

F. No. 4-1/2018-RE  
MINISTRY OF ENVIRONMENT, FOREST & CLIMATE CHANGE  
(RE Division)

**Minutes of the Third Meeting of Steering Committee on R&D Scheme to consider R&D projects of XIth and XIIth Five-Year Plans held on 30<sup>th</sup> August, 2018 at Indira Paryavaran Bhawan, New Delhi**

1. The Third meeting of the Steering Committee on R&D Scheme was held on **30<sup>th</sup> August, 2018** at Indira Paryavaran Bhawan, Jor Bagh, New Delhi to consider R&D projects funded in XIth and XIIth Five-Year Plans. The list of participants is at **Annexure-1**.

**2. Confirmation of Minutes of 2nd Meeting of Steering Committee**

The approved minutes of the Second Meeting of Steering Committee held on 18.07.2018 were circulated to the Committee members and were confirmed.

3. Dr. T. Chandini, Advisor welcoming the members of the Committee and participants, informed that the agenda includes review of Final Technical Reports (FTRs) of 12 R&D projects completed during the XIth/XIIth Five-Year Plan and Annual Progress Reports (APRs) of 9 ongoing projects of XIIth Five-Year Plan under the R&D Scheme which ended on 31<sup>st</sup> March 2017. The PIs were requested to briefly present the Final Technical Report (FTR)/Annual Progress Report (APR) of their projects in terms of the broad objectives, the major findings/outputs and outcome thereof etc. In addition, the FTRs of XIth Plan of 3 PIs who could not attend the 1<sup>st</sup>/2<sup>nd</sup> meeting were also included for consideration. Projects listed at S.Nos. 2, 10 & 19 were not considered as PIs did not attend the meeting. Thus, of a total of 24 projects listed at **Annexure-2**, 21 projects were considered in the meeting.

4.0 The projects were considered thematic area-wise:

4.1 **“Machining and Erosion studies of Red mud an Industrial waste based Polymer matrix Composite”** of Dr. M. Uthayakumar, Department of Mechanical Engineering, Kalasalingam University, Virudhnagar (F.No. 19-20/2012-RE)

Project Details: This is an on-going project started on 20<sup>th</sup> May, 2016 for a period of 3 years with a total cost of Rs. 27,00,000/-. The tenure of the project will be over in 19<sup>th</sup> May, 2019. A total of Rs 21,38,400/- has been released so far out of approved project cost of Rs 27,00,000/-. Audited Utilization Certificate, Expenditure Statement, GFR 12, GFR 19, proforma of assets and Annual Progress Report for the FY 2017-18 have been received.

Objectives:

- i. To fabricate natural fibre reinforced composites filled with red mud particulate,
- ii. To investigate the reinforcement effect of natural fibre filled with red mud particulate in thermosetting (General Purpose & Phenolic resin) matrix through various mechanical properties tests such as Tensile, Bending, Shear and Impact strength,
- iii. To study the effects of surface modification of natural fibre filled with red mud particulate on mechanical properties and to carry out studies on fibre matrix interactions,

- iv. To study the effects of basalt scale fibres filled with red mud particulate on mechanical properties, to conduct drilling studies and the erosion study on the produced composite materials,
- v. To compare the mechanical properties of different natural fibre composites filled with red mud particulate, and
- vi. To determine the effects of environmental exposure on natural fibre composites filled with red mud particulate behaviour.

PI made a presentation on the progress of the study. It was stated that 80% of fabrication was finished, Mechanical test was performed on sisal red mud composites and for remaining composites mechanical testing is going on, Erosion study is finished for fabricated composites, Abrasive water jet machining was performed and analysed on 20% red mud and 30% sisal fibre reinforced composite and Water absorption test was conducted on sisal red mud composites.

The major findings of the study are:

- Filled composite with 10% red mud addition showed better water resistance than the unfilled composite which has 20%, 25% and 8% reduction in water absorption when compared to unfilled composite at distilled, normal and sea water respectively.
- Composite with 20% and 30% red mud percentage increases the water intake.
- Analysis on the water absorption tested specimens revealed the development of cracks in the matrix surface and fibre delamination and damage. Prolonged immersion in water caused separation of fibre layers.

Based on the experimental result and findings it is recommended that the polymer composite with 10% red mud can be used in composite structures in aquatic application.

Further Work to be done in the balance period of study:

- Erosion and mechanical test will be completed by December 2018 and analysed for selecting better performing combination.
- From result analysis, a new set of specimen is planned to be fabricated for conducting drilling and water jet cutting study.

The Committee agreed to the completion of the balance activities to be undertaken, however this may be completed by March 2019 and FTR submitted by April 2019. The Committee requested the PI to analyse the water for heavy metals wherein the material was dipped. The Committee stated that Redmud being a hazardous waste, its use may require prior approval of SPCB/CPCB/MoEFCC. The Committee desired that details of DBT which require to be uploaded regularly every month since April 2018 on the Bharat Portal/DBT App for the project to be done expeditiously by the PI for further release of funds/settlement of dues at the closing stage.

- 4.2 **“Remediation of Ground Water Contaminated with Hexavalent Chromium in Sukinda Valley, Odisha, Using Nano Zero Valent Iron (n-ZVI) Technology”** by Dr. Alok Sinha, Centre of Mining Environment, Indian School of Mines, Dhanbad (F.No. 19-79/2013-RE).

Project Details: The project was started on 3<sup>rd</sup> March, 2017 for a period of 2 years with a total cost of Rs. 24,80,800/-. The tenure of the project will be over in 2<sup>nd</sup> March, 2019. A total of Rs 17,12,320/- has been released so far out of approved project cost of Rs

24,80,800/-. The PI has forwarded Utilization Certificate, Expenditure Statement, GFR 12 and Annual Progress Report for the FY 2017-18 by post, which is under examination.

PI was requested to present the Annual Progress Report before the Committee but has however not attended the meeting. It was decided that further release to the project will be made only after consideration of the APRs, and examination of documents such as UCs, ES, and data under DBT required to be uploaded on the DBT Bharat Portal/DBT App every month since April 2018.

**4.3 “Impact of Environmental Bio-aerosol Pollution on Human Health: A “case-control study” for Exacerbation of Chronic Obstructive Pulmonary Disease (COPD) in North Indian Population” of Dr. Chirashree Ghosh, Department of Environmental Studies, University of Delhi, Delhi (F.No. 19-56/2013-RE)**

Project Details: This is an on-going project started on 1<sup>st</sup> November, 2015 for a period of 3 years with a total cost of Rs. 37,72,216/-. The tenure of the project’s term will be over on 30<sup>th</sup> October, 2018. A total of Rs. 31,06,644/- has been released so far out of approved project cost of Rs 37,72,216/-. Original documents such as UC, ES are awaited. In addition, information on DBT related data is also awaited.

Objectives: The objective of the approved project is to establish relationship between environmental pollutant Bio-aerosol exposure and exacerbation of Chronic Obstructive Pulmonary Disease (COPD), to analyze and categorize the concentration of different fractions of Bio-aerosol in indoor and outdoor environment and conduct epidemiological study to evaluate respiratory dysfunction with reference to bioaerosol exposure and development of COPD etc.

PI made a presentation on the progress of the study. It was clarified that the population studies were restricted to NCT Delhi. PI obtained clearance during 2015-16 for collecting human samples from GTB Hospital & UCMS Institutional Ethical Committee (IEC), to get the access for indoor Bio-aerosol environmental monitoring and recruitment of staff. This study was undertaken in three Socio-Economic Zones namely SEZ-I (Low), SEZ-II (Mid) and SEZ-III (High). Different sites based on different land-use configuration such as dumping site, commercial site, University health Centre, University library, Patel Chest Respiratory Hospital and life style attributes were selected and on that basis, two experimental modules (outdoor and Indoor) were prepared.

Major findings of the study carried out so far:

- (i) Land use pattern has a bearing on the microbial dynamics.
- (ii) Seasonal trends varied with the local micro-climate.
- (iii) There are various potential season dependent factors (other than meteorological parameters) which affect the microbial count at each site.
- (iv) Outdoor as well as indoor microbial counts showed a similar seasonal pattern in all SEZs i.e., lowest in pre-monsoon season.
- (v) The indoor microbial count was influenced by outdoor microbial count across all SEZs, despite the use of different ventilation systems.

Other findings include:

1. Aerosolised microbial count at diverse residential areas majorly depends on build-up in environment.
2. COPD exacerbation episodes increase with fall in temperature.
3. COPD exacerbation episodes increase with increased bacterial counts.
4. No linear relationship was established with Relative Humidity and Fungi.

The PI informed that as approval for purchase of two major equipment Bio-aerosol cascade Impactor & Multimode ELISA Reader was not received from the Ministry, the project work was delayed during past two years could not be completed in time. PI sought ex-post facto approval for purchase of bioaerosol cascade Impactor in 2017 and approval for purchase of alternate equipment - multimode reader, spectrophotometer Nanodrop facilities.

The allotted budget under manpower head hasn't been exhausted fully as on date due to late joining of research assistant (since April, 2018). The tenure of project was for 3 years (from November 1<sup>st</sup>, 2015 to 30<sup>th</sup> October, 2018). The PI sought extension of project by five more months i.e from 1st November, 2018 to 31<sup>st</sup> March, 2019 for completion of the project and submission of FTR with no extra fund to complete the following:

- (i) Continuation of site specific regular Bio-aerosol monitoring along with OPD patient follow-up specifically tagged confirmed COPD patient.
- (ii) Conducted site specific survey for generating primary data base for epidemiological study (to evaluate respiratory dysfunction).
- (iii) Continuation of genomic DNA extraction, RNA extraction and preparation of samples.
- (iv) Specific primers for RAPD (Random Amplification of Polymorphic DNA) method and for Investigation of serum cytokine level through ELISA (Enzyme-linked immune sorbent assay) method is undergoing.

The Committee after discussions agreed to the above. The Committee desired to know the composition of bioaerosols (fungi and bacteria) found in PM10 and PM2.5 in the geographical of study. The Committee requested PI to furnish documents such as APR for 2017-2018 to be sent to Ministry at the earliest and for updation/uploading of month-wise data on DBT Bharat Portal/DBT App.

#### 4.4 **“STREAT- Sustainable Semi-Dcentralized Sewage Treatment- Wastewater Reuse, Nutrient Recovery and Biogas production in the Delhi Metropolitan Area”** of Dr. Mukesh Khare, IIT, New Delhi (F.No. 19-29/2011-RE)

Project Details: The project was started on 16.04.2012 for a period of 3 years with a total cost of Rs. 21,52,800/-. Project tenure was over on 15.04.2015. A total of Rs 10,75,250/- has been released so far out of the total approved project cost of Rs. 21,52,800/-.

Objectives: The objective of the approved project was to introduce a technology for treatment of municipal wastewater in a decentralised manner, instead of sending to a STP through extensive sewerage network and pipelines which are cost intensive. **Rotating biological contactor or RBC** is a biological treatment process used in the treatment of wastewater following primary treatment. The already compact RBC can be obtained as a modified module by systematic extension, such as micro filter and disc membrane. All three units will work with a driving motor on one shaft, and thereby may not require any further treatment for N- and P- elimination- that N and P can be reclaimed with locally available additives.

Co-PI of the project made a presentation.

#### Objectives of the project:

- Development of RBC as a decentralised option for treatment of sewage.
- Treatment of the post-RBC effluent for removal of pathogens and recovery of P so as to make it suitable for irrigation purpose.
- Anaerobic digestion of the sewage sludge mixed with other locally available organic solids so as to recover energy with simultaneous use of the digested solids as biofertilizer.

Major findings of the study:

- The laboratory scale study gave a promising result proving decentralized systems such as RBCs are in the long run cost efficient as well as environmentally sustainable sewage treatment technology. The need of the hour is on-site wastewater treatment, RBC is the best viable option.
- Ozonation proved to be an efficient disinfection technology. The pathogen count were negligible.
- Phosphorus recovery using lime is an answer for exporting phosphatic fertilizers in India. The way-old technology of precipitation proves efficient and cost effective.
- Anaerobically digesting the sludge from RBC makes the system self-sufficient.

The Committee desired that a summary table be prepared giving comparison of the conventional wastewater treatment technology vis-a-vis this technology developed on three issues: (i) Efficiency in terms of treatment of the wastewater in terms of physico-chemical characteristics (parameters) of the input (wastewater) and output (treated water) and how they compare with ISI standards, (ii) Cost of treatment per litre or MGD including feasible scale of operation (maximum and minimum), (iii) long-term use of technology (sustainability) in terms of O&M. The MoEFCC could forward the details of the technology for pilot-scale and wider use thereafter in specialised Missions and Programmes such as National River Conservation Programme (NRCP), Namame Gange Scheme of MoWR&GR, Swatchh Bharat Mission of Department of Drinking Water, M/o Rural Development, Smart Cities Programme of M/o Urban Development, and State Governments such as Govt of NCT of Delhi, Administration of A&N Islands, Lakshwadeep Island, etc. Copy of the FTR may also be forwarded to CPCB for their comments.

The Committee requested the PI to furnish pending documents such as consolidated audited UC, ES, photographs of permanent equipment, Bills & Invoices of Permanent Equipment, balance 8 pending UCs of IIT, Delhi for settling the balance amount/dues by the Ministry. In addition, 10 copies of FTR may also be provided for circulation by MoEFCC to the Ministries/Departments as given above.

4.5 **“Some Mathematical Model for Pollutant Uptake in Plants”** of Prof. Arun Kumar, Government College, Kota (F.No. 19-20/2007-RE)

Project Details: The project of XIth Plan was started on 1<sup>st</sup> December, 2008 for a period of 3 years for a total cost of Rs. 7,22,085/-. The tenure of the project was over on 30<sup>th</sup> November, 2011. A total of Rs 5,57,600/- has been released so far out of approved project cost of Rs 7,22,085/-The FTR has been accepted in 6<sup>th</sup> Meeting of PAC on 13-14<sup>th</sup> June, 2013, however, no details of Outcome-Outputs are available. 5 copies of FTR and Executive Summary have been received.

Objectives: The objective of the approved project was to deals with the mathematical modeling of pollutant (Water) uptake by plant roots. The model will be treated with a matched asymptotic expansion and an analytic formula for the rate of pollutant uptake. Then this basic model will be extended to include root hairs and mycorrhizae, which have been found experimentally to be very important for the uptake of immobile nutrients and pollutants. This model will direct to build a model for water movement and uptake by branched root structures. Model for simultaneous movement and uptake of both pollutants and water also. This will be derived as a new tool for interpreting available experimental

results and designating future experimental results and designing future experiments. The parallels between evolution and mathematical optimization will also be discussed.

PI made a presentation on the outcome of the study. It was stated that the study will be helpful in estimation of pollutant contents in plants, Optimization of nutrient contents and minimization of pollutant, Development of model for uptake with roots and pollutant competition, Model for pollutant uptake by multiple root branching structure including Mycorrhizae etc. Presentation of the project given by PI is as follows:

Outcome of the study:

- (i) Developed model for uptake pollutant for different uptake parameters by a single cylindrical root in an infinite extent of soil.
- (ii) Normalized Concentration profile was derived and plotted for different uptake parameters.
- (iii) Validation of theoretical models by comparison with experimental evidence.
- (iv) Comparison between theory and experiments has been made.
- (v) Presented model is able to explain previously unresolved discrepancies between experiments and theory.
- (vi) A modelling framework is derived for calculating the pollutant uptake by realistic plant root networks.
- (vii) In this research it is shown that how to go from small cylindrical root scale to the larger root branching structure scale
- (viii) Both analytical and numerical methods to solve the model equation have been made.
- (ix) Experimental observations have shown that water and pollutant uptake is often inter-related

The research work will be helpful in:

- Estimation of pollutant contents/uptake in plants.
- Optimization of nutrient contents and minimization of pollutant.
- Development of model for uptake with roots and pollutants competition
- Model for pollutant uptake including by Mycorrhizae.
- Identification of bio-indicator plants.
- Estimation of fertilizer requirement at any point of time and at any stage of plant growth
- Deciding the fate of pollutant (rate of decomposition of ions)
- Model for pollutant uptake in plants for different Lithospheric conditions
- Pollutant removal techniques.
- Model for mining the heavy metals through plants.

The Committee after deliberations desired that technology evolved under the project could be used by other scientists for studying pollution uptake in different ecosystems as stated above. The Report could also be forwarded to Institutions involved in pollution reduction in natural waters/wetlands, etc. In this regard, PI stated that the Model has successfully been used by another scientist in estimating pollutant uptake in his study. The Committee requested the PI to furnish the Consolidated audited Utilisation Certificate and Expenditure Statement urgently for final settlement of dues.

**4.6 “Impact of cell-phone technology on selected plants and animals”** of Dr. R.K. Kohli, Professor, Centre for Environment and Vocational Studies, Punjab University, Chandigarh (F.No. 14/28/2008-ERS/RE)

Project Details: The project was started on 1<sup>st</sup> November, 2010 for a period of 3 years with a total cost of Rs. 23,20,269/-. Project tenure was over on 31<sup>st</sup> October, 2013. A total of Rs 19,41,415/- has been released so far out of the total approved project cost of Rs.

23,20,269/-. FTR was accepted by Apex committee in its 5<sup>th</sup> meeting held on 20.08.2014, however details of major findings and outputs-outcome of the project are not given. PI has informed that he will submit audited Utilization Certificate and Expenditure Statement for final settlement, if required. Demand draft of unspent amount is awaited. FTR has been submitted.

PI gave a presentation.

Objectives: The objective of the approved project was to assess the quantum of **electric and magnetic field radiation (EMF-r)** of the range of mobile telephony and to assess, if the EMF-r of the cell phone intensity has any impact on plant and animal systems and if so, what could be the possible mechanism of action. The study was undertaken in the light of increasing awareness among the public on impacts of cell phone radiation one hand and enhanced demand and use of the technology on the other. Expertise of Zoology Department was utilised in regard to study of impacts on insects, rats, etc.

PI made a presentation on the outcome of the study. It was stated that there is very little scientific information/data available on the impact of EMF-r of the cell phone range is available in literature. Whatsoever known is related to EM-field generated from high tension wires. The study was carried out in 55 sectors of Chandigarh City, industrial areas 1 and 2 villages in the urban & rural Chandigarh in order to assess emf-r cloud. The study assessed the density of cell-phone towers in the city, the average power density of the emf-r cloud in the city and change in the number & location of the towers as also that of power density of the emf-radiations. It was informed that the number of towers has increased from 335 in September 2009 to 465 in September 2012. The range of Power Density ( $\mu\text{w}/\text{m}^2$ ) also increased from <1000-47640 to 5.6-13620 during this period.

The following parameters were studied in plants:

- Growth studies in crop & wild plants (*P. aureus*, *A. thaliana*, *Z. mays*, *T. aestivum* and *C. occidentalis*)
- Photochemical efficiency & transpiration rate.
- Effect on oxidative stress markers and antioxidant defence enzymes.
- Effect on starch metabolism enzymes (Acid invertases, Alkaline invertases, acid phosphatases, alkaline phosphatases, starch phosphorylases and  $\alpha$ - $\beta$  amylases).
- Histochemical detection of lipid peroxidation, loss of plasma membrane integrity, superoxide anion and hydrogen peroxide.
- Mitotic index, Aberration (%) in *A. cepa* and DNA damage studies in *A. cepa* and *Z.mays*.

The following parameters were studied in animals:

- Growth and Behavioural studies: Body weight, locomotor activities, closed arm entries and open arm entries to check stress and anxiety level in Rats.
- Brain marker enzymes Acetylcholinesterase and Monoamine oxide activity
- Effect on Antioxidant defence enzymes: Glutathione reductase, glutathione-s - transferase, catalase and superoxide dismutase, total glutathione, reduced glutathione of cerebellum of rats.
- Densitometric analyses of p53 and  $\beta$  actin protein expressions in cerebellum of rats.

- Honey Bees: Brood area, returning ability to hive and pollen carrying capacity.

The major findings and conclusions/outcome of the study:

- The work indicated harmful impacts of EMF-r of cell-phone range on both plants and animals over long-term exposure.
- Body weight, locomotor activities of rats with long-term exposure was affected.
- Development of early-stage chick embryos was also found to be reduced and showed increased mortality.
- Returning ability of bees hives, pollen carrying capacity, etc was also impacted.
- Anxiety and stress-like behaviour was noted in lab animals which were tested for long-term exposure.
- The study recommended the use of mobiles in controlled manner.
- The results from this study will form a strong scientific base in decision making while formulating policies related to cell-phone towers, its emission limits and cell-phone usage.

The Committee was informed that the findings had been shared with Department of Telecom (MEIT), GOI and with telecom operators. The Committee was of the view that the MoEFCC should forward the Report to the relevant Ministries (MEIT, Health), ICMR and TRAI for appropriate action. PI was requested to furnish consolidated audited Utilization Certificate and Expenditure Statement for final settlement, if required and Demand draft of unspent amount.

4.7 **“A process development for ameliorating alarming environment and health hazardous posed by phthalates in plastic vis chemical, biochemical and bioremediation approaches”** of Dr. Sailas Benjamin, Prof., Biotechnology Division, School of Biosciences, University of Calicut, Thrissur- Calicut Road, Thenhipalam (Kerala) (F.No. 19-62/2005- RE)

Project Details: The project was started on 10<sup>th</sup> March, 2008 for a period of 3 years for a total cost of Rs. 27,16,312/-. The tenure of the project was over on 31.12. 2011. A total of Rs 19,80,577/- has been released so far out of approved project cost of Rs 27,16,312/-. FTR was accepted in 5<sup>th</sup> meeting of Apex committee held on 13-14<sup>th</sup> June, 2013, however details of Output-Outcome are not available in the records.

The ministry had been informed recently by one of the researchers of the project, namely Mr. Sarah Josh M.K. that the PI, Dr. Sailas Benjamin is no more. Mr. Sarah Josh M.K. had also requested the Ministry for settling an amount on balance stipend/fellowship. The matter was taken up by the Ministry with Head, Biotechnology Division, School of Biosciences, University of Calicut.

Dr. Elyas K. K., Head Biotechnology Division of the University participated in the meeting and presented the major findings of the project.

Objectives of the study:

“Phthalates” or phthalic acid esters are major plasticizers – over 30 types. Plasticizers are substances added to plastics to increase their flexibility, transparency, durability and longevity. The manufacturing of plastics often creates large quantities of phthalates Di(2-ethylhexyl)phthalate (DEHP) is the most common in PVC plastics (represent over 90% of all phthalates). DEHP has been shown to be carcinogenic to rodents, and should be considered as a potential carcinogen in humans. It is lipophilic, i.e. it can easily get accumulated in

biological system, DEHP non-covalent interaction and toxic leach out can cause threat to environment and health. DEHP has been shown to be carcinogenic to rodents, and should be considered as a potential carcinogen in humans. Plastics are recycled temporarily – tarring, incineration, brick-making, burning, burying, remolding, etc. All these methods releases phthalate in the environment. The objective of the study was to find an inexpensive method to remediate phthalate for valuable products, thus clean environment. Leaching of DEHP from blood bags (3 brands) studied using various solvents; the blood bag was used as model in this study.

The objective of the approved project was to discover and perfect suitable Bioremediation process, discovery of the biodegradation pathway of the phthalates in plastics using HPLC, NMR and GC-MS techniques, to study leaching out of phthalates from plastic matrix, to study the chemical hydrolysis, to study biodegradation kinetics, chemical conversion of plastics.

#### Findings of the study:

1. Certain bacteria and fungi efficiently degrade diethylhexyl phthalate (DEHP). The study discovered and characterised novel six fungi and seven bacterial cultures which efficiently degrade DEHP in situ and ex situ. These were isolated.
2. *Achromobacter denitrificans* strain SP1, a novel bacterium remediates DEHP in PVC blood bag in to pharmaceutically important drug, the 25-C prodigiosin – a patent has been filed. Esterase, produced by *A. denitrificans* SP1, the crucial enzyme which breaks the ester bond in the phthalate was characterised. *A. denitrificans* SP1, a novel bacterium remediates DEHP in PVC blood bag in to pharmaceutically important drug, the 25-C prodigiosin – patent has been filed.
3. Using mycelial fungi, developed a batch process for the remediation of DEHP in plastics. Isolated *Gordonia rubripertincta* strain BAA1, a novel DEHP utilising bacterium, and elucidated the complete DEHP biodegradation profile. Protocol for the production of industrially-significant esterase from *Gordonia rubripertincta* strain BAA1 was demonstrated.
4. Molecular interactions of commonly used 12 di-phthalates and their mono-phthalates (which impact human health) were investigated with human nuclear/steroid receptors such as hPPARs, hRXRs, hERs, hERRg, hPR, hAR, hGR and hPXR. Most of them are pioneering studies on such interactions.
5. Chemoremediation process involving migration and hydrolysis was established for the DEHP blended in commercial blood bag

Dr.Elyas informed that Prof. Sailas Benjamin had bagged the Best Publication Award of the University of Calicut in 2013 for the article titled, “Mycelial fungi completely remediate di (2-ethylhexyl) phthalate, the hazardous plasticizer in PVC blood storage bag” in Journal of Hazardous Materials (I.F. 6.434, Elsevier). In addition, patents have been filed for the process of biodegrading and bioremediation for reducing phthalates from plastics.

The Committee was of the view that the work carried out under the study for biodegradation of phthalates from plastics was important and the Report should be forwarded to Central Pollution Control Board, New Delhi for their comments, if any and use of the findings.

The Committee appreciated Dr. Elyas K. K., Head Biotechnology Division of the Calicut University for having taken the time and effort in participating in the meeting. The Committee requested Dr. Elyas for his assistance in forwarding details such as an audited consolidated statement of utilisation of funds and expenditure statement, status of patent filed, soft copy of FTR, proof of statement that no fellowship was paid to this Researcher for the period of claim for final settlement of balance payments/dues.

4.8 **“Bryophytes – tool for national multi-elemental atmospheric survey of 100 years”** by Dr. Dinesh Saxena, Dept. of Botany, Bareilly College, Bareilly, UP (F.No. 19-13/2008- RE).

Project Details: The project of XIth Plan was started on 5<sup>th</sup> December, 2009 for a period of 3 years for a total cost of Rs. 29,27,463/-. The tenure of the project was over on 4<sup>th</sup> December, 2012. A total of Rs.26,25,795/- has been released so far out of approved project cost of Rs.29,27,463/-. FTR was accepted, however Outputs-Outcome are not available in records. Final settlement is due.

Objectives: PI made a presentation of the study. He stated that a report of WHO states that 30% reduction in particulate emissions by 2030 would save India \$105 billion in health-related costs; a 10% reduction would save \$24 billion, and policy makers needs mitigation program and that requires present atmospheric load of pollutants and for the same monitoring is pre-required. Mosses were selected for the study as they can retain atmospheric moisture, thus if planted with angiosperm plants, may help encourage their survival. Mosses have tendency to photosynthesize in very low light also, even 1 watt. So, if kept inside the room, these may release oxygen and help reduce indoor pollution.

- The widely common moss species were validated for metal tolerance in field and in lab.
- Results of the present study is on seasonal and annual, distance dependent atmospheric metal load from Uttar Pradesh, Uttarkhand-Kumaon, Garhwal, Himachal, Punjab, North-east part of the country for the bio-monitoring programme.
- An attempt was also made to retrieve past atmospheric metal load as well as % change in time.
- GIS has been used for the study.

Major findings of the study:

- Data revealed that accumulation of metals (Zn, Pb, Ni, Fe, Mn, Cu and Cd) in moss *Rhodobryum* sp. was in the order summer>winter>monsoon season in each year.
- Nearly same trend was found with other mosses *Rhodobryum* sp., *Thuidium*, *Hylocomium*, *Isopterigium*.
- The present study confirmed the potential use of moss for biomonitoring of seasonal atmospheric metal load and present work encourages the use of moss *Rhodobryum* sp., *Thuidium*, *Hylocomium*, *Isopterigium* as biomonitor for biomapping approach & which can be a tool for the assessment of atmospheric pollution loads.
- This finding is in process of being applied by the Noida Development Authority also.
- PI has also developed low cost mask using mosses. The technology developed under the project is in process of being patented to the PI.

PI stated that further studies are in progress in the States of Delhi, Jammu, Himachal, Karnataka, Uttarakhand, West Bengal, J&K, Meghalaya and Maharashtra.

The Committee was of the view that the Report should be forwarded to Central Pollution Control Board, New Delhi for their comments, if any and information and use.

**4.9 “Studies on Population structure, distribution pattern and regeneration potential of some lesser known commercially potent non-timber forest product yielding species in tropical west evergreen forests of Assam of Dr. Roshan Sarmah, Dept. of Botany, Debraj Roy College, Assam (14-20/2012-ERS/RE)”**

Project Details: The project was started on 15<sup>th</sup> June, 2013 for a period of 3 years with a total cost of Rs. 20,75,000/-. Project tenure was over on 14<sup>th</sup> June, 2016. A total of Rs. 17,62,200/- has been released so far out of the total approved project cost of Rs. 20,75,000/-. Details of Outputs-Outcome are not available in records. Proforma for assets, photographs, one copy of FTR and 3 copies of summary of FTR have been submitted. 10 copies of FTR have been received in June, 2018.

Objectives: The objective of the approved project was collection, identification and documentation of utilization pattern of NTFP yielding species of the region, to study the role of NTFPs in socio-economic development of the people, to study population structure, distribution pattern and natural regeneration status of some selected lesser known commercially potent NTFP yielding species, to study the regeneration potential of some selected commercially potent NTFP yielding species in ex-situ condition, to study extraction pattern and impact of extraction of NTFPs on plant community structure and to prepare species wise strategies for sustainable extraction and use for conservation of biodiversity as a whole and NTFPs in particular.

PI made a presentation on the outcome of the study. It was stated that the status of natural regeneration of selected NTFP yielding species was done in a natural habitat.

Major findings of the study:

- Cattle grazing in most of the forest area are common disturbances. Although it helps in grassland activities but it affects seedling survival of selective species such as *Garcinia*, *Thysolenema*, Bamboo, etc. which have high market potential.
- People should encourage cultivating the plants which are used in different traditional systems such as *Schumannianthus dichotomus*, *Garcinia pedunculata*, *Flemingia strobilifera* etc.
- Cultivation of commercial NTFPs should be promoted.
- Encourage of participation of indigenous people and other local communities for sustainable harvesting, and fruits should not be allowed to be harvested before mature/ ripen.
- The present study was able to document 144 medicinal plants used to cure various diseases by different healers, 64 wild edible plants, 10 commonly used house building plants and 12 fodder species.
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The Committee after deliberations desired that the FTR may be forwarded to the Director, ICFRE, DG (Forest), MoEFCC as well as Department of Forest, Government of Assam for their information and comments if any, and for implementation of recommendations/ findings. The Committee requested the PI to expeditiously furnish Audited consolidated Utilization Certificate, Expenditure Statement, Bills and invoices of permanent equipment, GFR-12A duly filled in and GFR-19 in PFMS Portal for settling for dues.

- 4.10 **“Patterns of tree cavity occurrence and use by vertebrates in tropical forests of the Western Ghats: a community web approach and its implications in forest management”** by Dr. P. Balakrishnan, Division of Conservation Biology, Jawaharlal Nehru Tropical Botanic Garden & Research Institute, Palode, Thiruvananthapuram (Kerala) (F.No. 14-34/2014-ERS/RE)

Project Details: This is an on-going project started on 21<sup>st</sup> June, 2016 for a period of 3 years with a total cost of Rs. 42,52,910/-. The tenure of the project will be over in 20<sup>th</sup> June, 2019. A total of Rs 18,94,000/- has been released so far out of approved project cost of Rs 42,52,910/-. Unaudited Utilization Certificate, Expenditure Statement, GFR 12A, GFR 19, invoices, DBT details and one copy of Annual Progress report for FY 2017-18 have been received.

The project was listed for consideration of the Annual Progress Report for FY 2017-18 but the PI has however not attended the meeting and hence was not considered. It is proposed to consider it in the next meeting of the Committee. PI requires furnishing audited UC, ES for FY 2017-18.

- 4.11 **Impact of fire and grazing on structure and function of grassland ecosystem of Cherrapunjee** by Dr. B.K. Tiwari, Department of Environmental Studies, School of Human and Environmental Sciences, North-Eastern Hill University, Shillong (Meghalaya) (F.No. 14/32/2010-ERS/RE).

Project Details: The project was started on 22<sup>nd</sup> March, 2012 for a period of 3 years for a total cost of Rs.16,36,500/-. The tenure of the project was over on 19.03.2015. A total of Rs.12,83,400/- has been released so far out of approved project cost of Rs.16,36,500/-. FTR was accepted in the 15<sup>th</sup> Meeting held on 29<sup>th</sup> February and 1<sup>st</sup> March, 2016, however details of Outputs-Outcome are not available in records. The PI has submitted consolidated Utilization Certificate, Expenditure Statement, invoices etc. in July, 2018. 5 copies of FTR were also received during the meeting.

The PI made a presentation.

Objectives: The objective of the approved project was to study the impact of fire and grazing on the grassland of Cherrapunjee which represents various stages of arrested succession of the climax forest. The following parameters were studied:

- (i) Analysis of vegetation structure of the grassland community
- (ii) Determination of biomass and primary productivity of the grassland community
- (iii) Analysis of physico-chemical characteristics of soil
- (iv) Determination of the rate of Nitrogen mineralization in soil
- (v) Interactions and interviews with key persons
- (vi) Household survey was also done.

A total of 35 species belonging to 30 genera and 16 families were recorded in all the treatment plots.

The major findings of the study are:

- (i) Results indicate that species richness increased with fire and grazing treatments

- (ii) In all the treatment plots, species richness was highest during the rainy season and lowest during the winter season.
- (iii) The most commonly represented families were Poaceae and Cyperaceae.
- (iv) *Arundinella khasiana* Nees ex Steud., *Chrysopogon gryllus* (L.) Trin., *Eragrostiella leioptera* Stapf, Bor., *Eulalia quadrinervis* (Hack.) O. Kuntze., *Ischaemum goeblii* Hack. and *Jansenella griffithiana* (C. Muell.) Bor were the dominant grass species
- (v) Perennial species (22-26) were more than annuals (7-9).
- (vi) Grazing and burning seem to have positive influence on species diversity etc.

#### Conclusions:

1. Impact of fire and grazing on vegetation structure of grassland ecosystem of Cherrapunjee are highly variable; while grazing tends to favour the diversity of perennial grasses, fire influences the richness of annual grasses and other monocots.
2. The combined effect of grazing and fire increases the diversity of forbes (herbaceous flowering plants that is not a graminoid (grasses, sedges and rushes).
3. While grazing alone promotes uniform distribution of plant diversity, which creates homogenization of the vegetation. Fire alone cannot maintain the heterogeneity but fire with grazing play a vital role in creation and maintenance of the diversity of the habitats.
4. Overall the study suggests that annual grazing and burning had profound negative effects on the vegetation structure and ecosystem function of the Cherrapunjee grasslands.
5. The study recommends that the people and government join hands to control fire and regulate the grazing. Any eco-restoration work can be taken up only after the fire and grazing has been controlled

#### Outcome of the study:

1. The research has been disseminated to all stakeholders through publications, seminars and distribution of the Executive Summary to relevant departments of the State Government.
2. On the basis of the findings, State Government has started some work on the prevention and control of fires.

PI was desired to undertake economic evaluation of the grasslands and suggested to include economic evaluation of grasslands as one of the objectives of R&D Proposal, which PI is in process of submitting to the Forest Dept., Govt of Meghalaya.

The Committee after deliberations decided that copies of the FTR may also be forwarded to DG, Forest of the MoEFCC, Director, ICFRE for their use and implementation of findings.

- 4.12 **“Assessment of Anthropogenic pressure and its impact on Forest and Grassland Ecosystem of Dachigam National Park, J&K India”** by Dr. Azra Musavi, Department of Economics, Aligarh Muslim University, Aligarh (F.No.14/13/2013-ERS/RE).

Project Details: The project was started on 23<sup>rd</sup> December, 2014 for a period of 3 years for a total cost of Rs. 21,99,960/-. The tenure of the project was over on 22.12.2017 and the PI had sought extension which was granted upto 31.03.2018 with no additional cost. A total of Rs.14,71,800/- has been released so far out of approved project cost of Rs. 21,99,960/-.

Audited consolidated Utilization Certificate, Expenditure Statement, GFR 12, GFR 19, invoices, DBT details, details of Outputs-Outcome of the project and Final Technical Report are awaited.

This case was also listed in 1<sup>st</sup> and 2<sup>nd</sup> SC meeting for consideration and PI had been again requested to make a brief presentation before the Committee on the Outputs-Outcome of the Project but PI had not attended the meeting. Dr. Jamal Khan on behalf of PI has informed vide email dated 17<sup>th</sup> August, 2018 that Dr. Azra Musavi will not be attending the meeting due to an accident and has fractured both her hand. PI sought deferment for consideration in next meeting where she herself would like to make the presentation.

4.13 **“Ecological Studies on distribution patterns and food plant resources of butterflies along altitudinal gradients in Sub-alpine forests of Himachal Pradesh”** by Dr.Pawan Kumar, Himalayan Forest Research Institute (ICFRE), Conifer Campus, Panthaghati, Shimla (F.No. 14/21/2012-ERS/RE).

Project Details: The project was started on 29<sup>th</sup> May, 2013 for a period of 3 years for a total cost of Rs.29,57,500/-. The tenure of the project was over on 28<sup>th</sup> November, 2016, with an extension of six months with no additional cost. A total of Rs.26,71,000/- has been released so far out of approved project cost of Rs.29,57,500/-. The PI has refunded two DDs for an unspent amount of Rs 1,38,076/- (Rs.1,33,073/- and Rs. 5003/-). Audited consolidated Utilization Certificate, Expenditure Statement, GFR 19, invoice and photographs of equipment, details of Outputs-Outcome of the project are awaited. One copy of Final Technical Report is available.

This case was also listed in 1<sup>st</sup> and 2<sup>nd</sup> SC meeting for consideration, wherein PI was requested to make a brief presentation before the Committee on the Outputs-Outcome of the Project and for furnishing of documents for settling of accounts, however PI has not attended the meeting. PI has informed vide his e-mail dated 27<sup>th</sup> August, 2018 that he will not be attending the meeting and sought deferment for consideration in next meeting.

4.14 **“Assessing the Floristic Diversity and Ecosystem values of selected High altitude wetlands of Indian Trans Himalaya”** by Dr. K. Chandra Sekar, G. B. Pant Institute of Himalayan Environment & Development, Almora (F.No. 14/178/2013-ERS/RE)

Project Details: The project was started on 27.03.2015 for a period of 3 years with a total cost of Rs. 23,07,900/-. Tenure of the project was over on 26.03.2018. A total of Rs 16,38,879/- has been released so far out of approved project cost of Rs 23,07,900/-. The PI has submitted audited Utilization Certificate, Expenditure Statement, GFR 12, GFR 19, DBT details, invoices, photographs of equipment, 3 copies of executive summary and 4 copies of FTR and Annual Progress Report for the FY 2017-18. The PI informed that audited consolidated Utilisation Certificate, Expenditure Statement will be submitted for settling of accounts.

PI attended the meeting and made a presentation on the study.

Objectives: It was stated that High Altitude Wetlands (HAWs) found in the Indian Trans Himalaya are of great importance to the people living in this region because they provide

livelihood and are considered sacred, Pasturelands fringing the wetlands are used for grazing livestock and have also been identified as the home of several rare/ endemic species of plants including high medicinal values and wild fauna, these wetlands are important staging and breeding areas for local and migratory birds, they play significant role in the hydrological cycle and water resources of Indian subcontinent, HAWs depend on water provided by glacier streams or snow melt.

The objective of the approved project was to document and assess the floristic diversity components of targeted wetlands, to investigate the floristic diversity changes in the targeted wetlands, to analyse the ecosystem services emanating from the targeted wetlands, to inculcate awareness and sensitize local inhabitants on issues pertinent for conservation of selected wetland ecosystems.

The major findings of the study are:

- (i) A total of 329 taxa (327 species, one subspecies and one variety) of plants recorded from wetland regions of Trans Himalaya.
- (ii) Among these, 327 taxa (325 species, one subspecies and one variety) are angiosperms distributed under 39 families and 161 genera and gymnosperms represented by a single family, namely, Ephedraceae with two species.
- (iii) Floristic diversity of wetlands contributes more than 26% of plants recorded in the Trans Himalaya/cold desert region. Tso Kar wetland recorded highest number of plants (133), followed by Tso Moriri (113), Pangong Tso (109), Chushul and Tisgul Tso (90), Chandra Tal (75) and Suraj Tal (63). The reason of diversity of plants due to flat surface and may be favourable for growth of plant.
- (iv) Total of 154 plants used for different medicinal purposes and detailed enumerated in the wetland are showing importance of wetland ecosystem.
- (v) A total of 37 threatened plants were recorded from the wetlands and highest number was recorded from Tso Kar wetland of Ladakh.
- (vi) The water physiochemical characters shows high total hardness ( $866\pm 364$  mg/L), magnesium ( $184\pm 70.9$  mg/L), total alkalinity (as  $\text{CaCO}_3$ ) ( $566.6\pm 148$  mg/L) and lower calcium ( $111.0\pm 91$  mg/L) concentrations. Chander Tal and Suraj Tal are the purest water sources of HAWs.
- (vii) As per the recorded tourism, the wetland of Ladakh region having highest impact on wetlands. The number of tourists has increased from 24,034 to 2,79,679 during 2010 to 2016, respectively (data received from District Tourism and Information Centre, Leh). Most of the tourists were visiting the wetland of Ladakh and important destination for camping, adventuring, etc. Income from tourism is one of the best source of income in Ladakh.

Specific Recommendations based on findings:

1. Control in livestock grazing in and around the wetland area.
2. Popularizing cultivation of threatened high value medicinal plants in nearby villages for medicinal usage and reduce the collection from wild natural population,
3. Promote monitoring of threatened species population,
4. Promote adventure and nature based tourism in the area.

The Committee after deliberations decided that copies of the FTR to be forwarded to the Govt of J&K and to the State Biodiversity Board for their information and for

implementation of the findings for conservation of their wetlands and flora many of which are unique to the region and in RET or in vulnerable state. The Committee also decided that the Report be forwarded to BSI for their record and use and for comments, if any.

- 4.15 **“Monitoring structure, functioning and ecosystem services of dry tropical forest ecosystem of Gir for conservation and management of ecosystem, prey populations and predators”** by Dr. Jamal A Khan, Professor & Chairman, Department of Wildlife Sciences, Aligarh Muslim University, Aligarh (F.No. 14/246/2015-RE)

Project Details: The project was started on 10<sup>th</sup> May, 2016 for a period of 3 years with a total cost of Rs. 53,52,680/-. The tenure of the project will be over in 9<sup>th</sup> May, 2019. A total of Rs 19,94,550/- has been released so far out of approved project cost of Rs 53,52,680/-. PI had been requested to make a brief presentation on the progress of the project before the Committee and for furnishing of documents. PI has attended the meeting and informed that he will submit audited Utilization Certificate, Expenditure Statement, GFR 12, GFR 19, DBT details, invoices, photographs of equipment and Annual Progress Report for the FY 2017-18.

Objectives: The objective of the approved project was to gather current data on ecological parameters related to structure and functioning of vegetation and other habitat factors of Gir forest ecosystem and compare the same with baseline data and information, to gather current data on ecological parameters related to prey populations of Gir forest ecosystem and compare the same with baseline data and information, to investigate unstudied aspects of ecology of studied species and to gather ecological data on unstudied species of Gir forest ecosystem, to assess and quantify ecosystem services of Gir forest ecosystem, to carry out overall analysis and synthesis of past and current information from ecosystem's Perspective in order to extract ecological gradients, patterns and predict future trends.

PI made a presentation on the progress of the study. It was stated that Chital is the key prey species for lion and leopard, there has been moderate increase in population of Chital but its consumption has increased manifold, data for 5 such species have been collected which was not available till date/Species were not studied till date. PI acknowledged the cooperation of Government of Gujarat and Field Director, Gir National Park in execution of the project.

PI presented the status of the project.

The PI informed that the Gir National Park was extensively degraded during the 70s due to ecosystem degeneration. The Park covers a total area of 895 sq km. The Park harbours an average 60 lions/sq km as against 50-55/sq km during 1985-87. The total population of lions has been estimated as 700 in 2018 as against 250 in 1985-87. Similarly, there has been an increase in the prey population of Chital and Sambar Deer which form their prime diet estimated as 2.3/sq km.

Work carried out so far:

Of the total 895 sq km, the project has studied an area of 200 sq km so far. The balance area also requires to be studied. A total of 100 camera traps were set for 2 seasons (pre-monsoon and winter) each for 90 days. Camera trapping in western part of Gir from April, 2017 to June 2017 and November 2017 to March 2018. 420 vegetation plots have already been laid in whole Gir. Systematic sampling was followed using 2X2 km grid. Data were

collected on tree layer, shrub layer, herb layer, seeding, sapling and indirect evidences in vegetation plots. Vegetation data computer feeding is on. 80 plots were chosen from different forest ranges of Gir to estimate densities of trees. 35 vehicle transects were run in whole Gir ranging from 13 to 30 kilometres. Data entry completed for analysis. Densities of Chital and Sambar were calculated using programme DISTANCE 7.2. Food plant species of chital assessed through direct sightings. A total of 200 km<sup>2</sup> area (50 sites) was covered with an effort of 2500 trap nights.

Data pertaining to status, distribution, activity pattern and habitat preference of large and small mammalian fauna has been collected. Scat collection for lion, leopard and small cats carried out in summer 2018.

Work to be carried out yet:

- Camera trapping in central and eastern part of Gir.
- Ungulates census in winters and summer season.
- Scat collection of lion and leopards for dietary studies
- vegetation sampling around camera traps for habitat use studies of large and small mammalian fauna
- Radio collaring of leopard to study their spatial ecology

The PI informed that the Park Authorities and the Government of Gujarat have given full cooperation in carrying out the study. PI sought approval of use of funds available in the project for engaging a Project Assistant and for salary of a Field Assistant required in the project, since this a field-based study, and therefore services of a Field Assistant is required. This was agreed to.

The Committee after deliberations desired with PI to collect data on types of food plants, which are key food species for the herbivores in the Gir NP. The use GIS overlay maps of the vegetation (type and density), prey population and density and predator population and density for interpretation of the status of health of the Gir National park and prediction on the population dynamics of the predator-prey relationship requires to be studied. PI informed that this would be studied in the next phase of work.

The committee opined such studies may be replicated in other NPs/PAs. The Committee sought specific recommendations from the study whose implementation will ensure long-term survival of the Lions not only in the Gir National Park in the State of Gujarat but for the long-term survival of the species as a whole in our country.

4.16 **“Integrated Farming System in Degraded Coastal Land Areas of West Bengal and its Socio-Economic and Environmental Impact on the People”** by Prof. Kalyan Bhattacharjee (Retd.), Community for Social Work, 84 Rabindra Pally, Kolkata (West Bengal) (F.No. 24-06/2010/RE)

Project Details: The project was started on 10<sup>th</sup> May, 2016 for a period of 3 years with a total cost of Rs. 56,43,635/-. The tenure of the project will be over in 9<sup>th</sup> May, 2019. A total of Rs 39,56,028/- has been released so far out of approved project cost of Rs 56,43,635/-. This is an NGO. Audited Utilisation Certificate, Expenditure Statement, GFR 12, DBT details, photographs of equipment and Annual Progress Report for the FY 2017-18 have been submitted in May, 2018.

Objectives: The objective of the approved project was Identify the probable reasons of resource mis-utilisation and its impact of socioeconomic condition of the people, improve productivity of degraded land and water resources of the coastal region through integrated farming system approaches, enhance livelihood security and employment generation for the poor farming communities of the coastal region, empower stakeholders including men and women farmers through capacity building and skill development, assess the impact of integrated farming system (IFS) on socioeconomic and environmental upliftment to identify the pathway of IFS and its impact on resource productivity, to examine the nature and costs of those impacts and to suggest appropriate adaptation strategies and evolve adequate mitigation measures.

Introduction of diversified cropping in the same farm land and at the same time to reduce input cost and to increase the income of the individual land holders and increase high cost benefit ratio, Development of marketing facilities improve the economic benefit among the disadvantaged people. Integrated Farming System (IFS) where the total ecology is maintained in a sustainable approach with a goal of profit maximization from a single piece of land throughout the year and to mitigate climate aberrations/ contingent planning in one go and multi farming system with emphasis on multi-cropping, rotational cropping, inter-cropping, mixed-cropping practices with allied activities like horticulture, livestock, fishery, agro-forestry, apiculture, conservation/ etc. are proposed to enable farmers not only in maximizing the farm returns for sustaining livelihood, but also to mitigate the impacts of drought, flood or other extreme weather events and at the same time promoting alternate micro-enterprises like organic manure/super compost production units, Goat farming/poultry farming, mushroom cultivation, fishery based activities etc.

Co-PI Shri Somnath Saha has attended the meeting and made a presentation on the progress of the study. Co-PI gave a presentation.

The major findings of the study are:

Organic farming system can reduce the expenditure in agriculture. It was observed that new components in biodiverse farming are the causes of increase in employment opportunities. Dependence of local people on the market has been reduced by production of vegetables, staple foods such as tuber, etc. At the same time farmers became skilled enough in production of vermicompost and practicing diversified integrated farming.

Remaining work:

- Introduction of more integrated farming system, expansion and diversification of livestock in order to enhance income among the remaining beneficiaries
- Promotion of more organic compost unit and its proper analysis and application in agricultural field
- Promotion and distribution of bio-agents like biofertiliser and biopesticide among the more no of beneficiaries
- Promotion and distribution of bio-agents like biofertiliser and biopesticide among the more no of beneficiaries
- Dissemination of the knowledge to the target groups by group discussion, publication ,training and documentation.

The Committee after deliberations desired that the Report be forwarded to Ministry of Agriculture for dissemination to the farmers with the help of their KVKs, etc. The Committee observed that the NGO needs to register on the MoEFCC NGO Portal and submit GFR-12A and GFR-19 on the PFMS portal.

4.17 **“Genetic Diversity analysis and conservation of Threatened *Salvadora oleoides*”**  
by Dr. Maneesh Singh Bhandari, Division of Genetics and Tree propagation, Forest Research Institute, Dehradun (F.No. 14/8/2013-RE)

Project Details: The project was started on 9<sup>th</sup> May, 2016 for a period of 3 years with a total cost of Rs. 24,10,800/-. The tenure of the project will be over in 8<sup>th</sup> May, 2019. A total of Rs 12,98,180/- has been released so far out of approved project cost of Rs 24,10,800/-. PI has submitted audited Utilization Certificate, Expenditure Statement, GFR 12, Proforma of assets, DBT details, letter of undertaking by post on 3<sup>rd</sup> August, 2018.

Objectives: The objective of the approved project was to select superior phenotypes of *Salvadora oleoides* from range of distribution of the species, to collect seeds and vegetative material for the establishment of gene banks and evaluation trials, to evaluate growth performance of different genotypes with specific reference to wood pulping resistance parameters as well as influence of environment parameters, to assess genetic variability among the genotypes using morphological and growth characteristics and to study microscopic and floral biology and assess genetic variability of different genotypes of *Salvadora oleoides*.

PI made a presentation on the progress of the study. Work done so far:

- i. Field survey for mapping was completed in Punjab, Haryana, Rajasthan and Gujarat.
- ii. Eco-distribution map of *S. oleoides* were prepared for the north-west India with the use of RS & GIS technology.
- iii. Population mapping of *S. oleoides* were completed from Northwestern India.
- iv. Superior phenotypes were selected on the basis of number of fruits produced by the tree and other morphological parameters.
- v. Based on the morphological parameters, selection indices were run on Candidate Plus Trees (CPTs) to select Plus Trees from Punjab, Haryana, Rajasthan and Gujarat.
- vi. *Salvadora oleoides* mortality has been recorded. Causes of mortality have been observed. Several biotic and abiotic factors causes mortality (i.e. insects-pest or environment conditions excessive rainfall).
- vii. DNA were isolated from 240 genotypes representing 8 populations of Haryana, Rajasthan and Gujarat. For genetic diversity analysis, the DNA extraction of 8 populations was completed and ISSR marker analysis was completed in 5 populations. Preliminary results of genetic diversity analysis showed population differentiation occurs at natural level. Quantitative and qualitative analysis were completed for all the 240 samples. Genetic diversity is detected using morphological characters such as leaf shape, length, width, trichome, leaf area, colour, surface texture, venation, petiole, apex, margin, odour, taste, and lamina (Plus Tree Data-2016).
- viii. For the floral biology study; parameters such as peduncle length, inflorescence length and number of inflorescence were used. Anatomical study of root and shoot was also conducted to see the xylem, phloem and other cortical tissue arrangements. For the microscopic study; parameters such as flower bud length, width, circumference and floral bud area was used (Plus Tree Data-2016).

PI made a request to change in the objectives at this stage due to following reasons:

- To evaluate growth performance of different genotypes with specific reference to wood, pulping, resistance parameters as well as influence of environment parameters.

Modification sought: To evaluate growth performance of different genotypes with respect to biotic and abiotic parameters.

Reason: Arid zone keystone species, and regionally vulnerable and couldn't move for the commercial utilization.

- To assess genetic variability among the genotypes using morphological and growth characteristics.

Modification sought: To assess genetic diversity among different populations of *S. oleoides* through molecular markers (MM).

Reason: MM are more reliable, showed high accuracy and reproducibility of the results, the technology is now cheaper and accessible. They established sophisticated laboratory for the population genetic analysis.

The Committee after deliberations desired that the revised objectives may be forwarded to Director, BSI for comments.

4.18 **“Fish community structure and patterns of diversity along impacted and unimpacted streams of Vindhya and Satpura hill ranges, Central India”** by Dr. Anuradha Bhat, Indian Institute of Science Education and Research- Kolkata, Mohapur Campus, Viswavidyalaya, Mohanpur, Nadia (West Bengal) (F.No. 14/87/2014-ERS/RE)

Project Details: This is an on-going project started on 30<sup>th</sup> June, 2016 for a period of 3 years with a total cost of Rs. 26,41,540/-. The tenure of the project will be over in 29<sup>th</sup> June, 2019. A total of Rs 10,85,000/- has been released so far out of approved project cost of Rs 26,41,540/-. PI has submitted Expenditure Statement, GFR 12, Annual Progress Report for the FY 2016-17.

Objectives: The objective of the approved project was to study the diversity and distribution of fresh water fish fauna in six rivers from the Vindhya and Satpura ranges of Madhya Pradesh in Central India and to compare these pattern in human impacted and pristine locations, to investigate the ecological correlates of fish species diversity and abundance distribution the disentangle the important physical/abiotic characteristics that are most important in determining assemblages structure, to study morphological adaptations in differing habitat conditions and their relation with specific trophic groups among common and abundant native fish species and to develop a generalized linear model for predicting species diversity parameters and propose scenarios (based on the model) for varying extents of disturbances levels. This would be then used for proposing conservation prioritizations plans.

PI made a presentation on the progress of the study:

It was stated that the impact of anthropogenic activities on the population and diversity of the fish communities have been attempted to be quantified in the area. Data on phytoplankton is yet to be initiated to be collected. It was stated that River Tawa has highest diversity of fish, 'Cyprinidae' species seems to be abundant in the streams of River Narmada, but local migration of fish is impacted due to anthropogenic activities, 20% of samples collected belong to vulnerable/endangered species. PI informed that marine fish of Andhra Pradesh are popular among locals.

Findings of the study undertaken so far:

- Overall diversity of Satpura/Vindhya and Perennial/Intermittent/regulated sites did not differ.
- Diversity in winter was least as compared to other three seasons.
- Seasonality plays important role in predicting alpha diversity.
- Dissolved oxygen and pH were two most important water parameters to predict alpha diversity.
- PER sites were more similar in species composition, INT and REG sites were dissimilar at spatial and temporal scales.
- Dissimilarities in composition between sites were explained by water parameters but not by habitat structural variables.

#### Relevance of the study deliverables

- Study provides a detailed understanding of the fish community structure as well as the ecological and human induced factors that are driving changes in community diversity patterns in the region. This study helps to understand the ecology of stream fish communities of dry-wet tropical climatic conditions since very few literature exist for these habitats. Moreover, this study provides baseline information to aquatic ecologists for future studies.
- This is of direct relevance to local communities that use the aquatic resources in the Narmada river basin area for subsistence. This study is also important for community awareness of the impact of human disturbances on aquatic fauna, particularly the fish communities.
- The results of this study would be important in environmental assessment and conservation planning within river and stream habitats of Central India.

The Committee after deliberations desired that the PI also contact ZSI for correlation of data. The PI was requested to submit audited Utilization Certificate, Expenditure Statement, GFR 12, Annual Progress Report, GFR 19, DBT details, invoices, photographs of equipment for the FY 2017-18.

- 4.19 **“Spider diversity in the Eastern Ghats of Odisha”** by Dr. Sanjay Keshari Das, Guru Gobind Singh Indraprastha University, Sector-16C, Dwarka, Delhi (F.No. 14/259/2015-RE).

Project Details: The project was started on 3<sup>rd</sup> May, 2016 for a period of 3 years with a total cost of Rs. 49,06,640/-. The tenure of the project will be over in 2<sup>nd</sup> May, 2019. A total of Rs 27,04,500/- has been released so far out of approved project cost of Rs 49,06,640/-. Sanction for third instalment of Rs. 15,05,890/- has been issued in August, 2018 for FY 2018-19.

PI had been requested to make a brief presentation on the progress of the project before the Committee. PI had confirmed vide his email dated 29<sup>th</sup> August, 2018, but he has not attended the meeting. Also, data on DBT have not been forwarded to Ministry and now require being uploaded and updated monthly on the DBT Bharat Portal website and on DBT App. The Committee decided that the project be considered in the next meeting and PI present the status of the project.

- 4.20 **“Investigations on Active Constituents of High Altitude Medicinal Plants traditionally used as Non-Toxic Drugs”** by Dr. Harsha Kharkwal, AMITY Institute of

Phytomedicine and Phytochemistry & Amity Center for Carbohydrate Research, Amity University, Noida (F.No. 19-27/2009- RE).

Project Details: The project of XIth Plan was started on 30<sup>th</sup> October, 2010 for a period of 3 years for a total cost of Rs.17,73,280/-. Project was granted extension till 31<sup>st</sup> March, 2015 with additional budget of Rs. 40,000/-. The tenure of the project was over on 31<sup>st</sup> March, 2015. A total of Rs. 13,94,689/- has been released out of approved project cost of Rs. 17,73,280/-PI has presented the progress of project before committee on 2-9<sup>th</sup> Dec, 2014. Final settlement is due. PI attended the meeting and has submitted audited consolidated Utilisation Certificate, Expenditure Statement, invoices, photographs of equipment, copies of executive summary, publications and along with 4 copies of FTR.

Objectives: The objective of the approved project was chemical identification of therapeutic constituents of medicinal plants of remote Himalayan region for content and composition, preparation of standardized extract/- isolation of active constituents and their chemical finger prints, identification of chemo-types, search for new/rich source of therapeutic ingredients and conservation and cultivation of Medicinal Plants with eco-tourism.

PI made a presentation on the outcome of the study. It was stated that 4 Patents have been filed during 2012-13. PI is in process of getting patent for the technology developed under the project, 1 PhD awarded under the project, 3 industries showing interest in implementation of research findings including Lotus Herbals. Species studied are threaded ones so commercialization may have adverse effects. Presentation of the project given by PI is as follows:

Industrial Utility of the study:

1. Species such as *Cinnamomum tamala* has got good potential as (methanolic and chloroform extract) good antimicrobial and antioxidant potential by using its extract in preparing low cost natural disinfectant in developing countries.
2. Iron oxide nanoparticles from aqueous extract of *Cinnamomum tamala* leaves can be a boon in the treatment of antibiotic chemotherapy as a cost effective extract.
3. *Rhododendron arboretum* flowers have good phenolic content thus can be utilized as immounomodulator. Quercetin a known polyphenol is known to have antimicrobial effect. A detailed study based on the pharmaceutical formulation has been done on *R. arboretum* and *Myrica nagi* which concludes that its extract can be used in the formation of emulsions, suspensions, tablets.
4. *Zanthoxylum alatum* can be utilized in the nutritional/pharmaceutical fields.
5. *Myrica nagi* can be used in the development of more effective and selective medications form functional foods that are capable of blocking the action of reactive oxygen species involved in oxidative stress.

The Committee desired that the necessary approvals may be obtained from the National Biodiversity Authority before filing for patent. The Committee desired that copy of the Report be provided to State Biodiversity Board and to BSI for their record and use.

- 4.21 **“Studies on Ecology and Diversity of Nematodes of Pir Panjal Range in Jammu & Kashmir”** by Dr. A.A. Shah, CBS School of Biosciences and Biotechnology, Baba Gulam Shah Badshah University, Rajouri, Jammu & Kashmir (F.No. 14/15/2010-ERS/RE).

Project Details: The project was started on 23<sup>rd</sup> January, 2012 for a period of 3 years for a total cost of Rs. 31,17,190/-. The tenure of the project was over on 31.01.2015. A total of Rs.23,29,200/- has been released so far out of approved project cost of Rs.31,17,190/-. FTR was accepted by the PAC in its 17<sup>th</sup> Meeting held on 06-07<sup>th</sup> October, 2016, however details of Outputs-Outcome of the project are not available.

This case was also listed in 2<sup>nd</sup> SC meeting for consideration and PI had been requested to make a brief presentation before the Committee on the Outputs-Outcome of the Project and for furnishing of documents for settling of accounts, however PI has not attended both the meetings. PI vide his email dated 29<sup>th</sup> August, 2018 has declined to attend. Audited consolidated Utilization Certificate, Expenditure Statement, GFR 12, FTR are still awaited.

The Committee decided that the matter be pursued and the PI contacted for presenting the Outputs-Outcome vis-a-vis Objectives of the project in the next meeting of Steering Committee and Audited consolidated Utilization Certificate, Expenditure Statement, GFR 12, GFR-19, 5 copies FTR, etc be sent to Ministry.

- 4.22 **“Aquatic fungal diversity of the hill-streams of Himachal Pradesh Monographic study and its in-vitro screening for Lignocellulolytic Enzymes”** by Dr. I.B. Prasher, Deptt. of Botany, Panjab University, Chandigarh (F.No. 14/257/2013-RE).

Project Details: The project was started on 7<sup>th</sup> September, 2015 for a period of 3 years with a total cost of Rs. 28,95,000/-. The tenure of the project over in 6<sup>th</sup> September, 2018. A total of Rs 18,20,000/- has been released so far out of approved project cost of Rs 28,95,000/-. PI had been requested to make a brief presentation before the Committee on the Outputs-Outcome of the Project and for furnishing of documents for settling of accounts. PI has attended the meeting and submitted 5 copies of FTR & Executive summary, equipment bill and photographs.

Objectives: The objective of the approved project was inventorisation of aquatic fungal diversity through microscopic taxonomic analysis and molecular systematic, In vitro conservation of these fungi and Screening of the fungi for lignocellulolytic enzymes for their commercial exploitation later on.

PI made a presentation on the outcome of the study. It was stated that 215 samples have been collected so far and 17 Species new to Science have been discovered, detailed physiological studies conducted on *Tetracladium apiense*. PI has published his Monogram based on the study and 1 Phd has been awarded during the study. Presentation of the project given by PI is as follows:

#### Species New to Science

- *Campylospora indicum* sp. nov.
- *Calcarispora indicum* sp.nov.
- *Pseudopetrakia indicum* sp.nov.
- *Obeliospora indicum* sp.nov.
- *Tetrachaetum indicum* sp. nov.

20 New Records found for India

27 New Records found for North Western Himalayas.

The Committee noted that a large number of new species have been recorded under the study. The Committee desired that a copy of this study be forwarded to Director, BSI for their information and use and comments, if any. PI was also requested to furnish audited consolidated Utilization Certificate, Expenditure Statement, GFR 12, GFR 19, DBT details and any balance Bills/Invoices for settling of accounts.

4.23 “**In-vitro conservation of *Memcydonflavescens gamble* – an endangered taxon**” by Dr. D. H. Tejavathi, Dept. of Botany, Jnanabharathi, Bangalore University, Bangalore (F.No. 23/9/2011-RE).

Project Details: The project was started on 1<sup>st</sup> April, 2015 for a period of 3 years with a total cost of Rs. 20,94,000/-. The tenure of the project was over in 31<sup>st</sup> March, 2018. A total of Rs 13,10,500/- has been released so far out of approved project cost of Rs 20,94,000/-. PI had been requested to make a brief presentation before the Committee on the Outputs-Outcome of the Project and for furnishing of documents for settling of accounts. PI has attended the meeting and submitted 5 copies of FTR.

Objectives: The objective of the approved project was to collect the seeds from the naturally grown trees, to raise the plantlets (in vivo/ in vitro) through the germination of seeds by enhancing the percent of germination by various treatments, to standardize the in vitro protocol for conservation of genetic resources in the form of - Micro propagation, Slow growth of cultures, A whole plant (in vivo/ in vitro), to standardize the storage protocols for establishment of an in vitro base gene bank this includes storage of synthetic seeds at various temperature, to study the phytochemical aspects of callus culture and regenerated plants to analyze the active principles present and to study the various aspects on eco-rehabilitation in wild conditions.

PI made a presentation on the outcome of the study. Presentation of the project given by PI is as follows:

Important Observations:

- The following are the important observations made during the tenure of the project with respect to flowering and fruit setting.
- Flowering was observed in only one plant among 20 almost same aged plants during their visit to this place in the month of December 2015, 10 in December 2016 and 6 in December 2017. These observations indicate the inconsistency in flowering prevailing in this taxon.
- 85 to 90 percent of flower buds are infested with insects and their larvae. They completely chew up both reproductive organs – anthers and ovules resulting in hollow/empty space in the flower buds.
- Low percent of fruit setting (10%), may be the result of insect infestation and failure of Pollination and fertilization.

Conclusion of the study:

- (i) The present studies have shown that there are several bottlenecks in the process of reproduction / propagation of the endangered taxon – *Memeylon flavescens*.
- (ii) Presence of fungal endophyte and exudation of phenolics are the major factors that have to be addressed immediately to develop an effective protocol for micropropagation.
- (iii) The other major factor that is posing threat to the multiplication / propagation is the insect infestation at the early stage of the flower bud formation. Measures have to be taken to either completely check or minimize the insect infestation by consultation with Entomologists.
- (iv) A detailed study on reproductive biology is the need of the hour to chalk out the programmes to conserve and multiply this endangered taxon.
- (v) Since reproductive cycle is greatly hampered by insect infestation, vegetative propagation methods are admissible to multiply this taxon.

The Committee requested the PI to obtain NOC from the National Biodiversity Authority before filing patents. The Committee also requested the PI to furnish audited consolidated Utilization Certificate, Expenditure Statement, GFR 12A, GFR 19, bills & invoices, photographs of equipment, etc for settling of accounts.

4.24 **“Studies on Abundance, Diversity and Eco-biology of Parasitic Hymenoptera of Rice ecosystems in Kerala”** by Dr. M. Naseer, Department of Zoology, University of Calicut, Calicut (F.No. 14/3/2011-ERS/RE).

Project Details: The XIth Plan project was started on 17<sup>th</sup> February, 2012 for a period of 3 years with a total cost of Rs. 27,32,890/-. Project tenure was over on 16<sup>th</sup> February, 2015. A total of Rs 14,87,200/- has been released so far out of approved project cost of Rs. 27,32,890/-. FTR was accepted by Apex committee in its 7<sup>th</sup> meeting held on 18.01.2016, however details of Outputs-Outcome are not available in records. Final Settlement is pending due to pending UCs. Sanction for final settlement was issued on 25.11.2016, but funds could not be released for wants of pending UCs. Reminders 02.01.2017, 13.02.2017, 15.05.2017 and 19.09.2017 have been sent by Ministry for submission of pending UCs, however of the total 7, only 3 pending UCs have been received from the institution till date.

PI has attended the meeting and submitted 5 copies of FTR, UC & ES for 01.04.2014 to 16.02.2015 and consolidated UC for 17.02.2012 to 16.02.2015.

Objectives: The objective of the approved project was to study the taxonomy of some major genera of Chalcidodea and Ichneumonoidea associated with rice ecosystem of Kerala, to study the species diversity and species richness of selected taxa of Chalcidoidea and Ichneumonoidea at selected localities of rice ecosystem in Kerala and study on the biology, behaviour, host-parasitoid relationship and seasonal abundance of selected species of parasitic hymenoptera.

PI made a presentation on the outcome of the study.

It was stated that survey of thirteen districts of Kerala was completed and around 13100, specimens were collected, generic diversity and abundance index of Chalcidoid and *Ichneumonoid parasitoids* was calculated, field efficacy of six species of egg parasitoids and one larval parasitoid was determined, Development biology of *Psalis pennatula*, a new pest

of rice in Kerala was studied, behaviour of four species of parasitoids could be observed, oviposition and searching behaviour of two species of larval parasitoid was studied in detail, development biology of *Microplitis pennatulae* a larval parasitoid of *P. pennatula* was studied and host data of 32 species of parasitoids could be established.

Major findings of the study:

1. Seven unidentified species of braconid, five eulophid, two ichneumonid, one eurytomid and one trichogrammatid were collected from various rice fields.
2. One new eulophid genus was collected during the study.
3. Two *Microplitis* species, *Microplitis narendrani* Ranjith & Nasser and *M. pennatulae* Ranjith & Rajesh described as the larval endoparasitoids of *Psalis pennatula* (Fab.) (Ranjith et al. 2015).
4. A pimpline species, *Clistopyga sziladyi* Kiss, which is recorded from India for the first time (Varga & Reshchikov 2015).
5. An orgiline genus, *Orgilonia van Achterberg* is recorded from India for the first time with its host. This will record a new host family for Orgilinae (Hymenoptera: Braconidae).
6. A braconine genus, *Furcadesha Quicke* recorded from paddy fields and which is known from Kerala for the first time.
7. Sixty one ichneumonoid and chalcidoid genera reported from rice fields of Kerala etc.
8. A new caterpillar pest of rice viz: *Psalis pennatula* (Fabricius) (Erebidae: Lepidoptera) from Kerala is reported.

Outcome of the study:

The study can be used in the biological control programme to pest of rice fields of Kerala and where similar pests are found.

The Committee decided that the Report be forwarded to ZSI and to State Biodiversity Board, Kerala for their information and use and comments, if any. The Committee desired that the 4 UCs pending against the institution be forwarded expeditiously for final settlement of dues.

The Chairperson, Steering Committee, Shri A.K. Mehta, Additional Secretary at the conclusion of the meeting was given a summary of the deliberations of the considered projects. Chairperson decided that a Compendium of all the useful work/outcome of the projects should be prepared for wider dissemination to all relevant stakeholders. The Compendium should also be made available on the Ministry website.

The Committee ended the meeting with a Vote of Thanks to the Chair.

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**ANNEXURE-1****LIST OF PARTICIPANTS OF THE THIRD MEETING OF STEERING COMMITTEE ON R&D SCHEME HELD ON 30<sup>TH</sup> AUGUST 2018**

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| 1. Shri A. K. Mehta, Addl. Secretary, MoEFCC   | Chairperson      |
| 2. Dr. B. Meenakumari, Chairperson,<br>National Biodiversity Authority (NBA), Chennai                        | Member           |
| 3. Dr. Kailash Chandra, Director, Zoological Survey of India   | Member           |
| 4. Shri V.P.Yadav, Additional Director,<br>representing Chairman, Central Pollution Control Board, New Delhi | Member           |
| 5. Dr. K. Ambish, Botanical Survey of India (BSI)<br>representing Director, BSI                              | Member           |
| 6. Dr. T. Chandini, Advisor, MoEFCC  | Member-Secretary |

**MOEFCC (RE Division)**

1. Dr. M. Salahudding, Director, MoEFCC
2. Shri S. P. Singh, US, MoEFCC
3. Shri B. K. Haldar, SO, MoEFCC
4. Shri Chaitanya P. Sharma, RO, MoEFCC
5. Mrs. Akanksha Sachan, ASO, MoEFCC
6. Shri Sandeep Bharti, Project Assistant, MoEFCC

**PROJECT INVESTIGATORS**

1. Dr. M. Uthayakumar, Department of Mechanical Engineering, Kalasalingam University, Virudhnagar.
2. Dr. Roshan Sarmah, Deptt. of Botany, Debraj Roy College, Assam
3. Dr. Chirashree Ghosh, Department of Environmental Studies, Univ. of Delhi, Delhi
4. Dr. Anuradha Bhat, Indian Institute of Science Education and Research- Kolkata, Mohapur Campus, Viswavidyalaya, Mohanpur 741252, Nadia, West Bengal
5. Dr. Jamal A Khan, Professor & Chairman, Department of Wildlife Sciences, Aligarh Muslim University, Aligarh
6. Dr. Maneesh Singh Bhandari, Division of Genetics and Tree propagation, Forest Research Institute, Dehradun
7. Dr. I.B. Prasher, Deptt. of Botany, Panjab University, Chandigarh
8. Dr Harsha Kharkwal, HOI, AMITY Institute of Phytomedicine and Phytochemistry & Coordinator Amity center for carbohydrate Research, J-1 Block, R. No. LG-14 Amity University, Noida
9. Dr. Mukesh Khare, IIT, New Delhi
10. Dr. Dinesh Saxena, Deptt. of Botany, Bareilly College, Bareilly, UP
11. Dr. B.K. Tiwari, Department of Environmental Studies, School of Human and Environmental Sciences, North-Eastern Hill University, Shillong-793 022 (Meghalaya)
12. Dr. K. Chandra Sekar, G. B. Pant Institute of Himalayan Environment & Development, Almora
13. Prof. R.K. Kohli, Professor, Centre for Environment and Vocational Studies, Punjab University, Chandigarh
14. Dr. M. Naseer, Department of Zoology, University of Calicut, Calicut
15. Prof. Arun Kumar (PI), Government college , Kota
16. Dr. D. H. Tejavathi, Dept. of Botany, Jnanabharathi, Bangalore University, Bangalore
17. Shri Somnath Saha, CO-PI representing Prof. Kalyan Bhattacharjee, Community for Social Work, 84, Rabindra Pally, Kolkata (West Bengal)
18. Prof. Elyas K. K. Representing Late Dr. Sailas Benjamin, Biotechnology Division, School of Biosciences, University of Calicut, Thrissur- Calicut Road, Thenhipalam, Kerala

**ANNEXURE-2****LIST OF PROJECTS FOR CONSIDERTION IN THE 3<sup>rd</sup> MEETING OF STEERING COMMITTEE ON R&D SCHEME HELD ON 30.08.2018**

<b>S. N.</b>	<b>File No. &amp; Title of the Project</b>	<b>Thematic area</b>
1.	19-20/2012-RE Machining and Erosion studies of Red mud an Industrial waste based Polymer matrix Composite	Pollution
2.	19-79/2013-RE Remediation of Ground Water Contaminated with Hexavalent Chromium in Sukinda Valley, Odisha, Using Nano Zero Valent Iron (n-ZVI) Technology	Pollution
3.	19-56/2013-RE Impact of Environmental Bio-aerosol Pollution on Human Health: A "case-control study" for Exacerbation of COPD in North Indian Population	Pollution
4.	19-29/2011-RE STREAT- Sustainable Semi-Decentralized Sewage Treatment-Wastewater Reuse, Nutrient Recovery and Biogas production in the Delhi Metropolitan Area	Pollution
5.	19-20/2007-RE Some Mathematical Model for pollutant uptakes in plants	Pollution
6.	14/28/2008-ERS/RE Impact of cell-phone technology on selected plants and animals	Pollution
7.	19-62/2005- RE A process development for ameliorating alarming environment and health hazardous posed by phthalates in plastic vis chemical, biochemical and bioremediation approaches	Plastic Wastes
8.	19/13/2008- RE Bryophytes – tool for national multi-elemental atmospheric survey of 100 years	Biodiversity
9.	14/20/2012-ERS/RE Studies on Population structure, distribution pattern and regeneration potential of some lesser known commercially potent non-timber forest product yielding species in tropical west evergreen forests of Assam	Forestry
10.	F.No.14/34/2014-ERS/RE Patterns of tree cavity occurrence and use by vertebrates in tropical forests of the Western Ghats: a community web approach and its implications in forest management	Forestry
11.	No.14/32/2010-ERS/RE Impact of fire and grazing on structure and function of grassland ecosystem of Cherrapunjee	Ecology
12.	F.No.14/13/2013-ERS/RE Assessment of Anthropogenic pressure and its impact on Forest and Grassland Ecosystem of Dachigam National Park, J&K India	Ecology

13.	F.No.14/21/2012-ERS/RE Ecological Studies on distribution patterns and food plant resources of butterflies along altitudinal gradients in Sub-alpine forests of Himachal Pradesh	Ecology
14.	F. No14/178/2013-ERS/RE Assessing the Floristic Diversity and Ecosystem values of selected High-altitude wetlands of Indian Trans Himalaya	Ecology
15.	F.No.14/246/2015-RE Monitoring structure, functioning and ecosystem services of dry tropical forest ecosystem of Gir for conservation and management of ecosystem, prey populations and predators	Ecology
16.	F.No. 24-06/2010-RE Integrated Farming System in Degraded Coastal land Areas of West Bengal and its Socio-economic and Environmental Impact on the People	Ecology
17.	F.No.14/8/2013-RE Genetic Diversity analysis and conservation of Threatened <i>Salvadoraoleoides</i>	Biodiversity
18.	F. No. 14/87/2014-ERS/RE Fish community structure and patterns of diversity along impacted and unimpacted streams of Vindhya and Satpura hill ranges, Central India	Biodiversity
19.	F.No.14/259/2015-RE Spider diversity in the Eastern Ghats of Odisha	Biodiversity
20.	19-27/2009- RE Investigations on Active Constituents of High Altitude Medicinal Plants traditionally used as Non-Toxic Drugs	Biodiversity
21.	No.14/15/2010-ERS/RE Studies on Ecology and Diversity of Nematodes of Pir Panjal Range in Jammu & Kashmir	Biodiversity
22.	F.No.14/257/2013-RE Aquatic fungal diversity of the hill-streams of Himachal Pradesh Monographic study and its in-vitro screening for Lignocellulolytic Enzymes	Biodiversity
23.	F.No.23/9/2011-RE In-vitro conservation of <i>Memcytonflavescens gamble</i> – an endangered taxon	Biodiversity
24.	No.14/3/2011-ERS/RE Studies on Abundance, Diversity and Eco-biology of Parasitic Hymenoptera of Rice ecosystems in Kerala	Biodiversity