GOVERNMENT OF KERALA
KERALA STATE PLANNING BOARD

FOURTEENTH FIVE-YEAR PLAN
(2022-2027)

WORKING GROUP ON

ENVIRONMENT & BIODIVERSITY

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 "Environment and Biodiversity." The Co-Chairpersons of Working Group were Dr T. Jayaraman and Sri.Suneel Pamidi IFS. 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 for environment and biodiversity conservation in the State.

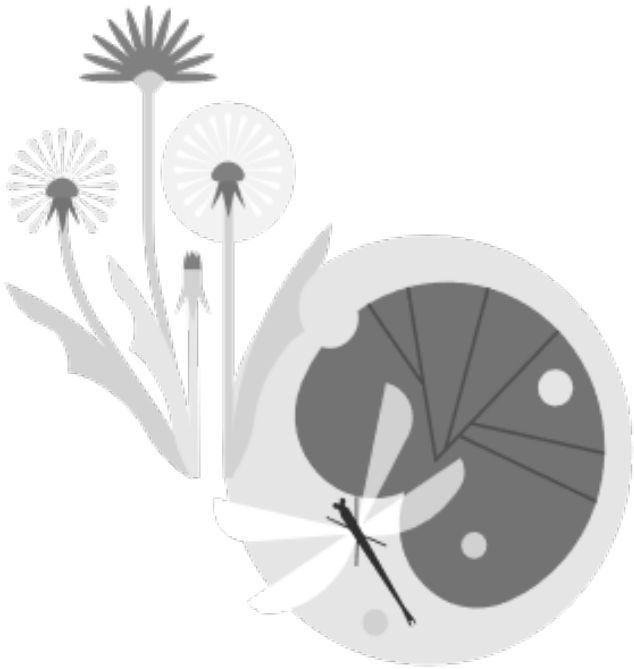
Dr T. Jayaraman
Expert co-chairperson

Sri. Suneel Pamidi IFS
Official co-chairperson

CONTENTS

HIGHLIGHTS

- A three-part report dealing with the Environment, Biodiversity, and Climate change and Coastal management in Kerala.
- Kerala's environment is under pressure from the rapid changes taking place in the society-nature relationship.
- A comprehensive multipronged approach is required which combines community involvement and scientific management.



ENVIRONMENT & BIODIVERSITY

EXECUTIVE SUMMARY

ENVIRONMENT

INTRODUCTION: The Kerala State Pollution Control Board (KSPCB) is the statutory authority for implementing various statutes for pollution control measures intended for enforcing these with a view to protecting the environment. The board is responsible for enforcing the following Acts: Water (Prevention and Control of Pollution) Act, 1974; Water (Prevention and Control of Pollution) Cess Act, 1977; Air (Prevention and Control of Pollution) Act, 1981; Environment (Protection) Act, 1986

THE STATE OF THE ENVIRONMENT AND KEY CONCERNS: Kerala's environment is under pressure from the rapid changes taking place in the society-nature relationship.

- Air Quality in the state is being monitored 24×7 using nine continuous ambient air monitoring stations across six districts in the state. To strengthen the monitoring network, a minimum of one continuous ambient air quality monitoring station in every district and more manual monitoring stations need to be established throughout the State in the next five years.
- Despite the significant deleterious effects of noise pollution, there is no established mechanism in the state for dealing with it.
- The Government of Kerala is committed to take suitable action to address antimicrobial resistance in the state by involving all stakeholders to develop and implement a State Action Plan on AMR, aligned with the National and Global Action Plans on Antimicrobial Resistance. This action plan has six strategic priorities, namely, awareness & understanding, knowledge & evidence, infection prevention & control, optimizing use of antibiotics, research and innovation, and collaborations.
- Addressing the problem of municipal solid wase disposal in Kerala requires a broader strategy to move towards a circular economy where waste is minimized and. Existing governance systems in the state must gear towards this in line with waste and pollution control norms.
- Extended Producer Responsibility, which may be defined as a policy principle to promote total lifecycle environmental improvements of product systems by extending the responsibilities of the manufacturer of a product to various parts of the entire life cycle of the product, and especially the take-back, recycling, and final disposal of the product, must be popularized and implemented.
- The treatment & disposal of legacy municipal solid waste is an urgent need by bioremediation and biomining. Waste to energy plants may also be required.
- Microplastics (plastic particles less than 5 micron in size) were recovered from all sediment samples from Vembanad Lake, which is indicative of their extensive distribution in the lake. Further research is required urgently to determine the implications.
- A Common Bio-medical Waste Treatment Facility (CBWTF) is a setup where biomedical waste, generated from several healthcare units, is imparted necessary

treatment to reduce the adverse effects that this waste may pose. The treated waste is finally sent for disposal in a landfill or for recycling purposes. The State needs more CBMWTF with fixed tonnage for catering to southern and northern region. The law and guidelines require such common facilities with a jurisdiction of 75 km radial distance. Such facilities will reduce the risk of long-distance transportation and storage of waste.

THE WAY FORWARD: THIS INVOLVES STRENGTHENING VARIOUS ASPECTS OF ENVIRONMENTAL MONITORING AS FOLLOWS:

- It is proposed to upgrade the laboratories attached to the Board's offices in all districts to NABL status for physical, chemical, and biological parameters. Upgrade/ modernization includes the purchase of modern equipment to improve the quality of analysis of air and water/effluent samples to improve the quality and accuracy of reports. NABL upgradation of all laboratories under the board shall be completed in this five-year plan.
- In addition to existing and upcoming real-time water quality monitoring stations on the Periyar and Karamana rivers, as well as the surveillance cameras, more facilities shall be established including surveillance cameras and RTWQMS in the five-year plan.
- Air quality in the state is being monitored 24×7 using continuous ambient air monitoring stations in six districts in the state. In addition to these, the board also monitors ambient air quality at 28 locations under the national air quality monitoring network (NAMP) and 7 under the state ambient air quality monitoring network (SAMP). . To strengthen the monitoring network, minimum one continuous Ambient Air Quality monitoring station in every district plus 10 additional manual monitoring stations throughout the state in the next five years.
- In Kerala, there are 93 Municipal Authorities responsible for MSW management. The most recent estimates indicate that, in 2021, the quantity of solid waste generated in Kerala was approximately 11,449 tonnes per day (this is almost twice the estimated waste generation reported in 2006; 6506 tonnes per day). The work of the seven Waste to Energy plants that are underway shall be completed in this five-year plan.
- Currently, the state has only one common biomedical waste treatment facility at Palakkad. Another one is being set up at Ambalamedu in Ernakulam with financial assistance from the Board. The state then requires one more CBMWTF in the southern region. The Board plans to facilitate one more CBMWTF in the southern region.
- Awareness programs are planned for biomedical waste management rules, solid waste management rules, e-waste rules, noise rules, and plastic waste rules, along with awareness days such as World Environment Day, World Water Day, and World Ozone Day.

BIODIVERSITY

THIRTEENTH FYP - AN OVERVIEW OF BIODIVERSITY COMPONENT: The key objectives during 13th Five-year plan were:

1. Develop biodiversity strategies and action plan at state level and local level
2. Documentation of biodiversity at local level in PBR
3. Strengthening the institutional structure for decentralized conservation of biodiversity and implementation of Peoples Biodiversity register derived action plan at LSG level.
4. Conservation of local landraces/threatened species/ecosystems/green protocols by Model BMC
5. Mitigating negative impacts of invasive species and climate change to biodiversity through selected pilot projects
6. Promoting Sustainable utilization and benefit sharing
7. Biodiversity and livelihood enhancement
8. Enhancing Communication, Education and Public awareness of biodiversity

The major achievements of the FYP includes the constitution of biodiversity management committees in all Panchayats and training them, completion and digitization of People's Biodiversity Register, laying down norms for Biodiversity Heritage Sites, establishment of Biodiversity Museum, assignment of Biodiversity Nodal Officers, empowering police officers to intervene in related issues, norms for utilization of Kerala Biodiversity Fund, preparation of Kerala Red Data Book, studies on natural disasters and biodiversity, and projects for rejuvenation of Pamba riverine system, conservation of agrobiodiversity, and database preparation for tradable bioresources, etc. Several funded projects are also underway. In addition, KSBB awarded 16 doctoral and 2 post-doctoral fellowships during this period

14TH FIVE YEAR PLAN - APPROACH PAPER ON BIODIVERSITY: The vision and mission for the 14th FYP are as follows:
Vision: To protect biodiversity in its own right and to ensure its enrichment and sustainable use for the development of Kerala

Mission: To conserve our rich biodiversity through policy guidelines, legislation, and action plans in a participatory mode for the welfare of all the living beings of our state

The UN-PDNA (Post-Disaster Needs Assessment) report and Rebuild Kerala Development Programme report post 2018 Kerala floods pointed out the necessity of an eco-sensitive area conservation policy for the state of Kerala. Biodiversity conservation has an important role to play in providing nature-based solutions and mitigating problems such as food and nutritional insecurity, spread of zoonotic diseases, and climate change related hazards. The recovery strategies should be site specific, eco-friendly, and based on a landscape and ecosystem approach for disaster risk reduction. The Approach to the 14th plan draws from the several International, National, and Regional commitments and treaties in this area, namely, Sustainable Development Goals, Post-2020 Global biodiversity framework, UN decade on Ecosystem Restoration, and National Biodiversity Targets and Action Plan 2008,

2014, and 2019.

Critical gaps identified in biodiversity management

1. Biodiversity is not integrated in schemes of line departments
2. Ecosystem degradation
3. Biodiversity depletion in areas outside the protected areas due to urbanization
4. Inadequacy in baseline data of bio resources, consumption, trade, and real value of bioresources
5. Lack of local Biodiversity strategies and action plan
6. Lack of data sharing and synergy between related R & D institutes, line departments, and NGOs
7. Scientific knowledge gaps for conservation activities
8. Skill and knowledge gaps among BMCs for biodiversity conservation
9. Inadequacy in institutional infrastructure at KSBB HQ and District- personnel, office space, etc
10. Biodiversity financing gaps

Approach for the 14th plan and thrust areas

Key objectives:

1. Contribute significantly to reducing the rate of biodiversity loss and ecosystem degradation for achieving relevant nationally agreed goals and targets
2. Biodiversity and livelihood enhancement and Promoting Business incubators in biodiversity
3. Strengthening scientific base on biodiversity conservation and decentralized management
4. Secure the necessary financial resources and means for mainstreaming biodiversity and implementation of the State Biodiversity Strategies and Action Plan
5. Thrust areas

For this period, seven thrust areas have been identified, and the thrust areas are:

1. Decentralization and skill development of BMCs to sustainably manage bio-resources
2. Ecosystem- conservation, rejuvenation and management
3. Biodiversity and livelihood enhancement
4. Strengthening scientific base on biodiversity conservation
5. Access and benefit sharing of bioresources
6. Creating communication, education, and public awareness for biodiversity
7. Securing needed financial, human resource and technical expertise

The report provides details of how each of these thrust areas may be addressed, including the possible activities to be undertaken in each case.

CLIMATE CHANGE AND COASTAL MANAGEMENT

CLIMATE CHANGE AND COASTAL MANAGEMENT: The activities planned in this regard may be classified under four heads as follows:
Environmental sensitization and incentives

Objectives:

1. To create awareness about climate change mitigation and adaptation, environmental acts, rules, and notifications, etc among the public especially those who reside in environmentally sensitive/vulnerable zones
2. To carry out conservation/restoration actions with the support of educational institutions, non -governmental organizations, professional associations, scientific bodies, community organizations, etc.
3. To utilize the enormous manpower available with students as conduits for environmental awareness in the society.
4. To equip people, practice, and advocate sustainable lifestyles.
5. To sensitize the society for maintaining environmental sustainability of the State.
6. Major programs under this scheme include Bhoo Mithra Sena Clubs (BMCs), Paaristhithikam, Paristhithimithram Awards and other environmental incentives programs
7. Environmental Research and Development

Objectives:

- To generate information and knowledge required for developing strategies, technologies and methodologies for better environmental management.
- To ascertain practical solutions to the problems of environmental management in the state.
- To develop and demonstrate the models suitable for environmental conservation, climate change adaptation, and mitigation, etc at the local level for adoption in the development plans of the local self-governments.
- To strengthen the capacity of local institutions for undertaking environmental research for evolution and demonstration of cost-effective and energy-efficient technologies for environmental management in the State.
- To generate, document, and analyze information for taking policy decisions relating to environmental concerns of the State.
- To encourage young researchers to undertake research work in environmental sector
- To create well-informed environmental database management at the department.

Under this program, financial assistance for Major (duration 24 – 36 months) and Minor (duration 12 –18 months) research project proposals are considered as invited or commissioned. Other programmes include Paristithiposhini, Vidhyaposhini Student Fellowship Programme, and Geospatial Laboratory.

Climate Change Action

Objectives

- To take appropriate action to address climate change-related issues by respecting, promoting, and considering the respective obligations on human rights, the right to health, the rights of indigenous peoples, local communities, migrants, children, persons with disabilities, and people in vulnerable situations; and the right to development as well as gender equality, empowerment of women and inter-generational equity.
- To achieve the same, the State is planning to carry out in-depth or specific studies paying special attention to cost evaluation in relation to climate change adaptation/ mitigation measures with the technical support of Research and Academic Institutions and climate change adaptation/ mitigation oriented specific programs/ projects/ action plan with line Departments, NGOs, PSUs, etc.

Some of the activities in this connection are action-oriented projects for climate change adaptation and mitigation, Ujjwal –Post Doctoral Fellowship, and strengthening of state climate change cell.

Climate Resilient Farming

Objectives

- Preservation of traditional farming knowledge and farming practices.
- Conservation of germplasm of climate-resilient crop varieties
- Climate Change Vulnerability and Risk Assessment of Agro-ecological zones of Kerala and adoption of agroecological principles.
- Building soil resilience through improved soil management techniques.
- Developing linkages with State Agricultural Universities and extension services
- Promotion of traditional farming knowledge and farming practices to achieve climate resilience.
- Adaptive cropping practices for extreme weather events in vulnerable agroecological zones.

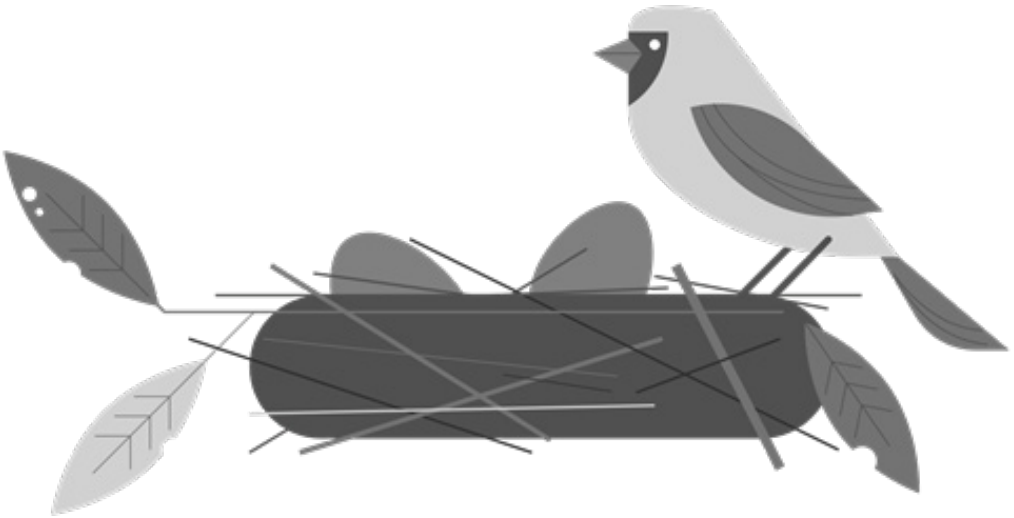
New Schemes Proposed in the 14th Five Year Plan

- Integrated Coastal Zone Management
- Kerala Centre For Integrated Coastal Zone Management (KCICM)
  - o Conservation of Coastal and Marine Bio-resources.
  - o Coastal pollution abatement and related infrastructure upgrade
  - o Livelihood Security of Coastal Communities.
  - o Capacity Building and Implementation of ICZMP.
- Environmental Awareness:
- Environmental Research & Development
  - Climate Change
  - o Strengthening of State Climate Change Cell
- Wetland Management
  - o Preparation & implementation of Integrated Management Plans of major wetlands in Kerala

- Declaration of more wetlands as Ramsar wetlands of international importance

- Coastal Zone Management. Some of the proposed measures include:
  - Kerala Centre for Integrated Coastal Management (KCICM) should be strengthened
  - DoECC to be developed as training hub for other departments.
  - Regional Coastal Process Study for the Kerala coast following sediment cell concept.
  - Mapping of coastal morphology including beach availability and coastal ecosystems
  - Mapping and monitoring of mudbanks
  - Settlement plans for coastal fishing villages considering long-term housing and other needs
  - Tidal inlet management plans
  - Assessment of functional and structural performance of the existing coastal protection measures
- Beach management

PART 1
ENVIRONMENT



Introduction

The Kerala State Pollution Control Board (KSPCB) is the statutory authority for implementing various statutes for pollution control measures intended for enforcing these with a view to protecting the environment. The Board was established in 1974 with the objective of prevention and control of water pollution in the state. Over the years, the scope increased with the enactment of new statutes aimed at protecting different aspects of the environment. The Board is now responsible for implementing the following statutes (Table 1):

The present infrastructure of the board consists of the Head Office at Thiruvananthapuram, three Regional Offices at Thiruvananthapuram, Ernakulam & Kozhikode, 14 District Offices with laboratories, a Central laboratory at Ernakulam, and a Regional Laboratory at Kozhikode. Considering the magnitude of potential industrial activity and related pollution in Ernakulam district, there are three separate offices for Ernakulam district, one looking after the Kanayannur, Kochi, and Aluva Taluks; second, looking after Kothamangalam, Kunnathunad, Moovattupuzha Taluks and the third at Eloor for industries at Eloor-Edayar area and also with North Paravur Taluk. This office is designated as the Environmental

Surveillance Centre
Table 1

ACT	Rules And Notification
Water (Prevention and Control of Pollution) Act, 1974	Water (Prevention and Control of Pollution) Rules, 1976
Water (Prevention and Control of Pollution) Cess Act, 1977	Water (Prevention and Control of Pollution) Cess Rules, 1979
Air (Prevention and Control of Pollution) Act, 1981	Air (Prevention and Control of Pollution) Rules, 1984
Environment (Protection) Act, 1986	Environment (Protection) Rules, 1986
	Manufacture, Storage, and Import of Hazardous Chemical Rules, 1989Hazardous and other
	Bio-Medical Waste (Management & Handling)
	Batteries (Management & Handling) Rules, 2001
	Noise Pollution (Regulation and Control) Rules,2000
	Environment Impact Assessment Notification, 2006
	Plastics Waste Management Rules, 2016
	Solid Wastes (Management) Rules, 2016
	Wastes (Management, &Transboundary Movement) Rules, 2016
	Construction and Demolition Waste Management Rules, 2016

The State of the Environment and Key Concerns

Kerala is rich in natural resources, flora, and fauna, which is of considerable economic, social, and cultural significance to its people. However, Kerala's environment is under pressure from the rapid changes taking place in the society-nature relationship. Though the population growth in Kerala has shown a declining trend, the population density is high which puts considerable pressure on the environment. A host of investments in expanding irrigation facilities and improving energy supply for agriculture has brought about major changes in the landscape and hydrology of the state. Moreover, certain industrial investments in Kerala have also had an adverse effect on the environment of the State. Over-exploitation of natural resources, air, and water pollution from non-industrial activities are some of the other environmental concerns of the State.

AIR QUALITY IMPROVEMENT IN THE STATE

Air pollution is the greatest environmental threat to public health globally and accounts for an estimated seven million premature deaths every year. Air pollution and climate change are closely linked as all major pollutants have an impact on the climate and most share common sources with greenhouse gases. The most dangerous of particulate impurities, which can include anything from soot to sulphates, are fine particles 2.5 microns or less in diameter — PM2.5.

Air Quality in the state is being monitored 24×7 using nine continuous ambient air monitoring stations across six districts in the state – Thiruvananthapuram (2), Kollam (1), Ernakulam (3), Kozhikode (1), Kannur (1) and Thrissur (1). To strengthen the monitoring network, the board has proposed setting up one station each at Alappuzha and Palakkad. In addition to these, the Board also monitors Ambient Air Quality at 28 locations under the National Air Quality Monitoring Network and 7 under State Ambient Air Quality Monitoring Network. To strengthen the monitoring network, a minimum of one continuous ambient air quality monitoring station in every district and more manual monitoring stations need to be established throughout the State in the next five years.

NOISE POLLUTION

Despite the significant deleterious effects of noise pollution, there is no established mechanism in the state for dealing with it. Hence, Kerala needs to establish ambient noise quality monitoring network across the State.

ANTIMICROBIAL RESISTANCE (AMR)

Antimicrobial Resistance (AMR) is a global public health problem. Even though there are many drivers of antibiotic resistance, the most dangerous trends contributing to rising AMR apart from the inappropriate use of antibiotics in humans include antibiotic use for growth promotion and disease prevention in animals, horticulture, and fisheries. The use of animal manure in soil and inadequate treatment of effluents containing antibiotic residues from the pharmaceutical industry, healthcare facilities, and farms also contributes to the problem of increasing AMR. The Government of Kerala is committed to take suitable action to address antimicrobial resistance in the State by involving all stakeholders to develop and implement a State Action Plan on AMR, which will be in alignment with the National Action Plan on Antimicrobial Resistance (NAP-AMR) and the Global Action Plan on Antimicrobial Resistance (GAP-AMR). Inter-sectoral collaboration and a One-Health Approach are crucial, and hence, integrated in the government's approach. Creating awareness on AMR among cross-sectoral stakeholders is important for AMR containment.

The Government of Kerala has been involved in creating awareness and developing skills for AMR containment among the medical community in Kerala. The Kerala Antimicrobial Resistance Strategic Action Plan (KARSAP) has six strategic priorities: (1) Awareness & Understanding (2) Knowledge & evidence (3) Infection prevention & Control (4) Optimizing use of antibiotics (5) Research and innovation (6) Collaborations. Awareness classes have been held at all Government medical colleges in Kerala for faculty and students. The focus of these classes is to emphasize the importance of rational antibiotic use, infection control practices, and the need to follow an institutional antibiotic policy. Participation

from the private sector and professional bodies, especially the Indian Medical Association has been encouraging towards drafting the policy and training the trainers. Strengthening laboratory capacity for AMR surveillance and collating the data on AMR is essential for assessing baseline AMR burden and providing evidence-based information for action. As of now, Kerala State Pollution Control Board is establishing a State-level Anti-Microbial Residue Monitoring Laboratory in the Board's Central Laboratory, Ernakulam.

The Board is to conduct antimicrobial resistance surveillance of the environment in three districts namely Thiruvananthapuram, Ernakulam, and Kozhikode districts as per the framework and to establish separate AMR database, standard operating procedures and develop separate biosecurity guidelines for different sources. Together with the Health Department of the State progress can be achieved about AMR containment.

CIRCULAR ECONOMY

A circular economy is an economic system of closed loops in which raw materials, components, and products lose their value as little as possible, renewable energy sources are used and systems thinking is at the core. Such an economy is based on a few simple principles, First, at its core, a circular economy aims to design out waste. Waste does not exist. Products are designed and optimized for a cycle of disassembly and reuse. These tight components and product cycles define the circular economy and set it apart from disposal and even recycling, where large amounts of embedded energy and labour are lost. Second, circularity introduces a strict differentiation between consumable and durable components of a product. Unlike today, consumables in the circular economy are largely made of biological ingredients or 'nutrients' that are at least non-toxic and possibly even beneficial, and can safely be returned to the biosphere, either directly or in a cascade of consecutive uses. Durables such as engines or computers, on the other hand, are made of technical nutrients unsuitable for the biosphere, such as metals and most plastics. These are designed from the start for reuse, and products subject to rapid technological advances are designed for upgrade. Third, the energy required to fuel this cycle should be renewable by nature, again to decrease resource dependence and increase systems resilience (for example, to oil shocks).

Currently, Kerala's municipal solid waste is characterized primarily by organic and compostable waste, along with significant quantities of recyclable waste such as paper and plastic. The latter is generated within households and commercial institutions. Addressing this requires a broader strategy to move towards a Circular Economy (where waste is minimized and reutilized) is, therefore, a priority. Existing governance systems in the state must gear towards this in line with waste and pollution control norms.

There are two components that have been identified to achieve this − regulations that encourage producer responsibility and waste collection, monitoring, and the evaluation of waste management and waste treatment infrastructure The creation of collection centers and decentralized recycling facilities must incorporate Extended Producer Responsibility (EPR) schemes. This would require the integration of financial and technical support from private producers and manufacturing firms that deal primarily with plastics and paper

towards improving the capacities of existing Material Collection Facility (MCF) centers and Resource Recovery Facilities (RRF). This producer responsibility chain must also increase the number of registered waste scrap merchants and scrap collectors who have been identified under the Haritha Kerala Mission. This can bring in the capacities of informal workers and the unorganized sector. Creating larger cooperative-based material collection and resource recovery centres would be the next logical step in increasing the scale of such operations.

EXTENDED PRODUCER RESPONSIBILITY (EPR)

Extended Producer Responsibility may be defined as a policy principle to promote total lifecycle environmental improvements of product systems by extending the responsibilities of the manufacturer of the product to various parts of the entire life cycle of the product, and especially the take-back, recycling, and final disposal of the product. The system is based on the premise that producers are required to provide financial incentives to the collection systems, processing facilities, and the recycling industry to collect and process plastic waste to meet the targets set out by the Government.

Countries like Belgium, Czech Republic, Ireland, Italy, France, Netherlands, Norway, Portugal, and Spain have the scheme where obliged industry creates one common non-profit entity that collects the necessary funding, cooperates with local authorities, and ensures recycling in the most cost-efficient and environment-friendly way. This reduces public spending on waste management by almost 15%. Countries like Austria, Germany, and Sweden have adopted a dual model where the industry has full operational and financial responsibility over collection, sorting, and recycling. There is a separate collection system designated to local authorities, but their influence is minimal. The United Kingdom has a model where a customer at the time of purchasing a product pays the price of the product however a fraction may be reserved with the shopkeeper until the container of the item is returned. Under the European Commission's model, the major goal setup was to have all member states recycle 25% of their total packaging material which was accomplished by 2010.

The interpretation of the Plastic Waste Management Rules, 2016 illustrates the primary responsibility for the collection of used multi-layered plastic sachet or pouches or packaging is of producers (manufacturers, importers, and users (brand owners)), importers and brand owners who introduce products in the market. They need to establish a system for collecting back the plastic waste generated due to their products. Rule 6(3) mentions that the local body for setting up a system for plastic waste management shall seek the assistance of producers. However, the Rule is silent on allocating any responsibility to the producer/importer/brand owner for establishing other parts of the waste management system like transportation, material recovery, recycling, and final disposal. For the overall implementation of the EPR framework, it is important that the producer/importer/brand owner should be involved in the overall implementation of the projects and not only the collection.

Collecting financial assistance from brand owners/manufacturers/importers for meeting the expected cost of door-to-door collection, and treatment and disposal needs to be a priority

across the State.

LEGACY WASTE

Since early days, household discards mostly include food waste, which goes back to the soil along with stable wastes via compost pits. Urban discards were collected by farmers, who convert them into compost and utilize it in farming and bring their produce to the town/ city. With the introduction of plastic in the seventies, the composition of city waste started changing and people started discarding plastic along with kitchen wastes. These plastics blanketed the fields and made them infertile, as less rain could enter, and few seeds could germinate. Thus, urban mixed wastes lost their desirability as input for composting, and cities were left with an unexpected burden. Initially, most towns and cities in India started dumping all this unwanted waste outside city limits, along roadsides that are unsupervised and in no-mans-land. Uncontrolled and continuous dumping of municipal solid waste led to mountains of legacy waste. After three decades of neglect, these open dumps have grown larger and higher, becoming point sources of pollution. Waste rotting in these airless heaps produces leachate, a foul dark liquid that kills vegetation around dumps and irreversibly pollutes groundwater. The heaps of garbage also produce methane, a greenhouse gas that causes 21 times more global warming than carbon dioxide, and contaminates air quality, which further, worsens due to frequent fire incidences.

The treatment & disposal of Legacy MSW can be done by bioremediation and biomining. It refers to the excavation of old dumped waste, making windrow of legacy waste, and thereafter, the stabilization of the waste through bioremediation i.e., exposure of all the waste to air along with the use of composting biocultures, i.e., screening of the stabilized waste to recover all valuable resources like organic fines, bricks, stones, plastics, metals, clothes, and rags, followed by its sustainable management through recycling, co-processing, roadmaking, etc. All legacy waste sites across the State need to be addressed.

WASTE TO ENERGY PLANTS (WTE)

'Waste to energy' describes the process of utilising waste to generate energy, in the form of electricity, heat, or fuels. WtE projects involve a range of stakeholders from local councils who manage municipal waste, through to businesses in the waste and energy sectors, energy users, and generators of waste. WtE is typically considered 'renewable energy' when organic waste (biomass) is used as the feedstock. However, the use of plastic feedstock in some WtE facilities also requires the use of fossil fuels, diminishing the environmental credentials of such initiatives. WtE initiatives present several potential opportunities for project proponents and the wider community. These include an increased opportunity to extract value from waste, opportunities to reduce greenhouse emissions, and reduced reliance on both fossil fuels for energy and landfills that are reaching capacity. Not only will such benefits improve amenities through reducing traffic, odour, and noise issues created by landfills, they may also alleviate the need to create additional landfill sites. Beyond these direct benefits, WtE initiatives present a significant opportunity for investment and associated job creation, along with opportunities to redeploy waste that is problematic in landfills (e.g., agricultural waste). The potential for businesses to reduce energy costs in the face of rising gas and electricity prices through WtE initiatives is another notable advantage. A number of these

potential opportunities and benefits have already materialized in a handful of existing and economically viable WtE plants in the country. A few proposals are currently live, but all major cities need to have such plants.

MICRO-PLASTICS

Microplastics are small plastics of size less than 5 mm. These particles come from a variety of sources, including from larger plastic debris that degrades into smaller and smaller pieces. In addition, microbeads, a type of microplastic, are very tiny pieces of manufactured polyethylene plastic that are added as exfoliants to health and beauty products, such as some cleansers and toothpaste. These tiny particles easily pass through currently available water filtration systems and end up in rivers, lakes, and seas, posing a potential threat to aquatic life.

Recently, rivers and estuaries have been acknowledged as the main sources of microplastics from land to the open ocean. Due to their size, microplastics are ingested by organisms in the entire food chain; they are also potentially transferred along successive trophic levels and eventually can reach top predators. Microplastics can potentially transfer adsorbed and/or absorbed trace metals, organic pollutants, and additives throughout food webs, with unknown implications for human health. Despite the increasing number of studies on this research topic, it is not yet clear how hazardous microplastics within marine and freshwater environments are. In Kerala, microplastics were recovered from all sediment samples from Vembanad Lake—the longest in India. It is indicative of their extensive distribution in the lake. The abundance of microplastics recorded from the sediment samples is alarming. It is essential to gather basic and novel knowledge regarding the impacts of microplastics in our natural ecosystems including accurate spatial and temporal approaches, robust sampling designs and methods, tracking and monitoring systems, modeling techniques, risk assessment predictions, and solutions in a circular economy approach. Detailed study across the state for assessment and mitigation is a priority.

COMMON BIO-MEDICAL WASTE TREATMENT FACILITY

A Common Bio-medical Waste Treatment Facility (CBWTF) is a setup where biomedical waste, generated from several healthcare units, is imparted necessary treatment to reduce the adverse effects that this waste may pose. The treated waste is finally sent for disposal in a landfill or for recycling purposes. The installation of individual treatment facilities by small healthcare units requires comparatively high capital investment. In addition, it requires separate manpower and infrastructure development for the proper operation and maintenance of treatment systems. The concept of CBWTF not only addresses such problems but also prevents the proliferation of treatment equipment in a city. In turn, it reduces the monitoring pressure on regulatory agencies. By running the treatment equipment at CBWTF to its full capacity, the cost of treatment per kilogram of Bio-Medical Waste gets significantly reduced. Its considerable advantages have made CBWTF a popular and proven concept in many developed countries.

CBWTF as an option has also been legally introduced in India. The Bio-medical Waste (Management & Handling) Rules, 1998, gives an option to the bio-medical waste generator

that such waste can also be treated at the common bio-medical waste treatment facility. The Second Amendment of the Rules in June 2000 further eased the bottlenecks in establishing the CBWTF by making the local authority responsible for providing suitable sites within its jurisdiction. The concept of CBWTF is also being widely accepted in India among the healthcare units, medical associations, and entrepreneurs. Currently, the State has only two common biomedical waste treatment facilities, one in Palakkad and another in Kochi.

The State needs more CBMWTF with fixed tonnage for catering to southern and northern region. The law and guidelines require such common facilities with a jurisdiction of 75 km radial distance. Such facilities will reduce the risk of long-distance transportation and storage of waste.

The Way Forward

STRENGTHENING ENVIRONMENTAL MONITORING

Monitoring the quality of ambient water/air, effluent, emission, and solid wastes is the mandate and requisite of the Board. On average 150 to 200 Nos. of effluent/ water, 350 to 400 Nos. of Air samples, and 5 to 10 Nos. of solid waste samples are being analysed in each Regional/District Laboratory every month. In Central Lab, an average of 300 to 500 Nos. of water/effluent samples, 900 to 1000 Nos. of air samples, and 20 to 50 soil/solid samples are analyzed each month. The quality of analysis shall be ensured in terms of SOP (Standard Operating Procedure). Hence the Board's laboratories should be accredited with NABL, OSHAS, Environment (Protection) Act, etc. The Hon'ble High Court also commented many times that statutory labs should be accredited to ensure the credibility of results.

The Board's Central Laboratory has obtained NABL accreditation as per ISO / IEC 17025:2005 for 61 parameters (Chemical & Biological). The other laboratories are also required to obtain approval from the Ministry of Environment, Forest, and Climate Change since the Board is implementing Environment Protection Acts and Rules. Hence strengthening the Board's laboratories is highly essential. In addition to the Central Lab located at Ernakulam, the Board has 15 district-level laboratories attached to all district offices. These are provided with facilities for measuring various physical, chemical, and microbiological parameters of water/wastewater and solid waste. Heavy metal, pesticide organic compounds, etc. are being analysed in the Central Laboratory of the Board at Ernakulam as district labs are not equipped with such instruments and require more manpower. It is proposed to upgrade the laboratories attached to the Board's offices in all districts to NABL status for physical, chemical, and biological parameters. Upgradation of the labs at Palakkad, Kozhikode, Thiruvananthapuram, Kollam, and Thrissur is almost completed under plan schemes during previous years. Upgrade/modernization includes the purchase of modern/advanced analytical instruments/equipment to improve the quality of analysis of air and water/effluent samples. The aim of upgrade/modernization of the Board's laboratories is to improve the quality as well as the accuracy of the analytical results. NABL upgradation of all the laboratories under the Board shall be completed in this five-year plan

IMPROVING WATER QUALITY

The Board undertakes routine as well as continuous monitoring of water quality in the state.

Currently, there are 128 monitoring stations under the National Water Quality Monitoring Programme and 175 monitoring stations under the State Water Quality Monitoring Programme. A wide array of parameters are monitored, including pH, turbidity, electrical conductivity, dissolved oxygen (DO), ammoniacal nitrogen, bio-chemical oxygen demand (BOD), chemical oxygen demand (COD), nitrate, chlorides, colour, calcium, sulphate, total hardness, iron, total alkalinity, phosphate, boron, and magnesium. The Board has one real-time water quality monitoring station in the portion of the Periyar river passing through the Eloor industrial area upstream of the Pathalam bund cum regulator. Currently, another RTWQMS is proposed to be installed the downstream of Pathalam Bund Cum Regulator. One more RTWQMS is currently under installation in the Karamana River. To further strengthen the surveillance along the river Periyar in the industrial corridor nine cameras, of which two are night-vision type, are installed along the banks of river Periyar. More facilities shall be established including surveillance cameras and RTWQMS in the five-year plan.

MONITORING AIR QUALITY

The Board undertakes routine as well as continuous monitoring of the ambient air quality in the state. Air quality in the state is being monitored 24×7 using continuous ambient air monitoring stations in six districts in the state – Thiruvananthapuram (2), Kollam (1), Ernakulam (3), Kozhikode (1), Kannur (1), and Thrissur (1). To strengthen the monitoring network, we have proposed to set up one station each at Alappuzha and Palakkad. In addition to these, the board also monitors ambient air quality at 28 locations under the national air quality monitoring network (NAMP) and 7 under the state ambient air quality monitoring network (SAMP). Currently, there is a minimum of one air quality monitoring station within a 10 km radius of every collectorate except in the case of Idukki. The district collector of Idukki has extended his willingness to allot space in the district collectorate for the setting up of CAQMS. The Board plans to set up CAAQMS in every district in this five-year plan. In accordance with certain NGT orders, the Board must establish a CAAQM station in every district headquarters. To strengthen the monitoring network, minimum one continuous Ambient Air Quality monitoring station in every district plus 10 additional manual monitoring stations throughout the state in the next five years.

ESTABLISHING NOISE MONITORING NETWORK

As the prevalence of noise as a pollutant is rising rapidly, the State needs to establish an ambient noise quality monitoring network across the state. As a preliminary step, PCB is currently in the process of setting up two continuous real-time noise monitoring stations in Thiruvananthapuram and Ernakulam districts. Extending this throughout the state in identified strategic locations will be a priority.

SOLID WASTE MANAGEMENT

In Kerala, there are 93 Municipal Authorities responsible for MSW management. The most recent estimates indicate that, in 2021, the quantity of solid waste generated in Kerala was approximately 11,449 tonnes per day (this is almost twice the estimated waste generation reported in 2006; 6506 tonnes per day). It is estimated that urban areas produce 3521 tonnes per day while rural areas produce 7928 tonnes per day. By 2021, it is

also estimated that 2,981 tonnes per day of waste is untreated. There are 721 composting units, 16 vermi-composting units, and 216 biogas plants at the community level. There is only one landfill site in operation and a total of 52 dumpsites have been reported. Kerala State Pollution Control Board convened a workshop on 1st June 2019 in association with the Suchithwa Mission and Clean Kerala Company for training the President/Secretary/ Health Officer/Health Standing Committee of the model city to make the local bodies fully compliant with environmental norms. Kochi Corporation has a Windrow composting plant at Brahmapuram. The corporation collects waste from nearby municipalities namely Angamaly, Thrikkakara, Kalamassery, Aluva, Thripunithura, and two panchayaths. The quality of the compost and leachate from the plant were analysed by the Board and was found unsuitable for use in food crops. Leachate collection provision has been established by Kochi Corporation.

The work for establishing the WtE plant in Njaliyanparambu, Kozhikkode has been awarded to M/s Zonda Infratech Pvt Ltd. A company named Malabar Waste Management Limited was formed. With a debt funding of Rs 146 Crore by SBI, the project is under implementation. In Kannur, Chelora, Kannur Blue Planet Waste Solutions Pvt Ltd has been formed to take up the development of the project. The waste characterization and waste quantification as part of DPR preparation are to be undertaken. At Kanjikkode in Palakkad 15 acres of land have been taken over from KSEB for the setting up of the WtE plant. Blue Planet Palakkad Waste Solution Private Ltd was formed to take up the development of the project. At Kuzheepura in Kollam, 7.05 acres of land have been taken from the govt for setting up a WTE Plant. The work has been allotted to Venad Waste Management Solutions (P) Ltd. A total of 20 Acres of land at Brahmapuram, Ernakulam, 2 Acres of land at Munnar, Idukki, and 8.09 acres of land at Malappuram has also been identified for setting up the WTE plants. The works of the Waste to Energy plants shall be completed in this five-year plan. The waste to energy plants are proposed to be installed in the next five years with the financial support of the Board. The biomining of legacy waste at Kollam corporation and Ernakulam corporation is underway. At Kochi Corporation, the work has been awarded to M/s Zonta Infratech Pvt Ltd., whereas in Kollam Corporation, the work has been allotted to M/s Zigma Global Enviro Solutions Pvt. Ltd. The site has been cleared and machinery is currently being brought to the site.

ESTABLISHMENT OF CBMWTF

In any area, only one CBWTF may be allowed to cater up to 10,000 beds at the approved rate by the prescribed authority. A CBWTF shall not be allowed to cater to healthcare units situated beyond a radius of 75 km. However, in an area where 10,000 beds are not available within a radius of 75 km, another CBWTF may be allowed to cater to the healthcare units situated outside this 75 km. The BMW rules call for a common bio-medical waste treatment facility within every 75 km radius. Currently, the state has only one common biomedical waste treatment facility at Palakkad. Another one is being set up at Ambalamedu in Ernakulam with financial assistance from the Board. The State then requires one more CBMWTF in the southern region. The Board plans to facilitate one more CBMWTF in the southern region.

ENVIRONMENTAL AWARENESS AND EDUCATION

Creating continuous awareness among the public will ensure success in the implementation of these Acts and Rules. Awareness programs are planned for biomedical waste management rules, solid waste management rules, e-waste rules, noise rules, and plastic waste rules, along with awareness days such as World Environment Day, World Water Day, and World Ozone Day. Exhibition stalls with video films, posters, and pollution monitoring and analyzing equipment are arranged by the Board and during various public festivals. Preparation and publishing of pamphlets on environmental issues including guidelines by the Board apart from Paristhithi Vartha (a journal released by the Board) are also done. Joint Programmes with NGOs are also proposed under this scheme for conducting awareness programs. Advertisements through dailies, other special publications, mass media & FM radio are also done to spread environmental awareness messages to the public. Such messages are also given during environmental awareness activities conducted by schools/colleges including professional colleges. Board has always given special attention to control pollution during festivals like Attukal Ponkala, Sabarimala Season, Deepavali, Ganeshothsav, and Vishu.

PART 2
BIODIVERSITY

Thirteenth FYP - An Overview of Biodiversity Component

The State Biodiversity Board was formulated with the objective of developing a roadmap towards achieving National Biodiversity Targets and Sustainable Development Goals with the active participation of local people and sustainable management of natural resources. As a precursor to this, a working group was constituted for biodiversity and the committee had identified eight key objectives. The key objectives during 13th Five-year plan were:

1. Develop biodiversity strategies and action plan at state level and local level
2. Documentation of biodiversity at local level in PBR
3. Strengthening the institutional structure for decentralized conservation of biodiversity and implementation of Peoples Biodiversity register derived action plan at LSG level.
4. Conservation of local landraces/threatened species/ecosystems/green protocols by Model BMC
5. Mitigating negative impacts of invasive species and climate change to biodiversity through selected pilot projects
6. Promoting Sustainable utilization and benefit sharing
7. Biodiversity and livelihood enhancement
8. Enhancing Communication, Education and Public awareness of biodiversity

MAJOR ACHIEVEMENTS OF 13TH FIVE YEAR PLAN

Biodiversity Conservation

1. Biodiversity Management Committees (BMCs) were constituted in all the three tier systems of panchayats, that is, gram panchayats, municipalities, and corporations and at the block and district level.
2. Preparation of People's Biodiversity Register completed in all panchayats, municipalities, and corporations
3. Kerala's first Biodiversity Heritage Site declared at Asramom in Kollam. A five- year Management Plan for the same was prepared with budget and linkages with schemes of line departments, which will be implemented by the BMC along with Kollam Corporation.
4. To promote the conservation of locally important areas in the State, a GO authorizing BMCs to declare biodiversity rich areas in their locality as local BHS was issued. Guidelines for declaration of local BHS was prepared and nine local BHS has been declared by the respective BMCs in different districts of Kerala.
5. The software for PBR digitization developed by KSBB was adopted by the National Biodiversity Authority at the national level and the digitization of PBR is ongoing.
6. Regular training to BMCs through Kerala Institute of Local Administration (KILA), and incorporation of biodiversity conservation in regular training programs of LSG were planned and undertaken.
7. Kerala Biodiversity Museum was set up at Vallakkadavu in Thiruvananthapuram as a state-of-art centre to impart biodiversity education and awareness with the aid of advanced electronic and digital technology. The museum is functioning well and is attracting large number of visitors.

Institutional strengthening

1. Range Forest Officers from the Forest department were designated as Biodiversity Nodal Officers for strengthening BMCs to function as Environmental watch groups and for enforcing Biodiversity Act, and awareness conducted in three different batches.
2. The Police department vide Executive directive No 2/2020/PHQ dated 03/02/2020 has authorized that if any police officers have reasonable grounds to believe that an offence has been committed under the provisions of the Act they shall verify the facts by spot inspection and inform the concerned forest officers to take necessary action and awareness program conducted to border police officers.
3. A GO regarding establishment and utilization of Kerala Biodiversity Fund has been issued.
4. A State level Steering Committee for Biodiversity was formed under the Chairmanship of the Chief Secretary vide the G.O. Rt. No.60/2018/Envt. dated 11.05.2018 for interdepartmental coordination in matters related to biodiversity.

Note : A major limitation in fulfilling plan project objectives is that despite a higher sanctioned outlay; the actual amount received would be less than 50% of the budget outlay in all the plan years.

Major Projects

1. A Red data book of Kerala incorporating threatened species of Kerala and their status is being prepared with the help of research institutes.
2. Studies on impact of natural disasters on biodiversity
3. Three new projects under the Rebuild Kerala Initiative, namely, on the Pamba Riverine Biodiversity Rejuvenation through BMCs, conservation of agro biodiversity through BMCs, and development of a database of tradable bioresources of Kerala, are ongoing.
4. A project for the conservation of coastal sacred groves has been awarded from MoEFC, and data regarding coastal sacred groves and management priorities are prepared.
5. A UNDP funded project on Munnar Landscape Project has been completed, and as part of this, a biodiversity documentation protocol for PBR update has been developed.
6. A FAO supported project for strengthening BMCs and identifying policy gaps in agrobiodiversity was completed
7. Four ABS agreements were signed, and the benefits shared.
8. KSBB awarded 16 doctoral and 2 post-doctoral fellowships during this period

Table 2 Year wise/scheme wise outlay and expenditure during the 13th plan (Rs. in lakhs)

Year	Name of Scheme	Budget outlay as per 13th plan	Actual outlay	Amount received	Expenditure
2017-18	Biodiversity Conservation	700.00	700.00	590.00	590.00
2018-19	”	905.00	821.60	581.20	604.15
2019-20	“	1025.00	1027.00	308.10	393.96
2020-21	“	1160.00	900.00	500.00	465.83
2021-22	“	1355.00	800.00	150.00	
Total		**5145.00**	**4454**	**2129.3**	

14th Five Year Plan- Approach Paper on Biodiversity

VISION AND MISSION FOR 14TH FIVE YEAR PLAN

Vision

To protect biodiversity in its own right and to ensure its enrichment and sustainable use for the development of Kerala

Mission

To conserve our rich biodiversity through policy guidelines, legislation, and action plans in a participatory mode for the welfare of all the living beings of our state

The context to the approach paper: International, national, and regional developments and commitments

Kerala, with a population of over 3.4 crores and a population density of 859/km2 ranks first among the Indian states on the Human Development Index (HDI). Kerala has a unique geography with 580 km long seacoast and steep gradients along the slopes of the Western

Ghats, making it prone to natural hazards such as cyclones, monsoon storm surges, coastal erosion, sea level rise, tsunami, flood, drought, lightning, landslides (debris flows), and land subsidence (due to tunnel erosion or soil piping).

The UN-PDNA (Post-Disaster Needs Assessment) report and Rebuild Kerala Development Programme report post 2018 Kerala floods pointed out the necessity of an eco-sensitive area conservation policy for the state of Kerala. Given the ecological importance of the Western Ghats, one of the eight hottest hot spots of biodiversity in the world, the coastal ecosystems (mangroves and beaches), the wetlands (Ramsar sites and others), the river ecosystems, and the excessive pressures on these areas due to the growing population, an overarching policy would be required to ensure that there is no further degradation, and the already degraded areas are reversed. These pressures are likely to intensify in the post-COVID-19 world.

Biodiversity conservation has an important role to play in providing nature-based solutions and mitigating problems such as food and nutritional insecurity, spread of zoonotic diseases, and climate change related hazards. The recovery strategies should be site specific, eco-friendly, and based on a landscape and ecosystem approach for disaster risk reduction. Biodiversity mainstreaming is the process of embedding biodiversity consideration into policies, strategies, and practices of key stakeholders. People, institutions, and organisations both in the government and outside the government have taken measures to protect, conserve, and enhance biodiversity at various levels. Biodiversity related activities, whether agrobiodiversity conservation, native breed conservation, conservation of riverine ecosystem, pollution control, water and energy conservation, or eco- tourism care, are being undertaken by various institutions. Therefore, integration of biodiversity related schemes of line departments and mainstreaming biodiversity across sectors, schemes, and programmes is necessary.

The Approach to the 14th plan draws from the several International, National, and Regional commitments and treaties in this area, namely:

Sustainable Development Goals (2015-2030): The United Nations Sustainable Development Goals (SDGs) link environmental protection with human welfare. The targets of SDG 15 (protection, restoration, and conservation of terrestrial ecosystems and biodiversity) can be crucial for preventing pandemics (SDG 3). Combating climate change related disasters (SDG 13), imparting clean energy solutions (SDG 7), contributing to ensuring food security (SDG 2), and for providing alternative livelihoods to secure economic growth (SDG 8) and help alleviate poverty (SDG 1). The SDGs directly related to biodiversity include:

SDG 1	No poverty
SDG 14	Life below water
SDG 15	Life on Land

Post-2020 Global biodiversity framework (2021−2030). By 2050, biodiversity is valued, conserved, restored, and widely used by maintaining ecosystem services, sustaining a healthy planet, and delivering benefits.

UN decade on Ecosystem Restoration (2021−30). The United Nations declared 2021–2030 as the Decade for Ecosystem Restoration, and efforts are being scaled up to halt,

reverse, and prevent future degradation of ecosystems worldwide, including natural, semi-natural, managed, production, and urban ecosystems and raise awareness of the importance of successful ecosystem restoration.

NATIONAL BIODIVERSITY TARGETS AND ACTION PLAN 2008, 2014, AND 2019

National Mission on Biodiversity & Human Well-Being. The National Biodiversity Mission proposes a two-component programme to bring biodiversity science to the forefront of scientific and public engagement. The first component, titled the 'Cataloguing and Mapping Life of India' will focus on building an inventory of India's biodiversity, and will use digital tools to map this biodiversity with people, cultures, and management regimes. The second component is divided into six programmes, which will focus on biodiversity with regard to ecosystem services; climate change and disaster risk reduction; agriculture; health; bio-economy; and capacity building and outreach.

State Biodiversity Strategies and Action plan at state level and local level. The Kerala State Biodiversity Strategies and Action Plan (SBSAP) was prepared during 2005-2007. Presently, the SBSAP is being updated with monitorable indicators and financing framework with UNDP funding. A methodology for implementing local biodiversity strategy and action plan on a pilot scale is ongoing at Munnar, and the methodology developed can be scaled up across the state. LBSAP will identify focus areas and long term and short-term action to be undertaken for this. A Biodiversity code of conduct – a model biodiversity inclusive protocol for the functioning and schemes of departments needs to be developed.

BIODIVERSITY MANAGEMENT- CRITICAL GAPS IDENTIFIED

1. Biodiversity is not integrated in schemes of line departments
2. Ecosystem degradation
3. Biodiversity depletion in areas outside the protected areas due to urbanization
4. Inadequacy in baseline data of bio resources, consumption, trade, and real value of bioresources
5. Lack of local Biodiversity strategies and action plan
6. Lack of data sharing and synergy between related R & D institutes, line departments, and NGOs
7. Scientific knowledge gaps for conservation activities
8. Skill and knowledge gaps among BMCs for biodiversity conservation
9. Inadequacy in institutional infrastructure at KSBB HQ and District- personnel, office space, etc
10. 10. Biodiversity financing gaps

APPROACH FOR THE 14TH PLAN AND THRUST AREAS

Key objectives:

1. Contribute significantly to reducing the rate of biodiversity loss and ecosystem degradation for achieving relevant nationally agreed goals and targets
2. Biodiversity and livelihood enhancement and Promoting Business incubators in biodiversity

3. Strengthening scientific base on biodiversity conservation and decentralized management
4. Secure the necessary financial resources and means for mainstreaming biodiversity and implementation of the State Biodiversity Strategies and Action Plan

Thrust areas

The 14th plan must build upon the achievements of 13th plan, viz. 100 percent Biodiversity management Committee (BMC) constitution and Peoples Biodiversity Register (PBR) preparation. The activities envisaged during the 14thplan shall be reoriented to participatory planning and management of biodiversity and degraded ecosystems through BMCs and promotion of bio-resources based livelihood. For this period, seven thrust areas have been identified, and the thrust areas are:

1. Decentralization and skill development of BMCs to sustainably manage bio-resources
2. Ecosystem- conservation, rejuvenation and management
3. Biodiversity and livelihood enhancement
4. Strengthening scientific base on biodiversity conservation
5. Access and benefit sharing of bioresources
6. Creating communication, education and public awareness for biodiversity
7. Securing needed financial, human resource and technical expertise

DECENTRALIZATION AND SKILL DEVELOPMENT OF BMCS TO SUSTAINABLY MANAGE BIORESOURCES

Critical Gaps

National policies and plans on biodiversity are often implemented at the local level, where local people can take action to ensure that biodiversity concerns are addressed in the schemes of the Local Self Government Institutions (LSGIs). People's Biodiversity Registers (PBRs) were prepared in a participatory manner in all the LSGs of Kerala. It was envisaged that the information in the PBR would be a significant input to the knowledge base for the preparation of Local action plan of LSGs. Although PBR preparation was completed in 2019 in all the 1034 local bodies which cover the whole jurisdiction of the State, the data collected and recorded in PBRs have not been utilized for spatial planning and natural resources management. The local communities, especially the inhabitants of the areas who are the first line sensors of biodiversity loss or climate change or its impacts, are least involved in any systematic documentation of such valuable information. If tapped scientifically, this would serve as a platform of biodiversity data generation for utilization or analysis.

Suggested activities

- Skill development for preparation of Local Biodiversity Strategies and Action Plan (LBSAP) by BMCs
- Participatory Biodiversity conservation and management by BMCs
- Digitization of PBR, ePBR, and PBR-derived action plan, Marine Biodiversity Register
- Skill development for resource mobilization for biodiversity conservation at LSG level.
- Skill development for continuous monitoring of biodiversity and its indicators, for identified BMCs with jurisdiction over highly sensitive, fragile, and unique ecosystems through the support of scientific institutions.

ECOSYSTEM- CONSERVATION, REJUVENATION, AND MANAGEMENT

Critical gaps

The UN Decade on Ecosystem Restoration (2021-2030) provides an opportunity for recognizing the need to prevent, halt, and reverse the degradation of ecosystems for the benefit of both people and nature. Urbanization and associated land use changes are the prime reasons for ecosystem degradation, which are associated with an increasing pollution of water and air leading to further degradation. It has been estimated that the cities alone consume 75% of natural resources and produce 50% of global wastes accounting for 60–80% of global GHG emissions. Green spaces in or near cities deliver services such as air purification, temperature regulation, groundwater recharge, and cultural services including aesthetics and recreation, all leading to healthier lifestyles.

Kerala has 11521.813 km2 (29.65%) as recorded forest areas largely consisting of Reserved Forests (RF) and Protected Forests (PF), constituted under the provisions of Indian Forest Act 1927 and State Acts. Protected Area network of the State covers8.85 per cent of its geographical area. The Protected Area network system alone cannot sufficiently address threats to biodiversity posed by the development in the economic and production sectors. The Forest Survey of India has recorded that the total forest cover of the State is 21,144 km2 (54.42%) against a recorded forest area of 29.65 per cent. Total forest cover includes areas outside the recorded forests with tree stands of more than 10 percent canopy density and size 1 ha or more. Such areas outside recorded forest areas are critical from the point of view of soil, water, and environmental conservation. Kerala has about 2000 sacred groves, which are distinct and unique in biological diversity varying in size from 40m2to 20 ha or more. KSBB has already proposed 14 of these as "Other Effective Area-based Conservation Measures" (OECMs). In Kerala 33 areas have been identified as important bird areas, of which 10 are not officially protected. Kerala has 18 important marine biodiversity areas, of which only one is protected as community reserve.

The mangrove areas serve as spawning and nursery grounds for many economically important freshwater/marine fishes and shellfishes. They also prevent soil erosion along the river coast thereby preventing sedimentation near the river mouth, so that the nutrient flow into the sea is normal. Ecologically, mangroves play an important role by acting as nesting place for many resident and migratory birds. Although these ecosystems are highly productive, the importance of mangroves is poorly understood. In Kerala, mangrove forests that once occupied about 700 km2, have now dwindled to 17 km2. Much of the mangrove area (89%) in Kerala is owned by private individuals, of whom some live within the system. In addition to owners, some people who live outside the system also depend on the mangroves for their livelihood. Hence, there is an urgent need for multi-stakeholder mangrove restoration and management to derive the full potential benefits from mangrove ecosystems, which act as bioshields during cyclones, storms, and even Tsunamis. Kerala has nearly 4600 km2 under back water, lagoons, intertidal areas, beaches etc. which can be suitably used for restoration of mangroves with the participation of residents and R&D institutions.

It could be seen that even outside the declared eco-sensitive areas and forests; Kerala's natural environment is unique as it is gifted with varying soil profile, rich vegetation, and distinct agro-climatic zones. However, Kerala has also the third highest population density among all Indian States, which poses strong pressures on land use and water resources and on its unique eco-system.

Suggested Activities

Extension of areas conserved outside protected areas as BHS or OECMs

- Coordinated scheme for identification of biodiversity rich areas outside PAs and conservation with community participation
- Conserving biodiversity rich areas as Biodiversity Heritage Sites, LBHS (Local Biodiversity Heritage Sites), or OECMs (Other Effective Area based Conservation Measures)
- Setting up of Biodiversity Parks or other biodiversity spaces/groves in identified areas serving multiple objectives of conservation, education and sustainable utilization.
- Safeguarding and reclamation of degraded ecosystems and urban biodiversity for human well-being
- Prioritising degraded areas for targeted restoration action.
- Area based conservation for degraded ecosystem including wetlands, riversides, coastal areas, abandoned quarries, etc
- Promotion of urban biodiversity/ urban green spaces and urban water bodies
- Document the existing mangrove and its associated marine diversity for estimating tangible and intangible values
- Evaluation of dependency of local communities on Mangroves for their sustenance

BIODIVERSITY AND LIVELIHOOD ENHANCEMENT

Critical gaps

Bio-resource based primary industries like agriculture, horticulture, medicinal plants, livestock husbandry, and aquaculture are the backbone of Kerala economy. There exists little scope for expansion of tree cover in the recorded forests areas, and thus, Trees outside the Forests (TOF) form an excellent option for the expansion of tree cover in the state, and a potential strategy to meet the needs of growing population (timber, medicinal plants, fuel wood, and fodder). It is hoped that the planting of valuable timber trees for meeting the domestic and industrial requirements and promoting cultivation of high value and highly traded NWFPs will reduce the pressure on the forest.

Kerala's economic growth is fueled by sectors such as tourism, IT, food processing, spices, rubber, Ayurveda, electronics, handlooms, apparels and garments, coir, and traditional products such as wood carvings and designer jewelry. Kerala is one of the leading producers of natural rubber, coir, coconut, cashew, coffee, and spices in the country. Agriculture is a major sector of exports from the state, but the state's exports of processed agricultural products is currently limited. The development of value-added products form spices and medicinal plants can generate more revenue to Kerala from export market as the state is still exporting raw drugs and spices without any value addition.

Innovation and research can provide us with new products derived from bioresources. A critical gap identified is the necessity of a strong eco-system for nurturing startups sustainably utilizing bioresources that will drive economic growth, generate employment opportunities, and reduce pressure on collection of wild species. There is a need to develop an industry-academia interface for facilitating innovation in research and development of novel, high quality affordable products. Innovations for value addition of bioresources, cultivation of highly traded and economically viable species, promotion of commercially viable native species of fish, extraction of essential oils, oleoresin, gums, resins, latex, fibers, and their export, popularization of sandal wood, teak, rose wood, and bamboo cultivation are some of the options for bioresources based livelihood.

Suggested Activities

- Promoting business incubators in Biodiversity
- Promoting start-ups to convert innovative research of public and private sector into viable and competitive products and enterprises
- Empower BMC members/ tribal and rural communities/ women/ Self-help groups about the value of bioresources in their jurisdiction and train them in value addition
- Popularization of sandal wood, teak, rose wood, and bamboo cultivation as a livelihood
- Establishment of nursery and quality planting materials of medicinal plants to meet the increasing demands both locally and internally.

STRENGTHENING SCIENTIFIC BASE ON BIODIVERSITY CONSERVATION

Critical Gaps

Promotion of research and development in various identified problem areas of ecology and environment is necessary for finding practical solutions for the conservation and protection of environment and natural resources of the state. The knowledge generated from the R&D projects shall be utilized for developing policies, strategies, action plans, and integration of such outputs in the on-going schemes and programmes for better management of natural resources.

The National Biodiversity Authority has estimated that about 115 governmental and non-governmental institutions are involved in the collection of data related to biodiversity and environment. This data is either spatial (e.g. species occurrence, water pollution), temporal (e.g. population trends of species, yearly harvest and trade of commercial species) or descriptive (e.g. species descriptions, habitat details, wildlife crime). The data generated by these agencies are currently used for specific objectives such as species inventory, pollution monitoring and wildlife crime control. However, in many cases, the data is not available in public domain for scientific documentation, monitoring and management of biodiversity and natural resources.

The two major drivers of biodiversity loss are reported to be climate change and invasive species. Kerala State Biodiversity Board had conducted a rapid assessment of impact of floods and landslides on biodiversity and the major observation was that the flood water had released about 15 alien species into the water bodies of Kerala. Of the 7 species that were recorded for the first time after the floods, many are illegally introduced and farmed

for the aquarium pet trade, as they are not listed in the species allowed to be imported to the country. The UN-PDNA (Post-Disaster Needs Assessment) report has also pointed out the environmental concerns posed by the escape of many exotic species of fish from aquaculture farms to the open system including ornamental fish, fish stocked with proper bio-security measures such as the genetically improved farmed Tilapia (GIFT), and illegal stocks of fish like the pacu.

IDENTIFIED RESEARCH PRIORITIES

Identifying threats to Biodiversity and prioritizing responses

- **Alien and invasive species**

a. Studies on pathways of introducing invasive aliens such as nursery, pet shops, aquaculture, etc., and regulatory measures to be implemented
b. Practical solutions for restoration of invasive species invaded habitats and early detection and rapid control of biological invasions

- **Biodiversity for climate change adaptation and mitigation.**

  The most obvious broad response of species to global warming would be to migrate from lower latitudes to higher latitudes and from lower elevations to higher elevations.

a. Pilot studies on range shifts of plants and animals due to climate change

- **Biodiversity conservation**

a. Pilot studies on landscape approach for biodiversity conservation and ecosystem valuation
b. Estimation of blue carbon storage capacity of the mangroves in Kerala and restoration of degraded mangroves
c. Strategies for in situ and ex situ conservation of rare, endangered, and endemic flora and fauna
d. Citizen science projects for inventorisation, assessment, and monitoring of natural resources
e. Studies on functional biodiversity, natural pollinators /predators, and non-harvested agrobiodiversity,
f. Studies on nutrient content of local landraces of crops to strengthen local food systems and nutrition.
g. Focused biodiversity research - Biodiversity fellowships for PhD and post-doctoral programs in selected areas
h. Socio-economic issues and impact on livelihood of biodiversity loss

ACCESS AND BENEFIT SHARING OF BIORESOURCES

Critical gaps

Genetic resources provide substantial opportunities for uses that benefit people around the world, including opportunities for scientific research and for the development and commercialization of pharmaceutical, agricultural, horticultural, herbal, industrial, and other products. There are many well-known medicines, foods, and other products that have been developed from genetic resources. For example, between the years 1981 and 2006, 78

per cent of anti-cancer drugs were either natural products or based on natural products. At the same time, the commercial development of genetic resources can negatively affect the interests of governments or local and indigenous communities that are the "providers" of genetic resources, if they are not able to make well-informed decisions about the genetic resources they own. Kerala holds just 1.2% of land area of India, yet it is home to nearly 20% of the biodiversity of the country and is thus aptly recognized as one of the hottest hotspots. Therefore, it is necessary to strengthen the ABS system so that access to these genetic resources and the associated knowledge can be legally regulated and the benefits could reach the knowledge providers/owner of such resources.

The potential of the legal framework on ABS to secure benefits from the use of biological resources has not been much explored in Kerala limiting the range of economic and social benefits that are channeled back to the communities. Although the KSBB has recently taken some steps to engage industries that utilize the bio-resources of the State commercially to sign the ABS agreements; there is need for a detailed examination of the issues constraining the revenue from ABS and identifying strategies to address these. Innovative models of ABS need to be developed. Even though large amounts of research have been carried out in Kerala and papers published on the medicinal uses/ ethno-pharmaceutical uses of bio resources and patents granted, very few of these are commercialized. In India, no more than 5% of patents reach the market, and two-third of the research originates from Government labs.

Identified Priority Areas

- Creation of access and benefit sharing facilitation cell in research institutes to facilitate technology transfer and commercialization of patents
- Scientific studies for estimating the ABS potential; and identifying the effective strategies for realizing the full potential of ABS in the state
- Development of Kerala Traditional Knowledge library
- Promoting Innovative models of Access and Benefit Sharing.

CREATING COMMUNICATION, EDUCATION, AND PUBLIC AWARENESS FOR BIODIVERSITY

Kerala State Biodiversity Museum is one of the first Biodiversity museums to be developed in the country. The following activities on education and awareness programs are suggested.

Suggested Activities

- Updating Biodiversity Museum with modern education and interpretation methods
- Biodiversity education through Biodiversity clubs
- Biodiversity knowledge centres along with existing libraries
- More outreach programmes including that utilising the scope of digital and social media platforms
- Celebration of International and National days related to biodiversity and environment for creating awareness among general public and students
- Continuing biodiversity awards for the public and children

SECURING REQUIRED FINANCIAL AND HUMAN RESOURCE AND TECHNICAL EXPERTISE IN KSBB AT DISTRICT AND BMC LEVEL

Critical Gaps

KSBB has attempted to map and estimate the current public expenditure on biodiversity through various government schemes and programmes being implemented in Kerala to estimate the additional funding required for implementing the SBSAP in the state. From a review of the budget documents of the Government of Kerala, 14 departments are implementing schemes/actions relevant for biodiversity conservation. While significant expenditure is incurred in production sectors and in research, the State needs to augment expenditure for restoration of biodiversity and enhancing implementation

The state should explore the option of enhancing the 'State Biodiversity fund', pooling contributions from state budgets and others, through the following:

1. Earmarked revenues of the identified economic sectors. The state should explore earmarking a specific portion, say 2-3 per cent of total revenue of tourism, mining, and hydropower departments for biodiversity conservation.
2. Amounts earmarked from CAMPA Fund: There is a need to integrate biodiversity in utilization of CAMPA (Compensatory Afforestation Fund Management and Planning Authority), especially for restoration and afforestation activities.
3. District Mineral Foundation Fund: About 20-30 per cent annual proceeds in 'District Mineral Foundation Fund (DMF)' can be earmarked for biodiversity conservation. It was estimated that Rs. 29.23 crore in DMF lies unutilized. The state should start planning expenditure on the priority areas from the fund to address the adverse impacts of mining on the biodiversity and livelihoods. The state should also explore the possibility to transfer a specific amount from DMF to 'Biodiversity Fund', which could be utilized for conservation and restoration purposes
4. Rationalizing user fee and additional fee. There is considerable scope for upward revision in user fees (with premium pricing for foreign tourists) at several tourist destinations across the state (e.g., beaches, wildlife parks, heritage buildings, museums). The state should also consider and levy a conservation cess on tourism activities in 4−5 km2 area around PAs which can be pooled into the Biodiversity fund.
5. The Board must be strengthened with adequate infrastructure including personnel and office space at State and district level

- Personnel. KSBB does not have any permanent staff, but it is functioning with Government staff on deputation and project personnel employed on project basis. For taking up projects in tune with international and national developments, the board needs to be equipped with experienced staff. Government shall identify some crucial scientific positions for posting through PSC.
- Infrastructure. The Board requires ample office space of its own for better output. Searching for rented buildings frequently (usually, once in three years) and shifting office furniture and files is a major hindrance to the smooth flow of work.
- District level Infrastructure and staff. The Board operates through BMCs. However, for co-ordination with BMCs, some district level personnel and an office at the district level is required.

PART 3
CLIMATE CHANGE AND COASTAL MANAGEMENT

Climate Change and Coastal Management

ENVIRONMENTAL SENSITIZATION AND INCENTIVES

The programs envisaged under this scheme aim to generate awareness among the public about the importance of environmental conservation and the impact of environmental degradation and climate change. Programs envisaged under this head expect that environmental sensitization and public awareness may improve the quality of our environment. The outlay will be utilized for conducting various awareness and incentive programs on environmental aspects/issues with the help of educational institutions, government departments, and authorized NGOs.

Objectives:

- To create awareness about climate change mitigation and adaptation, environmental acts, rules, and notifications, etc among the public especially those who reside in environmentally sensitive/vulnerable zones
- To carry out conservation/restoration actions with the support of educational institutions, non -governmental organizations, professional associations, scientific bodies, community organizations, etc.
- To utilize the enormous manpower available with students as conduits for environmental awareness in the society.
- To equip people, practice, and advocate sustainable lifestyles.
- To sensitize the society for maintaining environmental sustainability of the State.

Major programs under this scheme include:

Bhoo Mithra Sena Clubs (BMCs). The program aims to strengthen the environmental commitment of students at College and Higher Secondary levels in the State. Through this program, Bhoo Mithra Sena Clubs (BMCs) are established in all districts of the state to provide environmental education opportunities for students and involve them in addressing environmental issues in the locality. Each such BMC should have at least 50 student members, who show interest in environment-related issues. Each BMC will be advised/ supervised by a Faculty-in-Charge (FIC), who is selected from among the teachers of the member College/HSS on the basis of his/ her interest in environment-related issues by the Principal. The directorate of Environment & Climate Change (DoECC) will coordinate the implementation of the scheme in the State.

Presently, the scheme has 369 clubs across Government and Government Aided Colleges/ Higher Secondary Schools in the State in three different zones.

Paaristhithikam. This ongoing action cum awareness-oriented programme is intended to create state level environmental awareness and conservation/restoration actions through non-governmental organizations, educational and training institutions, professional associations, scientific bodies, and community organizations. The bodies singularly or in

partnership with other organizations may organize programs for creating environmental awareness followed by field action at local, regional, and state levels.

Observation of World Environment Day and other days of environmental significance. This program aims to create environmental awareness in society by observing World Environment Day and other nationally and internationally declared environmentally significant days.

Paristhithimithram Awards and other environmental incentives programs. This prestigious award is for honouring individuals and organizations for their achievements and contributions to environmental conservation activities. Awards are given in six categories:

1) Environmentalist
2) Environmental Researcher
3) Print Media Reporter
4) Visual Media Reporter
5) Environmental Organization
6) Local Self Governments

ENVIRONMENTAL RESEARCH AND DEVELOPMENT

The Environmental Research and Development scheme envisages the planning and coordination of environmental research in public interest for enhancing the understanding of the environment and ecology and devising strategies and solutions for effective environmental protection and management of the State. The scheme also provides fellowships for student researchers desirous of working at the forefront of Environment Management, Environmental Sciences, Environmental Engineering, Environmental Economics, and Climate Change, with a focus on problem-solving on environmental and climate change issues by way of research in environmental schools/institutions in Kerala.

Objectives

The objectives of the research and development scheme are summarized as follows:

- To generate information and knowledge required for developing strategies, technologies and methodologies for better environmental management.
- To ascertain practical solutions to the problems of environmental management in the state.
- To develop and demonstrate the models suitable for environmental conservation, climate change adaptation, and mitigation, etc at the local level for adoption in the development plans of the local self-governments.
- To strengthen the capacity of local institutions for undertaking environmental research for evolution and demonstration of cost-effective and energy-efficient technologies for environmental management in the State.
- To generate, document, and analyze information for taking policy decisions relating to environmental concerns of the State.
- To encourage young researchers to undertake research work in environmental sector
- To create well-informed environmental database management at the department.

Components Of The Programme

Under this program, financial assistance for Major (duration 24 – 36 months) and Minor (duration 12 –18 months) research project proposals are considered as invited or commissioned. Depending upon specific needs of the State or to focus research efforts on important areas of ecology and environment, the Directorate may directly commission research studies to one or a network of research institutions, identified on the basis of recognized capabilities in the concerned area. The research will be assigned depending upon specific needs of the State's policy making, including formulation of programs, dissemination of information and sensitizing local self-governments.

Paristithiposhini. The program will allow our most promising young researchers after completing MSc/Mphil/M Tech to do cutting-edge research on critical issues related to the environment and climate change in collaboration with leading institutes/universities and scientists in Kerala/India.

Vidhyaposhini Student Fellowship Programme. The program aims to provide financial assistance to M.Sc./M.Tech students to undertake short-term research projects in the field of environment as part of their course work.

Geospatial Laboratory. The objectives of this laboratory is as listed below.

- To function as a digital data repository of environmental information of the State
- To strengthen the capacity of DoECC in identifying solutions to problems in natural resources and environmental management of the State through the utilization of remotely sensed earth observation data and GIS techniques
- To monitor the resource base both in its content and Spatio-temporal distribution
- To enforce the environmental regulations much more effectively and efficiently including the monitoring of violations

Climate change poses a grave challenge to the sustainability of social and economic development, livelihoods of communities, and environmental management in Kerala. India has pursued a strong domestic agenda to counter climate change while engaging constructively with the international community in advancing actions to address this global challenge. Over the years, our country has pursued major domestic policies and schemes in areas of climate change mitigation and adaptation actions, particularly in the fields of water and soil conservation, carbon-neutral, clean, and renewable energy, enhancement of energy efficiency, development of less carbon-intensive and resilient urban development, promotion of waste to wealth, electric vehicles, etc. Even though the signs of climate variability are visible across states, and climate change impacts will become a major issue in the planning and implementation of State policies and programs. To achieve better climate resilience, one needs to improve climate literacy and decentralized actions for adaptation and mitigation. Every local government body should have a climate change adaptation plan and individuals should be educated about the carbon footprint of their individual actions, from consumption to modes of transport. Kerala, while urbanized in principle, is still living close to nature and hence could become a world leader in community-based climate resilience actions.

Objectives

- To take appropriate action to address climate change-related issues by respecting, promoting, and considering the respective obligations on human rights, the right to health, the rights of indigenous peoples, local communities, migrants, children, persons with disabilities, and people in vulnerable situations; and the right to development as well as gender equality, empowerment of women and inter-generational equity.
- To achieve the same, the State is planning to carry out in-depth or specific studies paying special attention to cost evaluation in relation to climate change adaptation/ mitigation measures with the technical support of Research and Academic Institutions and climate change adaptation/ mitigation oriented specific programs/ projects/ action plan with line Departments, NGOs, PSUs, etc.

ACTION-ORIENTED PROJECTS FOR CLIMATE CHANGE ADAPTATION AND MITIGATION

To carry out in-depth or specific studies paying special attention to climate change adaptation/ mitigation measures with the technical support of Research and Academic Institutions and developing specific programs/action plan with line Departments, NGOs, PSUs, etc.

UJJWAL –POST DOCTORAL FELLOWSHIP

This program envisages promoting Post-Doctoral Research in Climate Change mitigation and adaptation policies or issues, vulnerability analysis on different sectors, and ecosystem-based risk assessments. The main objective of the Post-Doctoral Fellowship program is to encourage and retain young Ph.D. scholars and who wish to pursue a regular career in research, teaching, and social activities. They should have a high potential and promise for conducting full-time research on specific themes and issues related to climate change. Such studies are expected to contribute to theoretical and conceptual advancement in different aspects; help to generate fieldwork based on empirical data and contribute towards policymaking.

STATE CLIMATE CHANGE CELL

The Directorate of Environment and Climate Change (DoECC) is the nodal agency for coordinating climate change activities in the State. As part of the National approach towards addressing climate change, States have been forming the Climate Change Cell (CCC) within the nodal department. As per the decision of the State Level Steering Committee (SLSC), vide G.O (Rt) No. 27/2018/Envt. dated 24.02.2018, the Climate Change Cell has been constituted with the Director, DoECC as the Head to support and coordinate the climate change-related activities of the stakeholder departments in the State.

New Initiative Proposed under the Scheme

Strengthening of State Climate Change Cell. The Climate Change Cell envisages functioning as a multi-stakeholder coordination agency by building capacities for climate change actions through improved climate change governance and service linking climate science, policies, and people. It will be the nodal body for informing and supporting various

departments and agencies to embed adaptation and mitigation measures within their action plans and their annual budgetary proposals.

A fully developed Climate Change Cell is imperative for inter-departmental coordination and to have periodic interactions with the stakeholders such as line departments, local self-governments, different regulatory authorities, R&D institutions, non-government organizations (NGOs), community-based organizations (CBOs), etc. including interaction with the international institutions for exchange of information on climate change, data sharing and to facilitate real-time monitoring of the plan programs. Such a plan must have clearly developed systems identifying the chain of command for the assessment and deployment of schemes on climate vulnerability and climate change adaptation. A task of this cell must be to assess how existing development schemes can be enhanced to improve capacities of districts identified as being most vulnerable to climate variability and long term climate change.

It also mandates to develop a Climate Change Knowledge Management Portal for the State to ensure proper collection, analysis, and dissemination of climate change data/information. The portal will serve as an online tool, for accessing comprehensive district/watershed/ regional/local level data on climate change and help in disseminating knowledge among citizens about all the major steps the Government is taking at both state and national levels to address climate change issues. The State Action Plan on Climate Change (SAPCC) is built on the sectoral climate change vulnerability assessment and in line with the existing policies of the state government by taking into consideration the ongoing programs and schemes being implemented at the state level as well as the National Action Plan on Climate Change. SAPCC mentions the need to have an implementation, monitoring, and evaluation framework for measuring the effectiveness of activities/strategies proposed in the document. The DoECC and Climate Change Cell are entrusted to coordinate the same. Strengthening of the CCC is inevitable to fully operationalize cell and to achieve the following

- Revision of State Action Plan on Climate Change
- Regular updating of Sectoral Climate Change Vulnerability Assessment
- Assessment of development schemes in areas identified as most vulnerable to climate variability and future climate change
- Downscaled regional climate projections for future planning
- Preparation & implementation of Local Action Plan on Climate Change – Pilot Scale
- State Climate Change Knowledge Portal
- Kerala State Network on Climate Change Assessment (KSCCA) - A network of departments/agencies/academic/research institutions to share knowledge and work in a collaborative manner on climate change issues with a digital/automated platform support.

CLIMATE RESILIENT FARMING

This scheme aims to enhance the resilience of the agriculture sector to climate change through strategic research, technology development, and demonstration. Well-framed

adaptation policies and programs are essential to increase the resilience of farming to climate change. Some practices that help adapt to climate change in farming are soil organic carbon build-up, in-situ moisture conservation, residue incorporation instead of burning, water harvesting and recycling for supplemental irrigation, growing drought and flood-tolerant varieties, water-saving technologies, location-specific farming, and nutrient management, etc. Building resilience in soil health is the key property that determines the resilience of crop production under changing climate. To adapt to climate change, farmers need to adapt quickly to enhance their resilience to increasing threats of climatic variability such as droughts, floods, and other extreme climatic events. Adoption of such resilient practices and technologies by farmers appears to be more a necessity than an option. Participatory on-farm demonstration of site-specific technologies will go a long way in enabling farmers to cope with current climate variability.

This requires inputs from Agricultural Universities in the State, and extension services to provide scientific input on the issues detailed above as well as research and development of climate resilient crops that can adapt to impacts of variable climate, high and low variations of temperature and precipitation, and long-term climate change. Along with this strategy the promotion of science-based practices that incorporate traditional knowledge on farming, is vital in responding to environmental challenges including flood, drought, diseases, and pest infestation and their attendant effects. Traditional agriculture practices also conserve key resources such as biodiversity, water, soil, and nutrients for resilience and adaptation. In addition, traditional varieties or landraces are more genetically diverse than modern varieties and are better able to withstand environmental stress such as lack of water or nutrients. This traditional strategy of minimizing risk stabilizes yields, promotes dietary diversity, and maximizes returns using low levels of technology and limited resources. Hence, this scheme also aims at the promotion of indigenous knowledge and traditional agricultural practices and their relevance in responding to and building climate change adaptation in the specific local context. The scheme also promotes strategic research and on-farm demonstration of site-specific technologies on adaptation to progressive climate change and climate resilience covers crops, livestock, fisheries, and natural resource management.

Objectives of the scheme include:

1. Preservation of traditional farming knowledge and farming practices.
2. Conservation of germplasm of climate-resilient crop varieties
3. Climate Change Vulnerability and Risk Assessment of Agro-ecological zones of Kerala and adoption of agroecological principles.
4. Building soil resilience through improved soil management techniques.
5. Developing linkages with State Agricultural Universities and extension services
6. Promotion of traditional farming knowledge and farming practices to achieve climate resilience.
7. Adaptive cropping practices for extreme weather events in vulnerable agroecological zones.

STATE ENVIRONMENT IMPACT ASSESSMENT AUTHORITY

SEIAA was constituted vide notification No. G.O.(MS) 8/11/Envt dated 19.12.2011 by the Ministry of Environment and Forest in order to give Environment clearances for various projects of different types as mentioned in the schedule, para 2 & 7 of Environment Impact Assessment Notification 2006.SEIAA is an authority constituted by Govt. of India authorizing to deal with Environmental Clearance for projects falling under category "B" of schedule in EIA notifications 2006. SEIAA was initially constituted vide S.O.2484(E) dated 3rd November 2011consisting of three Members including a Chairman, a Member, and a Member-Secretary to be nominated by the State Government or the Union Territory Administration concerned. The tenure of the nominated Authority is normally 3 years. The present Committee constituted as per Notification No. SO.4913(E) by MoEF dated 19.09.2018, has Dr. H. Nagesh Prabhu, IFS (Retired) as Chairman, Dr. S. Jayachandran, as Member and Principal Secretary, Environment Department, Govt. of Kerala as Member Secretary.

Functions of SEIAA

SEIAA is the ultimate Authority to issue Environmental Clearance to projects falling under category "B" of schedule in EIA notifications 2006. The decisions are normally taken based on the recommendations of SEAC after appraisal of projects by SEAC.

SEAC

SEAC is the state-level expert appraisal Committee that appraises projects or activities in category B for minor minerals. Normally the Committee meets at least once/twice every month. The Chairman & the members of the Committee is constituted by the Central Government in consultation with the State Government and the tenure of the Committee is 3 years. The ongoing Committee constituted as per Notification No. SO.4913 (E) by MoEF dated 19.09.2018 has Dr. C. Bhaskaran as its Chairman and the Director of DoECC as Secretary. The Committee consists of 11 other members in addition to the above.

Vide G.O.(MS) 2/2012/Envt dated 11.01.2012, SEIA& SEAC Kerala was constituted Vide GO(MS) 7/2015/Envt dated 21.5.2015 Government resolved to give functional freedom to SEIAA as it is envisaged an autonomous statutory authority without Supervisory or Legal Control of the State Government. Vide G.O.(MS) 15/2015/Envt. Dated 28.11.2015 of Envt(A) Department, functional autonomy had been given to SEIAA and Secretarial arrangement and institutional facilities sanctioned.

KERALA COASTAL ZONE MANAGEMENT AUTHORITY KERALA

Kerala Coastal Zone Management Authority is constituted as per the Coastal Regulation Zone Notification 2011 of the Government of India. In exercise of the powers conferred by subsections (1) and (3) of section 3 of the Environment (Protection) Act, 1986 (29 of 1986), the Govt. of India vide S.O. 3903 (E) dated 30-10-2019, constituted the present Kerala Coastal Zone Management Authority. The Authority was meant to function for the purposes of protecting and improving the quality of the coastal environment and preventing, abating, and controlling environmental pollution in the coastal regulation zone

areas in the State of Kerala. The Authority shall have the powers to process all the matters, proposals received, referred to, or placed before it for coastal regulation zone clearance.

The Secretary of, Environment Department is the Chairman and Director, Directorate of Environment & Climate change is the Member Secretary of the Authority. Vide G.O (Ms) No. 145/2016/GAD dated 03-10-2016 and G.O. (Ms) No. 03/2017/Envt dated 01-04-2017, the Kerala Coastal Zone Management Authority (KCZMA) was housed in the Directorate of Environment and Climate Change (DoECC).

As per clause 5 of the S.O. 3903 (E) dated 30-10-2019 of MoEF&CC, the KCZMA shall, for the purposes of protecting and improving the quality of the coastal environment and preventing, abating, and controlling environmental pollution in the Coastal Regulation Zone areas in the State of Kerala, take the following measures, namely: —

(i) The Authority shall, after receiving the application for approval of project proposal, examine the same if it is in accordance with the approved Coastal Zone Management Plan and within the requirements of the Coastal Regulation Zone notification issued by the Government of India in the erstwhile Ministry of Environment and Forests and published vide number S.O.19(E), dated 6th January 2011 (hereinafter referred to as the said notification), and make recommendations for approval of such project to the concerned authority, as specified in the said notification, within a period of sixty days from the date of receipt of such application;
(ii) The Authority shall regulate all developmental activities in the Coastal Regulation Zone areas as specified in the said notification;
(iii) The Authority shall be responsible for enforcing and monitoring the provisions of the said notification;
(iv) The Authority shall examine the proposals received from the State Government for changes or modifications in the classification of Coastal Regulation Zone areas and in the Coastal Zone Management Plan (CZMP) and make specific recommendations thereon, to the National Coastal Zone Management Authority;
(v) The Authority shall inquire into cases of alleged violation of the provisions of the said Act or the rules made thereunder; and review the cases involving violations or contraventions of the provisions of the said Act and the Rules made thereunder;
(vi) Yhe Authority shall inquire or review cases of violations or contraventions of the said notification suo-moto, or on the basis of a complaint made by any individual or body or organization;
(vii) The Authority is authorized to file complaints under section 19 of the said Act;
(viii) The Authority shall take such action as may be required under section 10 of the said Act, to verify the facts of the cases before it.

STATE WETLAND AUTHORITY, KERALA (SWAK) (State Plan)

Vide G.O.(Ms.) No.14/2017/Envt. dt. 28-12-2017], as per section 5(1) of the new Wetlands (Conservation & Management) Rules 2017, State Government has reconstituted State Wetland Authority Kerala and designated Hon'ble Minister for Environment as Chairman, the Chief Secretary to Government as Vice-Chairperson and the Director, Directorate of

Environment and Climate Change as the Member Secretary for the total conservation, rejuvenation, and management of wetlands in accordance with the principle of 'wise use'.

The following activities are to be carried out from the state plan.

- To perform activity-oriented programs on the restoration/rejuvenation of the wetland ecosystem.
- To study various aspects of wetland restoration and generating a baseline database through periodic and continuous wetland monitoring and surveillance.
- For regular functioning of SWAK which includes purchase/procurement of scientific equipment including a mobile wetland monitoring and surveillance unit and other IT infrastructures, computers, stationery, the salary of the staff, vehicles, sampling boat expense for convening the meetings, field survey, expenditure and allied activities for the functioning of all Project Management Units set up as part of the implementation of the approved Management Action Plans (MAPs) for Vembanad, Ashtamudi, and Sasthamkotta Ramsar wetlands and for the preparation of brief documents & MAPs of those wetlands which will be notified in the meantime, etc. The budgeted amount will be used for infrastructure development including office building, setting up of lab, furniture, acquisition of land data, etc.
- To undertake various awareness activities/workshops and research projects for the conservation and management of wetlands.
- To carry out the provisions of the post monitoring on violations against Wetlands (Conservation & Management) Rules, 2017.
- To implement the Management Action Plans for Restoration and Rejuvenation of at least 180 major wetlands across the state under 100 transformative ideas including the establishment of regular wetland Ecosystem Health Monitoring and Reporting System and Wetland Mitras in Phase I and Phase II program, under National Plan for Conservation of Aquatic Ecosystems (NPCA) Scheme.

STATE WETLAND AUTHORITY, KERALA (SWAK) (40% SS)

The outlay will be utilized for the preparation and implementation of the approved Management Action Plan for the conservation and management of three Ramsar Sites in Kerala – Vembanad Kol, Astamudi, and Sasthamkotta.

KERALA CENTRE FOR INTEGRATED COASTAL ZONE MANAGEMENT (KCICM)

The Ministry of Environment Forest and Climate Change (MOEFCC) Government of India has decided to extend the World Bank-assisted Integrated Coastal Zone Management Project (ICZMP) to the coastal states including Kerala under Phase II. In this regard, the Directorate of Environment and Climate Change (DOECC) has prepared and submitted the Preliminary Project Report (PPR) to MOEFCC with the project cost of Rs. 280 Crore. The MOEFCC awarded the project with the financial outlay into 50 percent World Bank Share (Rs.140 Cr.), 30 percent Government of India share (Rs.84 Cr.), and 20 percent State Government share (Rs.56 Cr.). The implementation project duration is four years, and the Kerala Centre for Integrated Coastal Management (KCICM) is the State Project

Monitoring Unit registered under Travancore-Cochin charitable society. At present, the KCICM is functioning in the premises of the Directorate of Environment and Climate Change. The activities envisaged under ICZMP are proposed to be implemented during this plan period.

NEW SCHEMES PROPOSED IN THE 14TH FIVE YEAR PLAN

Integrated Coastal Zone Management

Envisages the development and management plans for coastal zones that are integrated with environmental and social goals and are developed with the participation of coastal communities. The goal is to preserve, protect, develop, enhance, and restore where possible, the coastal resources. Major objectives include:

- Monitoring and abatement of coastal and marine pollution.
- Shoreline Change Assessment
- Conservation of Coastal and Marine Bio-resources
- Protection of ecologically sensitive areas like mangroves, mud flats, etc
- Improving the lives of coastal communities
- Resilient measures for mitigating impacts of climate change and high-intensity cyclones
- To balance development with conservation of the coastal environment

Kerala Centre For Integrated Coastal Zone Management (KCICM)

Proposed Activities

The location of the project identified is based on the concept of sediment cell and it covers 175km length of four Malabar districts namely, Kasaragod, Kannur, Kozhikode, and Malappuram. The lists of proposed activities are given theme-wise as follows.

Conservation of Coastal and Marine Bio-resources. Though the approach of ICZM proposed herein is not entirely an ecosystem-based one, an optimal balance between the ecosystem and activities targeted towards social and economic development is of utmost importance. Therefore, ecological conservation measures are proposed for enhancing environmental health. The sub-components of the theme are mentioned below:

Sub-Components:

- Community based Afforestation/ Restoration of mangroves
- Conservation of marine turtles and other marine animals
- Restoration of migratory pathways and other biodiversity habitats
- Marine Biodiversity Inventory
- Conservation of sacred groves
- Restoration of natural flow/water circulation of coastal wetlands
- Bio-shield for shore protection/shore stabilization
- Restoration of coastal wetlands - De-weeding and de-siltation
- Watershed management
- Conservation of cultural practices, historical monuments, traditional arts, rituals, folks, etc.
- Advanced technologies for shore and coastal wetland monitoring

Coastal pollution abatement and related infrastructure upgrade. Abatement of the pollution of coastal areas and marine waters is fundamental to ICZM principles. Therefore, steps towards ameliorating pollution are of prime importance in any ICZM activities. The summarized activities under this theme are proposed below:

Sub-Components:

- Removal of marine litter / Ghost nets
- Zero Waste Discharge – Septage and sewage treatment facilities
- Wealth from Wastes – Solid Waste Management
- Monitoring – Coastal Wetland Health Card

Livelihood Security of Coastal Communities. Sustainable resource development for livelihood improvement is proposed to be achieved mainly through wetland agriculture, fisheries development, and ecotourism activities. The economic utilization of vegetation, wetland fishes, and micro-enterprise development based on a value-added wetland product is an important factor for the community upliftment of the wetland system in the area. This can focus on poverty reduction through sustainable development. Towards realizing the specific activity, the list of sub-components are given below;

Sub-Components:

- Alternate livelihood for coastal communities
- Promotion of climate-resilient integrated farming and sustainable fisheries
- Mussel cultivation, sea-weed farming, and processing
- Provision of safe drinking water facilities
- Development of Responsible Tourism

Capacity Building and Implementation of ICZMP. The implementation and enforcement level of environmental rules and regulations in Kerala, especially in the most fragile coastal stretches, is not commensurable with the high level of environmental awareness and strong local governments, developed with resource and administrative powers. This is mainly due to poor integration of sectoral departments, lack of capacity building efforts and inadequate handholding support to the local governments. Therefore, it is necessary to ensure better integration of developmental efforts in different sectors enhancing the synergy of different activities. The sub activities involved to achieve the theme are summarized below:

Sub-Components:

- Establishment of KCICM – the State Project Management Unit (SPMU)
- Establishment of Capacity Building Training Centre
- Preparation of Detailed Project Report (DPR)
- Preparation of ICZM Plan for the State
- Training and capacity building of the Project Executing Agencies
- Improving education facilities in coastal areas
- Data collection, analysis and interpretation, dissemination via. print, audio-visual, internet, etc.
- Training programs, seminars, workshops, on conservation, sustainable way living,

climate change adaptation, pollution etc.

- Empowering Biodiversity Management Committee (BMC), Bhoomithrasena Clubs for conservation and sustainable utilization of marine bio-resources
- Adapting to Climate Change and disaster management – Study and Installation of Tidal Measuring Instruments (Automatic) and Providing Cyclone Mitigation Shelters
- Consultancy, Internal Audit, QC & QA
- Monitoring and Evaluation

Expected outcome

ICZM benefits are: reducing damages/impacts; mitigating pollution and resource overexploitation problems; enhancing coastal zone outputs; and preserving unique coastal ecosystems. More specifically, the benefits include reducing damages from coastal storms, hurricanes, shoreline erosion, salinity intrusion, excessive withdrawals from groundwater aquifers, sedimentation in navigable channels and harbors, breeding areas for vector-borne diseases, overexploitation of fish species. However, specifically as per the envisaged activities, the outcomes will be realized as follows;

1. To contribute towards capacity building of coastal communities/local inhabitants to manage coastal zone in an integrated manner.
2. Increased livelihood opportunities of the coastal communities/local inhabitants; and
3. Overall socio-economic development of the coastal communities/local inhabitants for sustainable management of coastal resources.
4. Environmental Awareness
5. Envisages environmental sensitization at all levels to raise awareness on major environmental issues in order to promote good practices and conservation and protection of resources.
6. Expansion of BhooMithrasena Clubs (BMCs) to all colleges and schools (both public and private) in the State.
7. Bring together the existing eco-clubs at the lower school level under the umbrella of this BhooMithrsena Clubs.
8. Recommends the extension of grace marks for the BhooMithrasena Club members akin to NSS, SPC, etc.
9. Incentivizing low-carbon initiatives and good adaptation practices
10. Empowering local bodies to address the environmental issues in their local level decision making, planning process, execution, and implementation of statutory regulations.

ENVIRONMENTAL RESEARCH & DEVELOPMENT

Environmental Knowledge Management & Decision Support System

In environmental governance, a robust decision support system is largely limited due to data insufficiency, unreliability, redundancy, obsolete data, accessibility, and usability. The solution is to have a State-Wide Database Management System established at the Government level, which will act as a common repository mandated by government orders/ statutes. This will ensure a full-fledged and scientifically managed Environmental Knowledge Management & Decision Support System.

CLIMATE CHANGE

Strengthening of State Climate Change Cell

There must be concerted efforts to strengthen the State Climate Change Cell as outlined earlier.

WETLAND MANAGEMENT

Preparation & implementation of Integrated Management Plans of major wetlands in Kerala

Integrated Management Plans (IMPs) are necessary to ensure the effective conservation and management of the wetlands in the State. The implementation of IMPs will be through the CSS-scheme National Plan for Conservation of Aquatic Ecosystems (NPCA)

Declaration of more wetlands as Ramsar wetlands of international importance

There are many more wetlands in the State which meet at least any one of the nine Ramsar criteria, so efforts should be made to designate more wetlands in the State as wetlands of international importance under the Ramsar Convention. This will lead to effective management of those wetlands and pave way for tapping international funding sources.

A wetland-specific local/regional governance cum supervisory body and a project management unit (PMU) in place in all the three Ramsar wetlands selected for implementing the Integrated Management Plans (imps) in the state. Technical staff with wetland ecosystem expertise & experience will be recruited in all the PMUs to carry out continuous operational Wetland Inventory Analysis and Monitoring (WIAMS).

Major Recommendations- Critical Gaps to be Addressed

- In the absence of regional or district-level offices, the directorate is depending on other departments/agencies to implement different schemes/projects. This is a constraint for effective implementation and monitoring of sanctioned projects and compliance of various environment related acts and rules.
- Expand Bhoo Mithra sena Clubs (BMCs) to all colleges and schools (both public and private) in the State and bring the existing eco-clubs at the lower school level under the umbrella of this Bhoo Mithra sena Clubs for better coordination and implementation.
- The existing limited technical staff is rendering their services for the functioning of other Statutory Authorities associated with the Environment Department such as KCZMA, SEIAA, SWAK, etc. This also affects the proper implementation and monitoring of the plan schemes. In this context, strengthening the Directorate by establishing regional / district level offices and increasing the existing staff strength is highly essential.
- The SAPCC revision should be completed in a time-bound manner with extensive stakeholder consultation and participation with the inclusion of specific sector-wise action-oriented items.
- The Institute for Climate Change Studies (ICCS) functioning under KSCSTE should be strengthened with a clear action plan on research priorities. The Institute must also be the coordinating center in providing the appropriate knowledge inputs periodically to the Directorate of Environment and Climate Change in carrying out specific tasks,

schemes, and programs, relating particularly to climate change. Since the matter of Climate change is dealt with by the Environment department ICCS should be brought under the Environment department for better coordination.

- The Directorate of Environment and Climate Change and the Institute for Climate Change Studies could together develop a knowledge portal for effective data sharing on issues related to climate change and hydro-meteorological disasters.
- NAFCC Project for Promotion of Integrated farming Systems of Kaippad and Pokkali coastal wetlands, a climate change adaptation project was successfully implemented in the coastal districts of Kerala. More such projects under national and global adaptation funding mechanisms like Green Climate Fund (GCF) should be implemented.
- Absence of a robust Decision Support System – Informed decision-making in environmental governance in the State is largely limited due to - data insufficiency, unreliability, redundancy, obsolete data, accessibility, and usability. The solution is to have a State-Wide Data Base Management System (DBMS) established at the Government level, which will act as a common repository mandated by government orders/ statutes. This will ensure a full-fledged and scientifically managed Environmental Knowledge Management & Decision Support System. The ENVIS is to be strengthened and updated so that it will act as a Decision support system for Government.
- The management action plans of all the Ramsar sites are to be updated and implemented by forming wetland level Management authorities.

Coastal Zone Management

- The Kerala Centre for Integrated Coastal Management (KCICM) should be strengthened for effective monitoring of shoreline changes and implementation of Coastal protection measures and Livelihood improvement activities.
- Expertise in ecosystem-based climate adaptations especially in coastal management has to be developed in DoECC with regular training, laboratory facilities, and appropriate manpower. The DoECC has to develop facilities and expertise for imparting training to Irrigation, harbor engineering, and other such departments in the above subjects. Support may be arranged from institutions like IISc, NCSCM, NCCR, KFRI, and Universities in the State.
- Regional Coastal Process Study for the Kerala coast following sediment cell concept may be undertaken which will help to have a detailed database on coastal processes required for coastal management (it includes near-shore bathymetry, waves, and breaker waves, currents, shoreline orientation, wind, sediment characteristics, beach characteristics, sediment inflow, etc).
- Mapping of coastal morphology including beach availability and coastal ecosystems may be taken up to plan ecosystem-based solutions. There has to be a realistic mapping of the coast demarcating vulnerable coastal stretches, coast with sufficient beach width, the coast where the beach is gradually depleting, mudbank coasts, etc.
- As envisaged in the Coastal Regulation Zone Notification and Coastal Zone Management Plan (CZMP) of the State, beach management plans to conserve existing beaches may be prepared and implemented to sustain sufficient beaches for the forces

of waves to act upon. These plans may consider the planting of vegetation and the development of artificial dunes based on scientific recommendations. This will help to conserve existing beaches to make these coasts safe from erosion in the future.

- Mapping and monitoring of mudbanks regularly for their occurrence, non-occurrence, and movement/migration. Mudbanks is a major influencing factor for coastal erosion north of the Kayamkulam tidal inlet.
- Identify locations suited for soft measures for coastal protection through institutions like Kerala Forest Research Institute (KFRI).
- Local bodies may be empowered to monitor beach state, the status of coastal protection structure, and the status of erosion regularly.
- Settlement plans may be prepared and implemented for coastal fishing villages considering their long-term housing and other needs with provisions for basic services including sanitation, safety, and disaster preparedness as envisaged in CRZ notification. A settlement plan has to be prepared with identified parameters taking into account the stock assessment survey and need assessment survey. This will considerably reduce the impact of erosion.
- Tidal inlet management plans for seasonal inlets with sand bars and modified inlets with harbours may be prepared and implemented.
- Assessment of functional and structural performance of the existing coastal protection measures may be carried out since this has not been done through the construction of coastal protection measures are going on for the last 65 years. This has to be done for learning from experiences, failures, and successes and not to repeat mistakes.
- An inventory may be made on the sustainable availability of materials suited for coastal protection measures like granite, sand, and other alternate materials. Environmental impacts of extraction of rocks, sand, and other materials may be assessed.
- Coastal cliffs of north Kerala are more stable than that of south Kerala due to the differences in lithology. There are cliffs with frontal beaches and those directly fronting the sea. Cliff management plans considering the differences in nature of lithology, structures, recession agents acting upon the cliff and land use may be prepared with recommendations for cliff stabilization and land use in identified areas.
- Coastal flooding due to wave overtopping coastal protection structures and those in wide accreted beaches must be mapped. Land use and drainage mapping followed with land use and drainage management plans are to be prepared for addressing the issue.
- There are many barrier systems along the Kerala coast where the land is sandwiched between the sea and backwaters. In such areas, the backwater side may be stabilized with mangrove plantations along the banks so that squeezing of space could be reduced.

Beach Management

- Regular Sand By-passing: Bringing back the accreted sand to eroded beaches. This is being successfully implemented in Pondicherry. This was also suggested as a remedial measure by CWPRS Pune, to prevent erosion at Anjengo coast in Trivandrum due to construction of Muthalapozhi fishing harbour.
- Artificial nourishment of Beaches: Dredged material to be exclusively used for

restoration of eroded beaches. Both capital and maintenance dredging is being carried at almost all ports during construction and after when affected with siltation. However, the dredged sand/sediments are either sold or used for reclamation of new areas. In future it should be made mandatory that, wherever dredging is done the dredged material should be used only for restoration of lost beaches (Chellanam in Kochi and Vizhinjam

- Coastal vegetation cover: This is already being implemented by Forest Department. However, these are done mostly in accreted beaches and serious efforts and experiments need to be done on what is possible in eroding beaches. Mangrove plantation wherever possible should also be tried.
- Campaign to 'bring back our lost beaches': A campaign is required with coastal communities as well as public to highlight the important role played by the beaches. Educational materials be prepared in simple language, explaining the coastal processes, sediment transports, causes of erosion etc and educational institutions and NGOs be involved in this campaign.

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)

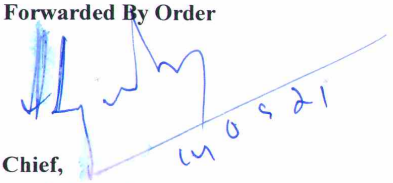
1. The non-official members (and invitees) of the Working Group will be entitled to travelling allowances as per existing government norms. The Class I Officers of GoI will be entitled to travelling allowances as per rules if reimbursement is not allowed from Departments.

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