Information dissemination and preparedness creation during disasters.
15. Provision of hands-on training for developing useful skill sets for community members

e.g., nursery techniques, planting and plant protection for PFM-related activities, and skill sets that would help in employment generation.

16. Development of a platform for obtaining fast and reliable solutions on various aspects of conservation in consultation with empaneled experts.
17. Formation of range-level PFM cell (range level coordinator and associate coordinator to coordinate and monitor the PFM activities and provide incentives).

PROGRAMME 6. PRODUCTION FORESTRY - EXTENSION BEYOND FOREST BOUNDARIES

Productivity Enhancement of Forest Plantations

Plantations in the forest sector in Kerala, particularly teak plantations, face considerable decline in productivity owing to a multitude of factors. Poor site-species compatibility, lack of site-specific stand management strategies, dearth of genetically superior planting materials, untimely application of management practices, and lack of timely monitoring of productivity are some of the factors that hinder the productivity of our plantations. MAIs (in terms of commercial volume) obtained from departmental plantations range from 1−3 m3 per hectare and are often below the potential yield of the site. There should be concerted efforts to enhance the productivity to 5−8 m3 per ha per annum. Need of the time is to let production forestry be taken up intensively with all scientific rigor only in the best sites so that their productivity is enhanced to compensate for the land sacrificed for protection.

Strategies for the Future

1. In view of the critical role of site selection in productivity for successful plantation forestry, the criteria for selecting land for teak and other plantations should be refined and as per the silvicultural characters of the species, commercial value, and other biophysical condition of the site.
2. Follow effective agroforestry practices involving compatible understorey crops such as wild medicinal plants, leguminous cover crops, and ensure that the site is not exposed to the sun.
3. Implementation of modern plantation techniques for optimizing productivity. The plantations will be developed and managed based on scientific silvicultural practices. Present silvicultural stand management strategies such as planting density, thinning schedules, thinning intensity, etc. will be revisited and modified considering the site conditions and biophysical factors.
4. Systems should be developed for the continuous monitoring of growth and productivity changes in the plantations and stand density management models need to be developed for effective assessment of future stock for various end uses.
5. There is a genuine lack of quality planting materials for teak and other plantation species. Efforts will be made to ensure the procurement of seeds from certified sources such as the KFRI seed center. Local collections if at all made, should be based on scientific seed collection protocols.
6. Adherence to modern nursery practices. Production of healthy seedlings is indispensable for the success of plantations. Root trainer-based healthy seedling production will

be followed in all the forest department nurseries subordinating stump-based planting especially for teak.

7. Expert committee will be constituted at the circle-level harnessing the expertise of institutions like KFRI, College of Forestry, KAU, and JNTBGRI to evaluate the status of forest plantations and offer timely management prescriptions.
8. Promotion of fast-growing indigenous trees species. In the context of phasing out exotic industrial plantations, efforts will be made to promote fast-growing indigenous tree species such as Gmelina arborea, Ailanthus triphysa, Acrocarpus fraxinifolius, Melia dubia etc.
9. Mixed plantation forestry needs to be promoted considering its potential to provide sustainable productivity without site deterioration. Compatible species combinations and management protocols will be standardized for major plantation species.
10. Both the public and private sectors should be aware of certification and the measures to be taken to comply with environmental standards. The potential to obtain higher prices in niche markets where consumers are prepared to pay a premium price for timber obtained from sustainably managed areas may be an incentive to produce certified timber. The costs and benefits of certification should be assessed, and the results disseminated.

Forestry beyond forest boundaries

Realization of the major contribution of trees outside the forests (ToF) in meeting the state wood demand calls for a game-changing approach towards strengthening the productivity of trees outside the forest boundaries. Also, the diversity of trees (timber, fruit trees, medicinal, fodder, green manure, ornamental) in the agroecosystems contribute to the economic and nutritional stability of the farming community in the state. Furthermore, the enhanced tree cover in agroecosystems offer considerable ecological resilience, especially in the fast-changing agro-climate of Kerala. Trees outside the forest (TOFs) include all trees excluded from the definition of forests and other forested lands. The recent FSI reports (2019) suggest that 14443 sq. km area in Kerala is under TOF which is about 37.17% of the state's geographical area. There still exists good scope for the further expansion of tree cover in this sector. This can only be achieved by promoting the potential of tree cultivation as a profitable land-use option.

Apart from the regular activities that the social forestry wing of the department is taking up, there is an urgent need to focus more on newer concepts like Nagaravanam, Vidyavanam, and stress on urban forestry to strengthen tree cover outside the forest boundaries.

Forestry Clubs in schools are being revamped and new Forestry Clubs being added as part of the "Mission Forestry Club" project. With the active participation of students in the Forestry Clubs, green plots for demonstration or miniature forests in the school/college premises called "Vidyavanam" are being established. Vidyavanam will inculcate among students a sense of love and belongingness to nature and forests, encourage students to get to know about the practical aspects of forest protection and sustainability of the environment, help develop environmental discipline and ecological stewardship, empower children with leadership, teamwork, and problem-solving skills.

Home gardens

The favorable agro climatic and terrain conditions has endowed Kerala with a rich tree wealth and a major share of this wealth is confined to the traditional home gardens of Kerala. Trees constitute the dominant component of the home gardens with high functional diversity and include timber trees, fruit trees, fodder trees, medicinal trees, and fuel wood trees. These unique self-reliant systems of Kerala are rich in the diverse native tree species and provide bulk of the timber requirement of the state along with a plethora of other services. However, tree functional diversity of the unique traditional home gardens is fast eroding due to undesirable land use practices, land fragmentation, and socio-economic changes. Hence, there is a genuine need to revitalize the existing home gardens by enriching tree species of variable functional utility.

Promotion of agroforestry/farm forestry

The agro-ecological conditions of the state offer good opportunities for the integration of diverse agricultural crops along with trees in the farmlands. The ecological advantages from the judicious mix of compatible tree-crop combinations offer interim returns to the farmer. However, farmers' understanding of such compatible agroforestry/farm forestry models is limited. In the wake of the recent floods, there is renewed interest among the farmers towards tree farming. Agroforestry systems that cater to the economic, ecological, and social needs of the farmer must be promoted. For instance, bamboo offers good economic benefits while ensuring soil protection and other ecological benefits. Also, the farmers' preferences have shifted towards fast growing tree species considering their short rotation and economic advantages. Preference for fruit trees is on the surge and the concept of "Fruit Forest" is emerging in a big way in the state. However, the trees in the ToF sector are unattended and lack proper institutional mechanisms for their healthy management. Institutional mechanisms with trained manpower for promoting tree husbandry alongside crop husbandry should be conceptualized and implemented at the agroecological unit. Kerala has a good network of research institutions for forestry research. These should take steps to develop workable models for different agro ecological units in the state during the plan period. Such working models should focus on the principles of biodiversity conservation and ensure income augmentation to the farmers wherever applicable.

The trees in the farmlands offer exceptional services by way of mitigating and adapting to climate change. The farmers involved in the tree farming and maintaining trees for protective reasons, hence, are eligible for economic incentives and payment for ecosystem services. Public involved in tree farming are also eligible for carbon trading. There is a need to explore the possibilities of securing the carbon trading options in the TOF sector.

The Indian Biological Diversity Act provides openings at the local Panchayath level to raise conservation funds to govern it. The social forestry division can act as a nodal department for implementing the Biodiversity Act, develop mechanisms to pool conservation funds under BDA, and redistribute it to those who are participating in conservation outside protected areas.

Urban Forestry

Urban forestry is another area that needs increased focus. Urban areas account for 78% of

carbon emissions and 60% of residential water use. An increase in the water-impermeable built-up area, reduction in open green areas, increase in pedestrian & vehicular traffic, congestion, pollution, sewage & garbage etc. are serious issues. Reduction in vegetation, higher prevalence of dark surfaces with low albedo and increased anthropogenic heat production results in the heat island effect. WHO suggests ensuring at least a minimum availability of 9 sq. m green open space per city dweller. Urban forestry aims to address these issues. As part of this, green patches or urban parks called "Nagaravanams" which are multi-canopy, close-to-natural forests with species indigenous to the area, are being established in cities across the state. The concept of high-density planting which involves the intensive planting of trees, shrubs, herbs, and climbers to create dense forests in a short time is being attempted. This is done by the Forest Department in collaboration with LSGIs, residential associations, business and commercial establishments, and local organizations, and will also serve as a platform for educating/sensitizing the public about the ecological, biological, and recreational values of forests. They may also help kindle a conservationist attitude in their minds.

Avenue planting shall also be taken up in collaboration with the State PWD Roads Division, National Highway Authority of India, and LSGD. Further, the cleaning and beautification of urban waterbodies will be taken up on a priority basis.

Institutionalization of ToF sector

There must be proper synergy between the forest department, agricultural department, and local self governments for bringing precipitous changes in the ToF sector. Unlike other sectors, the trees in the agro-ecosystems are unattended and often managed at the farmer's level without proper knowledge. Qualified personnel are required to take care of the development and management of trees in agro-ecosystems. Hence, the 14th FYP strongly suggests the deployment of one forestry expert at the block level who can provide all necessary guidance for the promotion of trees and tree farming in the respective blocks. In the event of floods and natural calamities, such technical services are vital for the healthy management of trees in agro-ecosystems.

Rationalization of social forestry programs

Along with the paradigm shift proposed in production forestry stretching outside the forest boundaries, there is a genuine need for revamping the social forestry wing of the forest department to deliver in tune with the changing aspirations of the community. The ToF sector involves multiple players like farming community, forest fringe community, local self-governments. The collective involvement of these components can be properly harnessed by the social forestry wing. The 14th FYP proposes social forestry with added commitments towards greening our state, delivering forest-based goods and services to the public.

As the 14th FYP proposes a landscape approach and ecosystem restoration as its core concept, the programmes naturally go beyond defined forest boundaries. Here, the participation of people and integration of existing governance structures are strategic for its success. The possible linkages of programmes and activities of the forest department to the larger development processes is vital. Strengthening the working group 13 at the LSG level with

fund allocation for biodiversity management, activating BMCs by linking them with 13th working group, assigning social forestry as a nodal department for implementing biodiversity conservation projects planned by BMCs through 13th working group, and appointing a district-level forestry officer to coordinate the activities of the BMCs at Panchayath level and to represent them in District Planning Committee, are suggested.

Strategies for the future are listed below:

1. The possibility of convergence with MGNREGS for implementing social forestry activities and urban forestry shall be explored.
2. The use of polythene bags for raising seedlings shall be phased out completely and cost-effective, eco-friendly biodegradable materials shall be utilized.
3. The relatively newer concepts of Nagaravanam and Vidyavanam shall be focused upon with yearly targets fixed for creating more Nagaravanams and Vidyavanams.
4. The Mission Forestry Club Programme shall be continued.
5. ToF sector needs to be institutionalized.
6. Establishment of tree grower's associations/cooperatives, especially to improve the marketing of timber and for implementation of certification programs.
7. The tree cutting permission procedures and transit rules may be further simplified.
8. Strengthening agroforestry/TOF extension facilities and deploying trained manpower to handle such activities.
9. Urban forestry needs to be promoted. The possibility of developing an urban forestry unit with technically qualified personnel in the local bodies (municipalities and corporations) shall be explored. The main tasks of such units could be proper planning of the urban landscapes with anticipated future developments at the core of the planning. They can also be the nodal agency for avenue planting, lopping/pruning trees in roads and public places, tree translocation etc. The onus of exploring such a possibility could be with the LSG Department and the Forest department can give technical guidance and other related support to such units.
10. Tree landscaping could be another focus area in urban areas and this needs to be taken up by the LSG Department. Mandatory provisions of having green spaces and living green walls (vertical gardens) when the sanction is accorded to large commercial buildings can also be explored.
11. Development of facilities for the value addition of tree/tree products at local level.
12. Providing institutional credit and insurance cover to promote tree cultivation
13. Promoting initiatives such as the Haritha Keralam Programme with the active participation of people from all walks of life
14. Promoting participatory approach in developing, managing, and distributing quality planting materials at local levels (e.g., Kudumbashree tree nurseries).
15. The social forestry wing of the KFD should be streamlined and empowered for effectively harnessing the activities of various connected agencies such as LSGs and other institutions and ensuring delivery of economic and ecological benefits to the society.
16. Increase the percentage allocation to the 13th working plan by 5% at the LSG level.

17. Allocate funds for BMCs from the forest department for biodiversity conservation projects and implement them through social forestry
18. Strengthen the social forestry wing with staff and money to handle the additional responsibilities.

PROGRAMME 7. e-GOVERNANCE IN FORESTRY, RESEARCH PRIORITIES, AND OUTREACH

The proposed shift in the management of our forest towards the landscape and ecosystems mode warrants renewed knowledge and expertise on the monitoring and management of the forests.

E-Governance (Use of ICT) in Forestry

The 13th FYP proposed a comprehensive governance improvement program to ensure a modern, efficient forest governance system. The e-Governance initiatives of the government focuses on service delivery at the doorstep of citizen and initiatives launched by the forest department include online application and disbursement of compensation to victims of wildlife attacks through the e-District Portal, e-Auction /buying timber through the e-Auction Portal of KFD, online booking of ecotourism packages/purchase of Vanasree Products through the Kerala Forest Ecotourism portal and the mobile app, online ticket booking for Agasthyarkoodam trekking, online wildlife photography contest in connection with the wildlife week celebration each year etc. Similar G2C services in the pipeline include providing online facilities for applying for nature camps, conduct of research in protected areas, film shooting in forest areas, and no-objection certificate for wood-based industries [cutting permission for trees in non-forest land in the KSWIFT clearance platform developed by KSIDC].

The G2B services which are being used by the Forest Department include GEM (Government E-Market Place), CPRCS (Centralized Procurement System) for procurement of electronic equipment for government offices, e-tender portal for floating/processing tenders etc., e-auction /buying timber through the e-auction portal of KFD etc. G2G services include eOffice, FMIS (Forest Management Information System), HAWK (Hostile Activity Watch Kernel), SPARK (Service & Payroll Administrative Repository for Kerala), PRICE (Project Information and Cost Estimation), PRISM (Pensioner Information System), BIMS (Bill Information & Management System), BAMS (Budget Allotment & Monitoring System), PLANSPACE (System for Progress Analysis & Concurrent Evaluation), VEELS (Vehicle Management & Location Tracking System), PFMS (Public Financial Management System), etc.

The GIS Unit iunder the forest department has also developed base maps, various thematic maps, and basic GIS Layers etc. of forest systems in the state.

Strategies for the future

1. Though the forest department has MIS and GIS databases, they don't work in synergy. An end-to-end MIS solution which is fully integrated with spatial data (GIS), with every asset and location geotagged, and all the activities and processes of the department

integrated with the spatial database would be the solution for the forest and wildlife managers to plan properly and take learned decisions.

2. Advanced communication facility for fast networking and alertness, modern control rooms for firefighting and crime control, cyber crime cell/forensic unit for handling wildlife and other crimes, GIS and Drone based land cover change studies for important watersheds etc. need to be in place.
3. Change analysis using satellite imagery also needs to be undertaken.
4. Office automation should be continued.

Research Priorities

The need for scientific management of the forests for their effective conservation and rational utilization is of particular importance to Kerala, where the forests and the Western Ghats play crucial roles in the economic prosperity and ecological stability of the agricultural landscape of the state. Both long-term and short-term studies are needed to address diverse issues of forest productivity and ecosystem functioning.

Similarly, there was a program to provide a grant-in-aid to Kerala Agricultural University for strengthening forestry education and grooming forest management professionals under the 13th FYP provided to the College of Forestry under the Kerala Agricultural University. However, the earmarked financial assistance was not delivered during the plan period due to financial constraints that arose from the floods and COVID pandemic. Hence, the 14th FYP proposes the continuation of the previous proposal to provide Rs. 50 lakhs grant-in-aid every year during the plan period to Kerala Agricultural University.

Strategies for the future

1. Both long term and short-term research/studies need to be encouraged, and research on urgent issues like human-wildlife conflict and forest fire control may be prioritised. Studies on productivity decline in plantations, site quality assessment studies , evaluation of indigenous fast growing tree species, studies on plantation nutrition, silvicultural stand management strategies, package of practices for selected species, mixed plantation forestry, pest control, soil fertility, agroforestry, carbon sequestration, wildlife related studies, socio-economic dimensions of forest dependent communities, assessment of NTFP resources, hydrologic and geomorphic studies in natural forest areas, impact of climate change on forest functions, ecology and regeneration dynamics of natural forests, phytosociological studies and vegetation distribution modelling, studies on forest disturbances, ecology of invasive species, etc., may also be promoted. Studies on different aspects of Forest management aspects and optimum utilization of Forest personnel etc. could also be investigated.
2. Scientific community and professionals need to be brought in and involved.
3. Grant-in-aid to Kerala Agricultural University needs to be continued.

Outreach Activities/ Forestry Extension

Conservation communication Use of modern communication applications and platforms are expected from institutions to spread public awareness.

The change in the perception of forests over the past few decades should be highlighted. These tools and platforms should be actively used to engage the public and shift their attitude from one based on destruction of nature for development to that of sustainable development. By involving creative minds from the field of art, design, and writing , the forest department should take steps to bridge the gap between people and forests. To achieve sustainable management of forests, we need to get the trust of the people and make them participants in our efforts to protect our forests.

The negative publicity generated on social media should be countered effectively and continuously by the department with the help of media, professionals, and technology. Similarly, the changed value system should also be addressed in all conservation communication. From the past focus on timber-based management of forests, the true value of our forests, vital role forests play in the management of freshwater, NTFP sector, role it plays in agriculture, livelihood of millions of people living on the fringes, ecotourism benefits etc. should be the focus points of modern communication.

Strategies for the future

1. Develop demonstrable models of successful forest conservation/eco-restoration/riverbank stabilization/ participatory management/ NTFP collection etc. and publicize using media/ documentaries.
2. Training (dept staff, elected members of panchayats, govt. officials, advocates etc.) on communication.
3. Content creation & sharing information (engage talented professionals for creation of content both for print and electronic media)
4. Nature education (school syllabus, nature camps)
5. Use of popular social media platforms.
6. Workshops for target groups (artists, writers, celebrities, judiciary, media)
7. Provide nature experience opportunities for celebrities and use their popularity for the cause
8. Overall brand building (aesthetics, design aspects, standardization of colors, use of technology)
9. Create a nature-loving future generation (form a nature brigade in schools like student police)
10. Create ecotourism guidelines (the dos & don'ts) and actively involve the people living on the fringes of forests in ecotourism projects.
11. Organize nature festivals (nature film festivals, theme based literary festivals etc.)
12. Institute appropriate awards & recognitions
13. Revive forestry clubs in educational institutions

APPENDIX I

PROCEEDINGS OF THE MEMBER SECRETARY
STATE PLANNING BOARD

(Present: Sri. Teeka Ram Meena IAS)

Sub: - Formulation of Fourteenth Five Year Plan (2022-27) – Constitution of Working Group on Forest and Environment – Revised Proceedings - reg.

Read: 1. Note No. 297/2021/PCD/SPB dated: 27/08/2021
2. Guidelines on Working Groups
3. This Office order of even number dated 08.09.2021

ORDER No:SPB/342/2021-Agri (4) Dated:14.09.2021

As part of the formulation of Fourteenth Five Year Plan, it has been decided to constitute various Working Groups under the priority sectors. Accordingly, the Working Group on **Forest and Environment sector** is constituted. For the smooth functioning of the Sectoral Working Group (SWG), it is decided to split the Working Groups into Expert Sub Groups (ESG). Hence the Working Group is categorized into four Expert Sub Groups as indicated in the proceedings. The names of the members of the SWG are indicated under each ESG. The Working Group shall also take into consideration the guidelines read 2nd above in fulfilling the tasks outlined in the ToR for the Working Group.

1. ENVIRONMENT AND BIODIVERSITY

Co - Chairperson

1. Dr T. Jayaraman, Former Member, Kerala State Planning Board
2. Suneel Pamidi ,IFS, Director, Directorate of Environment and Climate Change

Members

1. Dr C. George Thomas, Chairman, Kerala State Biodiversity Board
2. Dr Raman Sukumar, Eminent Ecologist, Expert in Human Animal Interface
3. Dr A. B. Anitha, Former Executive Director, CWRDM, Kozhikode
4. Dr A. G. Pandurangan, Former Director, TBGRI, Palode
5. Dr John Mathai, Scientist-G (Rtd.), NCESS
6. Dr P. S. Harikumar, CWRDM
7. Dr Syam Viswanath, Director, KFRI
8. Dr K. V. Thomas (Retd NCESS)
9. Dr R. Prakashkumar, Director, JNTBGRI
10. Mr B. Pradeep Kumar, Chairman, Kerala Pollution Control Board (KPCB)
11. Mr Reney R. Pillai, Member Secretary, Kerala State Biodiversity Board
12. Dr A. Gopalakrishnan, Director, Central Marine Fisheries Research Institute, Kochi
13. Dr K. Ranjeet, Associate Professor, KUFOS
14. Mr Joseph Vijayan, Social worker & Activist

15. Mr C. Baldwin, Kerala Karshaka Sangham, Aryardram, Kundara, Kollam
16. Dr.Aravindan Nagarajan, Sr. Lecturer, Azim Premji University, Bengaluru

Terms of Reference

1. To briefly assess the available information on the impacts of climate change on Kerala and how public policy should begin to address them.
2. To suggest a comprehensive framework for the design and implementation of schemes related to environment and climate change in Kerala.
3. The framework suggested may outline special problems pertaining to specific sectors of concern including infrastructure, the likely impact of climate change in specific sectors like agriculture and the impact of sea-level rise and other climate impacts on coastal regions and ecosystems.
4. The framework suggested may also list specific measures and schemes for knowledge generation and/or specific action as appropriate in these sectors.
5. To assess the design and implementation of existing schemes of Government of Kerala under the Department of Environment and Climate Change and suggest measures to improve their scientific orientation.
6. To outline special problems pertaining to biodiversity conservation, suggest a road map for their development, and examine the role of various agencies/departments/local self-governments in the implementation of biodiversity conservation-related programmes.
7. To suggest measures to better converge the activities and programmes of different line departments and agencies to meet the challenges of climate change and preservation of biodiversity.

2. ADDRESSING ISSUES RELATED TO HUMAN-WILDLIFE INTERACTIONS

Co - Chairperson

1. Mr P. K. Kesavan IFS, Principal Chief Conservator of Forests & Head of Forest Force
2. Shri. Bennichen Thomas IFS, PCCF(Wildlife)& Chief Wildlife Warden

Members

1. Dr P. S. Easa, Department of Wildlife
2. Dr Mani Chellappan, Professor, College of Horticulture, Vellanikkara
3. Mr O. P. Kaler, (Retd) APCCF, Kerala
4. Mr James Zacharia, (Retd) Forest Officer, Kerala
5. Dr S. Nandakumar, SIAD, Palode
6. Mr P. Viswan, Kerala Karshaka Sangham, Palothari, Koyilandi, Kozhikode
7. Mr K. Ramachandran, Adivasi Kshema Samithi, Panamaram

Terms of Reference

1. To assess the various interventions of the Government of Kerala in addressing the issues arising from human-wildlife interactions over the past decade.

2. To document the economic cost of crop losses arising out of human-wildlife interactions over the past decade.
3. To document the human and animal losses arising out of human-wildlife interactions over the past decade.
4. To suggest a multi-pronged plan of action on the different measures to be adopted to reduce human and animal losses as well as crop damages arising out of human-wildlife interactions over the next 10 years.
5. To ensure that the suggested plan of action includes a mixture of traditional and modern measures and that context-specific solutions are prioritised over generalised blanket solutions.
6. To suggest changes in forest governance and administration to allow a more effective resolution of issues arising out of human-wildlife interactions.

3. AN ASSESSMENT OF THE IMPLEMENTATION OF THE FOREST RIGHTS ACT IN KERALA

Co - Chairperson

1. Dr Geetanjoy Sahu, Associate Professor, Tata Institute of Social Sciences, Mumbai
2. Mr D. Jayaprasad IFS, PCCF (Planning and Development), Kerala Forests and Wildlife Department

Members

1. Mr P. N. Unnikrishnan, (Rted) PCCF, Kerala Forest Department
2. Dr A. V. Santhoshkumar, Professor and Head, Department of Forest Biology and Tree Improvement, College of Forestry, Thrissur
3. Dr G. Shine, Assistant Professor, College of Forestry, Thrissur
4. Mr O. R. Kelu, MLA, Mananthavady
5. Dr V. R. Najeeb, Independent researcher, Wayanad
6. Mr P. K. Suresh, Kerala Karshaka Sangham, Sarayu, Kammana, Wayanad
7. Mr.G.Anilkumar,Deputy Director,Tribal Resettlement &Development Mission,Vikas Bhavan
8. Mr.C.Herald John,Tribal Developmemnt Officer,Parappa,Kasargod.

Terms of Reference

1. To undertake a detailed assessment of the implementation of Forest Rights Act in Kerala between 2006 and 2021.
2. To identify gaps in policy and suggest measures to improve the implementation of the Forest Rights Act in Kerala over the next five years.
3. To identify outstanding issues in the legal structure and administrative reforms to facilitate a smoother implementation of the Forest Rights Act in Kerala.
4. To suggest a framework for a regular monitoring of the implementation of the Forest Rights Act in Kerala over the next five years.

4. TOWARDS A SUSTAINABLE MANAGEMENT OF FORESTS IN KERALA

Co - Chairperson

1. Prof T. K. Kunhamu, Professor, College of Forestry, KAU
2. Dr A. V. Raghu, Scientist, KFRI

Members

1. Mr S. Santhosh Kumar, ACF (Planning), Kerala Forests and Wildlife Department
2. Mr Tiju C. Thomas, Associate Coordinator-Communities, WWF India
3. Dr P. Niyas, Assistant Professor, College of Forestry, Thrissur
4. Ms T. R. Suma, Scientist, Hume Centre for Ecology and Wildlife Biology, Kalpetta
5. Mr Balan Madhavan, Senior Fellow, International League of Conservation Photographers
6. Adv. K. J. Joseph, Kerala Karshaka Sangham, Kuryasseri House, Chunkakunnu, Kottiyoor
7. Mr Rajith M R, Assistant Professor, Department of Economics, Dr.B.R Ambedkar Memorial Arts and Science College.

Terms of Reference

1. To critically assess efforts made in the last decade to improve the sustainability of forest management in Kerala.
2. To identify gaps in policy and suggest measures for improvement over the next five years.
3. To document the new global developments in the field of forest management and suggest best practices for adoption in Kerala.
4. To suggest measures to ensure that future policy on forest management blends the objectives of forest conservation and the livelihoods of people living inside and near forests.
5. To suggest measures to ensure that community participation is deepened in the design and implementation of the government's programmes and schemes towards forest management.

Convener

Mr.S.S.Nagesh, Chief, Agriculture Division, State Planning Board

Co- Convener

Dr.Reji D Nair, Research Officer, Agriculture Division, State Planning Board

Terms of Reference (General)

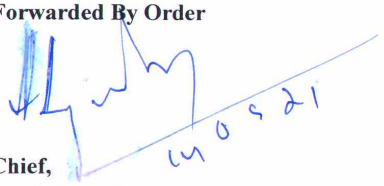
1. The non-official members (and invitees) of the Working Group will be entitled to travelling allowances as per existing government norms. The Class I Officers of GoI will be entitled to travelling allowances as per rules if reimbursement is not allowed from Departments.

2. The expenditure towards TA, DA and Honorarium will be met from the following Head of Account of the State Planning Board "3451-00-101-93"- Preparation of Plans and Conduct of Surveys and Studies.

The order read as reference 3 is modified to this extent.

(Sd/-)
Member Secretary

Forwarded By Order



Chief,
Agriculture Division

To

The Members concerned

Copy to

PS to Vice Chairperson
PA to Member Secretary
CA to Member (Dr.Ramakumar.R)
Economic Advisor to VC
Chief, PCD,SPB
Sr. A.O, SPB
The Accountant General, Kerala
Finance Officer, SPB
Publication Officer, SPB
Sub Treasury, Vellayambalam
Accounts Section
File/Stock File