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

Minutes of the Second Meeting of Steering Committee on R&D Scheme to consider R&D projects of XIth and XIIth Five-Year Plans held on 18th July, 2018 at Indira Paryavaran Bhawan, New Delhi

1. The second meeting of the Steering Committee on R&D Scheme was held on 18th July 2018 to consider R&D projects of XIth and XIIth Five-Year Plan, at Indira Paryavaran Bhawan, Jor Bagh, New Delhi. The list of participants is at **Annexure-1**.

Minutes of the Previous Meeting

Minutes of the First Steering Committee Meeting held on 07.06.2018 were circulated to the Committee members and were confirmed.

2. Shri A.K.Mehta, Additional Secretary, MoEFCC and Chairperson of the Committee welcomed all the members, Invitees, Project Investigators (PIs) and participants of the meeting. Dr. T. Chandini, Advisor informed the Committee that agenda includes review of Final Technical Reports for final settlement of 22 R&D projects that were completed during the XIth Five-Year Plan and 3 R&D projects that were completed during the XIIth Five-Year Plan under the R&D Scheme which ended on 31st March 2017. The PIs were requested to briefly present the Final Technical Report of their projects in terms of broad objectives of the project, the major findings/outputs and outcome thereof.

3. The Committee was informed that out of the 25 projects listed at **Annexure-2,** PI at S.No 19 had sought deferment, PI at S.No. 8 had confirmed but has not come to the meeting, PIs at S. Nos. 4, 18 & 24 have informed that they will not be attending, PIs at S.Nos. 1, 3, 5, 9, 11, 15, 16, 17, 20, 21, 22, 23 & 25 have not attended the meeting. The remaining 7 projects were taken up in the meeting.

4.0 The following projects were considered:

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

Project Details: The project was started on 10th 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 5th meeting of Apex committee held on 13-14th June, 2013, however details of Output-Outcome have not been given.

The ministry has been informed by Mr. Sarah Josh M.K., one of the researcher of the project that the PI Dr. Sailas Benjamin is no more. Mr. Sarah Josh M.K. has also conveyed to Ministry about some balance stipend/fellowship that requires to be settled. The Ministry had contacted Registrar and Head Bio-Technology Division, University of Calicut to

nominate a suitable person from the Division of Biotechnology to attend the meeting to present their findings and Outputs-outcome of the Study and furnish all relevant details to settle the accounts. The matter was also discussed by Advisor (RE) with Dr.Elyas, Head Biotechnology Division that 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 are awaited.

It is proposed to follow the matter again with the Head of Biosciences Division, Calicut University to nominate a representative for participation in the next Steering Committee meeting.

4.2 "**Reduction of chromium toxicity using nano particles laboratory and field scale Study"** by Dr. Debajyoti Paul, IIT Kanpur, Uttar Pradesh (F.No. 19/45/2010-RE).

Project Details: The project was started on 20.04.2012 for a period of 3 years for a total cost of Rs. 28,16,080/-. The tenure of the project was over on 19.10.2015 with extension. A total of Rs 22,45,040/- has been released so far in two instalments out of approved project cost of Rs. 28,16,080/-. The PI has submitted FTR.

Objectives: The objectives of the approved project are: (i) to assess extent of heavy metals pollution in agricultural soil and treated effluent samples, (ii) to assess spatial distribution of heavy metals and identify possible sources of contamination, (iii) additionally, Cr leaching potential, an important factor in spreading contamination to the local environment, and (iv) remedial approach is carried out on tannery wastewater and tannery sludge embedded soil using low cost and eco-friendly bio-sorbent from study site - from various sampling locations of water and soil contaminated by tannery effluents in an area of 15km across at Jajmau, Kanpur, which is an industrial (mainly Leather) suburb on the outskirts of Kanpur is located on the banks of the holy Ganges.

The Committee was informed that the objectives of the project were modified as per suggestions given by the Program Advisory Committee to develop low cost method for Cr (VI) remediation from water and soil samples in and around Tanneries in Jajmau, Kanpur. Thereafter, the Programme Advisory Committee (PAC) in its 11th Meeting held on 27th–28th December, 2013 had opined that the reorientation of work needs to be done keeping economic feasibility in view. Accordingly, the PI presented before PAC in its 19th meeting held on 8th – 9th December, 2014 and had presented his findings as of that date.

The PI made a presentation before the Committee on the major findings and outcome of his study. The PI informed that of a total of 56 soil samples, 20 water & wastewater samples collected from effluents from Upflow Anaerobic Sludge Blanket (UASB) Plant and nearby area, and 15 samples from sub-outlets from main canal through which effluents are discharged during 7 visits made during 2012-14 to the study site. The samples collected were studied for the extent of heavy metal pollution, and it was found that the on average ~65% of Cr is leachable. The sludge samples were treated with Biochar- a carbonaceous black porous material obtained by pyrolysis of biomass such as fallen leaves, wood chips, barks of trees, etc under oxygen-free atmosphere, using incubated methods and results were evaluated using Toxicity Characteristic Leaching Procedure (TCLP) and Sequential Extraction.

Major findings of the study:

a) Biochar, produced from biomass as a low cost and eco-friendly biomaterial has potential for the use in remediation of contaminated water and soil and can be produced in large scale.
b) A small-scale industry can be setup to produce Biochar from various available waste biomass.
c) Past studies have also shown that Biochar can also be applied in agricultural soil to enhance the plant production.
d) This Biochar can be used at the source that is the tanneries, to remove toxic metal ions to an extent of 85-90% prior to disposal of treated water into the local water bodies or before sending to STPs.
e) Sequential extraction of heavy metals such as Lead (Pb), Copper (Cu), Cadmium (Cd), Nickel (Ni), Zinc (Zn) apart from chromium is also possible. This can help recover precious metals from wastes other industrial wastes such as Bullion wastes, E-wastes, etc.

PI also informed that three research papers (and one under preparation) have been published in the journals.

The Committee desired to know from the PI about the proposed plan/idea for disposal of Biochar having high levels of the toxic $Cr^{+3'}$ removed from the contaminated soil and water samples. It was the view that the study may require to be scaled up to a Pilot or Demo Project to determine efficacy of the technology in field trials from techno-economic consideration. The Committee after deliberations desired that CPCB may also be consulted on the FTR for their comments/views.

4.3 **Some Mathematical Model for pollutant uptakes in plants of Prof. Arun Kumar, Government College, Kota (F.No. 19-20/2007-RE)**

Project Details: The project was started on 01.01.2009 for a period of 3 years for a total cost of Rs. 7,22,085/-. The tenure of the project was over on 01.11.2012. A total of Rs 5,57,600/- has been released so far in three instalments out of approved project cost of Rs 7,22,085/-. The FTR has been accepted in 6th Meeting of PAC on 13-14th June, 2013. However, as no details of Outcome-Outputs are available on the FTR, the PI was requested to make a brief presentation before the Committee for final settlement of Accounts. Copies of FTR were also sought for circulation for dissemination to all relevant organisations.

The consideration of the project was deferred as PI did not attend the meeting.

4.4 **Cellular /molecular mechanism involved for arsenic detoxification and tolerance in rice and Indian mustard varieties of Dr. Meetu Gupta, Jamia Milia Islamia, New Delhi (F.No. 19/48/2008- RE)**

Project Details: The project was started on 15.12.2009 for a period of 3 years for a total cost of Rs. 23,34,693/-. The tenure of the project was over on 15.06.2013. FTR has been accepted in 5th Meeting of Apex committee. However, details of Output-outcome of the FTR have not been given. The matter of final settlement is pending. the PI was requested to make a brief presentation before the Committee on outputs-outcome of his findings for final settlement of Accounts. Copies of FTR were also sought for circulation for dissemination to all relevant organisations. The consideration of the project was deferred as PI did not attend the meeting.

4.5 **"Removal of SO_2 and NO_2 from Coal Fired Thermal Power Stack Gases"** of Prof. M.K Mondal, IIT BHU,Varanasi, Uttar Pradesh (F.No. 19-85/2008 RE)

Project Details: The project was started on 30.10.2010 for a period of 3 years for a total cost of Rs. 25,73,280/-. The tenure of the project was over on 29.10.2013. A total of Rs 18,06,720/- has been released so far out of approved project cost of Rs 25,73,280/-. FTR has been accepted in the 19th Meeting of PAC held on 8-9th Dec, 2014.

PI has informed vide his email that the project was sanctioned when he was working at Banaras Hindu University. Presently, he is at Indian Institute of Technology (Banaras Hindu University). Both Banaras Hindu University and Indian Institute of Technology (Banaras Hindu University) are at present separate Institutes. According to the audit report, the sanctioned amounts of Rs 180720/- and Rs. 80500/- were not received at Banaras Hindu University which has been confirmed by PAO. Hence, the amount of Rs.1,37,190/- is shown as negative balance for the financial year 2013-14. Final settlement of the project is due.

Consideration of the project was deferred as PI did not attend the meeting.

4.6 **"Utilization of soil macro and microorganism for the decomposition of cellulosic waste materials"** of Dr. M Vasanthy, AF, Dept of Environment Biotechnology, School of Environment Sciences, Bharathidasan University, Tiruchirapalli (F. No. 19-116/2008-RE)

Project Details: The project was started on 02.09.2010 for a period of 3 years for a total cost of Rs. 30,04,080/-. The tenure of the project was over on 01/09/2013. A total of Rs 24,86,700/- has been released so far in 3 instalments out of approved project cost of Rs 30,04,080/-. The PI has submitted the FTR. PI has also submitted consolidated audited UC along with supporting documents during the meeting.

Objectives: The objective of the approved project was to determine efficacy of bio-composting using different materials. These included dry leaf material of common tree species such as Azadirachtaindica, Delonix regia, Tectonagrandis, Casuarina, Eucalyptus, Pongamiapurpuream, Cassia, Tephrosia purpurea, cellulosic materials such as paper cups, paper plates, food packaging materials, ice cream cups from the university campus. Different lignocellulosic waste namely leaf materials, paper waste and paper cups along with cow dung were subjected for vermicomposting using *Eudrilus eugeniae* and *Eisenia fetida* in different ratios. The materials were mixed the cow dung along with waste cellulosic materials and dry leaf materials in different composition made into heaps which were covered with polythene sheets and would be left undisturbed for about 40days for the production of the biodung.

PI made a presentation on the outcome of the study.

The major findings of the study are:

- Earthworms and certain strains of bacteria helped in the bio-composting process of cellulose waste material into vermi-compost/manure. The highest rate of degradation was observed for the vermi-compost produced using *Eudriluseugeniae,* when compared with *Eisenia fetida* and control.

- The organisms involved in degradation of leaf litter and paper waste were found to be *Bacillus cereus (KM289160), Bacillus thurigiensis (KM289164), Bacillus anthracis (KM289159), Bacillus funiculus (KM289165)* and *Lactobacillus pantheries (KM289166).* In ddtion, *Bacillus endophyticus (KM289167), Virgibacilluschiguensis (KM289163)* also degraded paper cup wastes. There was higher degradation of aliphatic and aromatic compounds present in the cellulosic waste. However, (High Density Poly Ethylene (HDPE) lining the paper cups were left intact after the period and were not degraded.

- It was found that in the vermi-compost final product, the lignin matrix was disaggregated by the earthworms, which grind the feed mixtures in the gut that contains cellulosic enzymes.

- Application of vermi-compost prepared from leaf materials using *Eudriluseugeniae* resulted in high rate of maturity in terms of increased shoot length, leaflets and number of flowers (100% higher number of flowers when compared with the control) was obtained when compared with control.

- The isolated bacterial strains and their enzyme production have facilitated the breakdown of the cellulosic compounds such as dry leaf materials, paper waste and paper cup waste.

- In the present study, a high degree of organic matter stabilization had been achieved in vermi-compost preparation regardless of the wastes subjected for the experiments namely the dry leaf materials and post consumer paper wastes.

- On the basis of C:N ratio, the maturity and organic matter stabilization was found be higher with vermi-composting effected by the microbes and earthworms.

Outcome of the study:

- Earthworms can be used for conversion of ligno-cellulose waste into manure, thereby reducing the aesthetic and solid waste pollution generated by these wastes.

- However, High Density Poly Ethylene (HDPE) used as lining in paper cups were not biodegraded by either bacteria or by the earthworms used in the study.

The PI informed the Committee that, in view of these important findings, environmental awareness campaigns were organised by the PI for different target groups of people such as local communities, schools, farmers, house wives etc of Ariyalur district, Tamil Nadu, South India for motivating them to replace use of HDPE lined paper cups with cups made of ceramic or stainless steel and use of leaf/ceramic/stainless steel plates instead of plastic plates as the most feasible solution for management of solid wastes.

It was advised by the Chairperson NBA, who is a member of the Committee to get approval from NBA for applying for patents on bioresources and observed that awareness on the Biological Diversity Act is lacking with the research community. The Committee after deliberations desired that the findings and outcome of the study be shared with Hazardous Substances Management (HSM) Division of the Ministry and with CPCB and for obtaining their comments/views, if any. The Committee also requested the PI to furnish an audited consolidated UC along with supporting documents for final settlement of dues.

4.7 **"Efficacy validation of soil amendments and microbial culture in reducing pesticides residues in soil, crops and ground water under field conditions"** by Dr. Anjana Srivastav, Department of Chemistry, College of Basic Science & Humanities, GB Pant University of Agriculture & Technology, Panthnagar, Uttarakhand (F.No. 19-22/2011-RE)

Project Details: The project was started on 01.04.2012 for a period of 3 years with a total cost of Rs. 25,37,760/-. Project tenure was over on 30.09.2015 (including 6 months extension). A total of Rs 21,10,960/- has been released so far in four instalments of the total approved project cost of Rs. 25,37,760/-. The PI has submitted a copy of FTR submitted to Ministry earlier, during the meeting.

Objectives of the study:

Persistent pesticides in soil often contaminate the next agricultural produce. Pesticides and their residues applied on crop or soil are washed down to reach to the aquatic bodies though run-off or leaching. The presence of pesticides in surface and ground water is a serious concern as it poses a great threat to the aquatic and human life. The problem of surface and ground water contamination due to pesticide could be tackled by ensuring their retention in soil and/or employing suitable microbial consortia in a scheduled sequence for reducing their leaching losses and ensuring their faster *in situ* degradation after the pest control. In the present investigation a detailed study was undertaken with selected pesticides commonly used in vegetables and grain crops. Validation of the efficacy of soil amendments and scheduled application of microbial consortium to reduce the pesticide residues in soil, crops and ground water has been done under field conditions.

The specific objectives of the approved project are: (i) survey of grain and vegetable growing belts of U.P and Uttarakhand for pesticide use and determination of pesticide residue in soil and agriculture produce, (ii) screening and isolation of soil microorganisms for their pesticide degradation capacity, (iii) to study the effect of different soil amendments on leaching of pesticides, (iv) to examine the effect of different soil amendments and selected microbial consortia individually and also in combination on degradation of pesticides under laboratory conditions, and (v) to demonstrate the potential of soil amendments in conjunction with the scheduled application of microbial consortia for reducing the pesticide residue levels in agricultural produce, soil and ground water under field conditions.

PI made a presentation before the Committee. The PI informed that survey was undertaken from intensively cultivated areas of different districts of Uttarakhand and Uttar Pradesh for collection of soil, water, seasonal vegetable and grains from fields where pesticide is being used.

The major outputs of the study:

- Based on the information collected on pesticides used by the farmers in Uttarakhand and Uttar Pradesh, it was concluded that Imidacloprid, Endosulfan, Cypermethrin and Chlorpyrifos insecticides and Carbendazim fungicide were commonly used against insect pests in vegetables.
- Fipronil and Chlorpyrifos insecticides were the common choice of the farmers in rice farming against rice pests whereas, for wheat crop, Sulfosulfuron was applied as a weedicide.

- Chlorpyrifos residues could be detected both in soil and water samples of Uttarakhand and U.P. but were within the safe limits.

- Cypermethrin was found above the recommended limits in some vegetables of the two states but its presence in soil and water was within MRL values.

- Fipronil and Sulfosulfuron was not above the MRL values in any of the grain and water samples collected from U.P. and Uttarakhand.

- Laboratory study observations indicated that the applications of soil amendments such as cereal straw @ 5 t ha^{-1} and FCD @ 500 kg ha^{-1} were more effective in reducing the leaching of pesticides in water and conjoint application of microbial consortia is further more effective in curtailing the leaching of pesticidesin application of these pesticides.

- The bacterial isolates which were used for the consortium development belonged to the *Bacillus, Pseudomonas, Microbacterium, Achromobater sp.* and this group biodegrades the pesticides to a higher extent as compared to the consortia mentioned in previous reports. The isolated pesticide degrading bacterial cultures were characterized as *Bacterium1-gw2-2 (SA2)*, *Bacillus spp.* Sulfo3*, Bacillus subtilis, Bacillus cereus, Bacillus sp. NH.217, Bacillus thruingiensis strain LA40.*

- On the basis of these results, two treatments i.e. application of cereal straw @ 5 t ha^{-1} and FCD @ 500 kg ha^{-1} were selected for the validation of their efficacies under field conditions for the imposition in field studies performed with rice, wheat and vegetable pea.

Outcome of the Study:

- From the results of the above investigation it can be recommended that the application of green manure/cereal straw @ 5 ton/ha or fresh cow dung @ 0.5 ton/ha along with microbial consortium prepared by mixing of *Bacillus, Pseudomonas, Microbacterium, Achromobater sp.*bacterial isolates at the time of transplanting/sowing can effectively prevent the leaching of pesticides into groundwater.

- Moreover their application in soil will also help in degrading the pesticides faster into non toxic compounds. This application can prove an effective measure in preventing water and soil pollution.

- The findings of the project can be utilised by the agriculture/farming industry or other organisations in preparing the mixture of green manure or fresh cow dung with microbial consortia using bacterial isolates mentioned above for bioremediation of soils contaminated with the commonly used pesticides discussed above.

- 10 Research papers have been published and 4 students have completed their PhD under the project. It is proposed

It was advised by the Chairperson NBA, who is a member of the Committee to get approval from NBA for applying for patents on bioresources and observed that awareness on the Biological Diversity Act is lacking with the research community. Also, requested the research group to look into the provisions of the Biological Diversity Act for doing research. The Committee after deliberations desired that copies of FTR be circulated to ICAR, Ministry of Agriculture, GoI and with Agriculture and Horticulture Depts of Govt of

Uttrakhand and U.P. for their comments/views, if any and also for implementation of recommendations/findings of the study.

4.8 **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/-. As per records available, 1st Sanction for Rs. 10,75,250/- was released on 22.03.2012. However, the UC received on 07.06.2013 was not in order. Ministry vide letter dated 11.10.2017 sought the FTR, Consolidated audited UC, ES and other supporting documents for release of balance payments and for settling of accounts, which are awaited.

PI was requested to present the Outputs-Outcome of the study before the Committee. The PI had confirmed of participation vide his email but has however not attended the meeting. The project was deferred for consideration in next meeting.

4.9 **"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 16.08.2010 for a period of 3 years with a total cost of Rs. 23,20,269/-. Project tenure was over on 05.01.2013. A total of Rs 19,41,415/- has been released so far in three instalments of the total approved project cost of Rs. 23,20,269/-. FTR was accepted by Apex committee in its 5th meeting held on 20.8.2014, however details of major findings and outputs-outcome of the project are not given. Demand draft of unspent amount is awaited.

The PI did not attend the meeting. However, hard copy of FTR has been received by post.

4.10 "**Pesticides degradation using cultural and biological tools to minimize ground water pollution"** by Dr. Anjana Srivastava, Assistant Professor, Department of Chemistry, College of Basic Science & Humanities, G B Pant University of Agriculture & Technology, Pant Nagar, Uttarakhand (F.No. 19-73/2005-RE)

Project Details: The project was started on 03.07.2007 with a total cost of Rs. 19,52,438/-. Project tenure was over on 31.03.2011. A total of Rs. 17,87,381/- has been released so far out of approved project cost of Rs. 19,52,438/-. FTR was accepted, however details of Outputs-Outcome are not available in the records. The PI has submitted consolidated audited UC, ES, etc for the final settlement during the meeting for processing for final settlement.

Broad Objectives of the Project:

- To examine the retention, release and transport of selected pesticides (Chlorpyrifos & Lindane) through coarse and fine textured soils.

- To evaluate the effect of organic manures and other soil amendments on retention, release and transport of selected pesticides (Chlorpyrifos & Lindane) through coarse and fine textured soils.

- To isolate pesticide degrading microbes from agricultural soils and examine their *in vitro* pesticide degradation potential.

- To prepare effective microbial consortia and examine their *in situ* potential for pesticide degradation.

The PI made a presentation. The major findings/achievement of the study are:

- The kinetics of adsorption of Chlopyrifos and Lindane conformed to the first order kinetics. The kinetics of desorption of both Chlorpyrifos and Lindane could be accounted the two components first order kinetics.

- The parameters of both the adsorption and desorption kinetics of Chlorpyrifos could be successfully predicted on the basis of common soil properties to assess the potential sites of leaching losses.

- Application of soil amendment especially, 5t FYM/ha could substantially reduce the leaching losses of Chlorpyrifos.

- The dissipation of Chlorpyrifos from soil could be encouraged by the application of 5t gypsum or 0.5t FCD ha-1. The dissipation of Lindane from soil was promoted by 5t FYM or 0.5 t FCD ha-1.

- Lysimeter studies revealed that a conjoint application of 5t FYM ha-1 and microbial consortia of *Bacillus* sp. and *Psuedomonas* sp. substantially reduced leaching losses of Chlorpyrifos. Similarly, a conjoint application of 5t FYM ha-1 and a microbial consortium of *Gordonia* spp. were effective in reducing leaching of Lindane onto soil.

Recommendations based on findings:

- Application of 5t FYM/ha can reduce leaching of Chlorpyrifos from agricultural soils. This treatment can also promote dissipation of Lindane from soil.

- Application of 0.5t FCD/ha can promote dissipation of both Chlorpyrifos and Lindane from soil.

- In order to reduce pesticide residues of Chlorpyrifos and Lindane in leaching water, soil and grown crops (maize and paddy crops), agricultural soils may be treated with 5t FYM/ha and microbial culture of *Bacillus* sp. and *Psuedomonas* sp. (for Chlorpyrifos) or microbial culture of *Gordonia* spp. The PI informed that the technology is proposed to be patented.

It was clarified that the dosage and frequency of application of these pesticides by farmers in actual conditions has not been replicated in the study. It was advised by the Chairperson NBA, who is a member of the Committee to get approval from NBA for applying for patents on bioresources and observed that awareness on the Biological Diversity Act is lacking with the research community. The Committee after deliberations desired that the FTR may be forwarded to CPCB, ICAR, Ministry of Agriculture, relevant State Departments for comments if any, and for dissemination of findings and for implementation and wider use.

4.11 "**Developing eco-friendly microbial consortia for pathogen removal in sewage waste water and mitigation of pathogen entry into hydrological cycle"** by Dr. P Dhevagi, Tamil Nadu Agriculture University, Department of Environmental Sciences, Coimbatore (F.No.19-13/2006-RE)

Project Details: The project was started on 01.04.2008 for a period of 3 years with a total cost of Rs. 11,55,964/-, later it was revised to Rs. 13,22,044/- due to revision of fellowship. Project tenure was over on 31.03.2011. A total of Rs 9,27,800 /- has been released so far out of approved project cost of Rs 13,22,044/-. FTR has been accepted, however details of Outputs-Outcome of the Project are not available in records. Last UC is received on 05/10/2010 for the FY 2009-10. PI has sought final settlement of the project., however audited consolidated UC & ES are still awaited despite reminders dated 16.10.2017, 10.01.2018 and 25.01.2018.

The PI had been requested to make a brief presentation before the Committee on the Outputs-Outcome of the Project, however PI has not attended the meeting.

4.12 "**Floristic studies on Macrophytic diversity of Nameri National Park (Assam) and Pakke Tiger Reserve (Arunachal Pradesh")** by Dr. Nilakshee Devi, Lecturer, Deptt. of Botany, Guwahati University, Guwahati (F.No. 14/16/2006-ERS/RE)

Project Details: The project was started on 01.12.2008 for a period of 3 years with a total cost of Rs. 7,66,080/-, which is revised to Rs. 9,17,280/- on account of Fellowship arrears. Project tenure was over on 30.11.2011. A total of Rs 6,79,446/- has been released so far out of approved project cost of Rs 9,17,280/-. FTR was accepted by Apex committee in its 6th meeting held on 11.02.2015, however details of outputs and outcome are not available in records. The PI has submitted FTR.

Broad Objectives of the project:

i) Classify the species on the basis of a) Status: RET, endemic, abundant and dominant, etc. b) Ethnobotanical and other uses: food, medicine, material culture etc.

ii) Categorize the species on the basis of their presence i) near streams, rivers, water bodies and dry places, etc. ii) in Core area and periphery i.e. disturbed habitats (in open and closed area).

iii) Relate the presence and absence of faunal species on the basis of above.

PI made a presentation. It was stated that extensive field surveys of Pakke Tiger Reserve and Nameri National Park was carried out during the period of December, 2008- November, 2011, to bring about an account of Macrophytic flora of the study areas. Several Field Surveys were carried out to collect macrophysics flora of the area. The specimens were collected in their flowering and fruiting stages at regular intervals covering all the seasons of the year. Collected specimens were compared with the collection of herbarium sheets of Botany Dept. G.U. and Kanjilal Herbarium, Shillong, CNH, NBRI and FRI. Regional and National Floras will be compared for identification.

Findings of the study:

A total of 560 macrophytic species have been identified in Nameri National Park (Assam) and Pakke Tiger Reserve (Arunachal Pradesh). Angiosperms were represented by 534 species belonging to 337 genera and 110 families. Pteridophytes were represented by 25 species belonging to 21 genera and 17 families. The lone family of Gymnosperm is represented by single genera with single species.

Recommendations including remedial measures:

Community conservation programmes may help to conserve the study area. From the findings also observed forest village people greatly depend on the forest bio-products such as taro, yam, wild fruits, wild vegetables, medicinal plants, dye, tarpin, resins and floriculture, etc. Alternative livelihood programmes could help in the conservation of bio-resources of Nameri National Park (Assam) and Pakke Tiger Reserve (Arunachal Pradesh). Alternately, cultivation of these bio resources should be promoted by the local Krishi Vigyan Kendras or by the District Forest officers so that the pressure on the Nameri National Park (Assam) and Pakke Tiger Reserve (Arunachal Pradesh) is minimised.

The Committee after deliberations desired that FTR may be forwarded to State Biodiversity Board of Assam, National Biodiversity Board and Botanical Survey of India (BSI) and to State Governments of Assam and Arunachal Pradesh for their information and comments, if any and for implementation of recommendations/findings. The PI was requested to furnish an audited Consolidated UC, ES and other supporting documents for settling of accounts.

4.13 "**Habitat Ecology and Species Diversity of Cordyceps in district Pithoragarh, Central Himalayas"** by Dr. Chandra Singh Negi, Department of Zoology, LSM Government Post Graduate College, Pithoragarh (Uttarakhand), Pithoragarh (F.No. 14/27/2010-ERS/RE)

Project Details: The project was started on 31.01.2012 for a period of 3 years with a total cost of Rs. 23,81,750/-. Project tenure was over on 30.01.2015. A total of Rs 19,18,100/- has been released so far out of approved project cost of Rs. 23,81,750/-. FTR was received but the same has not been accepted by the PAC because PI could not attended two meetings i.e. 15th Meeting held on 29th February & 1st March, 2016 and 17th Meeting held on 06-07th October, 2016. Now, the PI has attended this meeting. The PI was requested to furnish an audited Consolidated UC, ES and other supporting documents for settling of accounts.

Broad objectives of the project:

i) Exploration of the different known and lesser known habitats/ sites for the assessment of biodiversity across the Taxa-Cordyceps, principally within the district Pithoragrah which is being harvested for use as traditional medicine by Chinese.

ii) Habitat ecology and phytosociology of each individual species encountered in the district.

iii) Resultant effects of the anthropogenic pressure, including grazing pressure on the status of the Cordyceps, as well as other associated species.

iv) Bio-chemical analysis of the crude extracts for isolation of bio-active compounds, principally of cordycepic acid, mannitol, and polyphenols.

v) A comparative study the different bio-active compounds for their pharmacological effects.

The PI presented the Outputs of the Study:

- An extensive survey of the five different forests, apart from the four known alpine habitats of *Ophiocordyceps sinensis* was conducted, and specimens collected.
- In terms of species diversity across the taxon- *Cordyceps,* able to collect altogether 28 odd species, which can be identified on the basis of gross macro-morphological features as well as on the basis of host larval features.
- Soil texture, as well as macro- and micro-nutrient analysis of a number of *Cordyceps species* were carried out.
- Similarly, soil macro- and micro-nutrients for the 8 broad landscapes (habitat sites) too have been analyzed for C, P, K, S, Mg, Zn, Fe and Cu.
- A preliminary investigation of the growth/ life cycle of the host larva has been carried out, along with affect of the environmental variables on the population size of the host insect.
- Population dynamics of the host larva vis-à-vis the environmental variables and the impact of over-harvesting and the concomitant decline in larval population size have been duly carried out.
- To ascertain the medicinal properties for which it is being harvested, dried powdered samples of the 4 most conspicuous (relatively abundant species of *Cordyceps*), along with the species of commerce, i.e. Yartsa Gunbu were dispatched to CSIR-CDRI, Lucknow for pharmacological tests.

Major Findings of the Study:

- The study conducted over a period of 5 years conclusively shows a substantial decline in the host larva population. Rapid Vulnerability Assessment of the species show that (i) the species is vulnerable, (ii) over-harvesting that too mostly of immature samples, has resulted in drastic decline in not just the yield of Yartsa Gunbu, but of its host population too.
- Altogether 28 additional species of *Ophiocordyceps* and *Cordyceps* have been discovered. A number of these species (8) have been identified precisely from literature review, substantiated by gross macro-morphological studies, and the associated host insect sp.
- Three of the study sites were intensively covered to carry out the phytosociology, to ascertain the associated flora, as well as to ascertain the yield per hectare of Yartsa Gunbu. The yield per hectare is perceptibly less as compared to another area such as Tibet Autonomous Region, as also the quality of the samples.
- A number of moth species were collected during the study period. An inventory of the same has been created. Even though *Thitarodes* remain the known host species of *Cordyceps, Cordyceps* in itself is known to infect a broad category of insects or taxon, and not just limited to infecting the *Thitarodes.* Hence the inventory becomes important.

- Pharmacological tests using dried powdered samples was carried out at CSIR-CDRI, Lucknow were on the following: (i) Antidyslipidemic activity, (ii) antithrombotic potential, (iii) Antihyperglycemic potential and (iv) Hypolipidemic potential. The results are encouraging, since a number of these species reportedly has similar therapeutic use in Chinese Materia Medica, as well as in traditional use.

- Preliminary attempts at artificial culture of the *Cordyceps spp.* was carried out, with initial results being encouraging. Attempts were similarly made for growing *Cordyceps spp.* in solid culture, say in brown rice, which too though encouraging to begin with, finally showed signs of contamination. The experimental design needs to be made more tamper proof, as well as establishment of culture room would go a long way in successful culture of the different species.

It was informally shared that harvesting of *Cordyceps sp*. has become a very profitable venture in the region as a kilogram of the material which sold earlier for about Rs 40,000-80,000 can now fetch upto Rs 80 lakhs/kg (depending on quality) in the international grey market. This has led to disruption of the normal life of people in the region such as cessation of farming/agricultural actives, students abandoning their education, etc in search of *Cordyceps* during season. The sudden inflow of wealth has also changed the general peace and social fabric of the society/local communities. Due to the enormous business profits, the activity is now being controlled by certain elements that are not part of the local population/community. A large percentage of the harvest is also illegal and hence no records/ data would be available on the extent of benefits, etc to the State and reaching the actual land owners. However, since these issues were not part of the objectives of the study, more detailed study is required on these aspects.

The Committee noted that the findings are important in identifying the urgent need for conservation measures for these taxa. The Committee also was of the view that the medicinal properties of *Cordyceps* needs to be studied more thoroughly and in case it is not of much value, then awareness campaigns need to be launched against the use of such traditional medicine as this is drastically reducing the populations of *Cordyceps*. The Committee after deliberations desired that ICFRE, FRI, BSI, ZSI and State Biodiversity Board may also be consulted on the FTR for their comments/views and also forwarded to State Government and Forest Department of Uttarakhand for implementation of recommendations/findings and for necessary follow up. The Committee requested the PI to furnish an audited consolidated UC along with supporting documents for settling the accounts.

4.14 "**Monitoring of biomass stocks and forest community structures in temperate zone of Western Himalaya"** by Dr. Rajesh Thadani, Centre for Ecology, Development & Research (CEDAR), Dehradun (F.No. 14/81/2013-RE)

Project Details: The project was started on 21.10.2014 for a period of 3 years with a total cost of Rs. 20,91,250/-. Project tenure was over on 20.10.2017. A total of Rs 16,63,120/- has been released so far out of approved project cost of Rs. 20,91,250/-. The meeting was attended by Dr. Vishal Singh, CO-PI of the project. During the meeting, he has submitted FTR and a DD for unspent amount of Rs 27,698/- vide DD No.215908 dated 23.04.2018. Consolidated audited UC along with supporting documents is awaited.

Broad objectives of the project:

i) Assessing the biomass stocks and carbon sequestration rates of major forest forming species over an altitudinal gradient from 1600-2200 metresasl.
ii) To measure the soil carbon stock and macro nutrients status of different forests in the studied area.
iii) To understand the relationship between Leaf area Index and carbon sequestration rates of different forest forming species.
iv) Determining the population dynamics and community structure of the studied region.
v) Develop permanent plots for baseline data and long-term monitoring to study the impact of climate change

The PI presented the FTR. The PI informed in his presentation that the study sites were Nainital & Mukteshwar. An oak dominated forest type was found in both sites. Data on population dynamics provides an insight on the impact of climate change on the forests of the region. For long term monitoring, relatively undisturbed sites were chosen.

Findings of the Study:

- A total of 1085 trees were measured in the 48 plots (1.76 ha) with a tree density of 616 trees per ha.
- 22 tree species were identified of which 6 species constituted over 94% of the total stems.
- Soil Organic Carbon (SOC) was found more in Nainital transect but the difference was not significant.
- Banj stems were found to be largely in the 10-30 cm DBH class – implications of lower than expected stems in larger diameter class.

The Committee desired that DG, ICFRE may also be consulted on the FTR for their comments/views, if any and also copies forwarded to State Forest Department, Uttarakhand for implementation of recommendations/ findings. The Committee requested the PI to furnish an audited consolidated UC along with supporting documents for settlement of funds.

4.15 "**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 project was started on 01.02.2012 for a period of 3 years with a total cost of Rs. 27,32,890/-. Project tenure was over on 31.01.2015. 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 7thmeeting 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. No response has been received from PI to Ministry's recent letter dated since 14.03.2017.

PI had been requested to make a brief presentation before the Committee on the Outputs-Outcome of the Project, however PI has not attended the meeting.

4.16 "**A study of diversity of Insect Fauna in Loktak Lake of Manipur"** by Dr. M. Bhubaneshwari Devi, Reader, Deptt. of Zoology, P.G. Centre, D.M. College of Science, Imphal-795001 Manipur (F.No. 14/9/2011-ERS/RE)

Project Details: The project was started on 22nd March, 2012 for a period of 3 years for a total cost of Rs.18,00,125/-. The tenure of the project was over on 21.03.2015. A total of Rs.16,22,999/- has been released so far in 3 instalments out of approved project cost of Rs.18,00,125/-. FTR was accepted by the PAC in its 17th Meeting held on 06-07th October, 2016, however details of Outputs-Outcome are not available in records. As per checklist, GFR-12A etc. are awaited. Final settlement is to be done.

PI had been requested to make a brief presentation before the Committee on the Outputs-Outcome of the Project, however PI has not attended the meeting.

4.17 **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-793 022 (Meghalaya) (F.No. 14/32/2010-ERS/RE).

Project Details: The project was started on 22nd 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 in 2 instalments out of approved project cost of Rs.16,36,500/-. FTR was accepted in the 15th Meeting held on 29th February and 1st March, 2016, however details of Outputs-Outcome are not available in records. Consolidated ES & UC and other documents are still awaited. Several letters have been sent to PI.

PI had been requested to make a brief presentation before the Committee on the Outputs-Outcome of the Project, and for furnishing of documents sought above, however PI has not attended the meeting.

4.18 "**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 23rd 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 in 2 instalments out of approved project cost of Rs. 21,99,960/-.

Dr. Jamal Khan on behalf of PI has informed vide email that Dr. Azra Musavi will not be attending the meeting due to an accident and has fractured both her hand. He sought deferment for consideration in next meeting where she herself would like to make the presentation.

4.19 "**Ecological Studies on distribution patterns and food plant resources of butterflies along altitudinal gradients in Sub-alpine forests of Himachal Pradesh"** by 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 29th 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 25.05.2016. A total of Rs.26,71,000/- has been released so far in 4 instalments out of approved project cost of Rs.29,57,500/-. The PI has refunded two DDs for an unspent amount of 1,38,076/- (Rs.1,33,073/- and Rs.5,003/-).

PI has informed vide his e-mail that he will not be attending the meeting and sought deferment for consideration in next meeting.

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

Project Details: The project was started on 5th 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 04.12.2012. A total of Rs.26,25,795/- has been released so far in 2 instalments out of approved project cost of Rs.29,27,463/-. FTR already accepted, however Outputs-Outcome are not given. Final settlement is due.

PI had been requested to make a brief presentation before the Committee on the Outputs-Outcome of the Project, and for furnishing of documents sought above for settling of accounts, however PI has not attended the meeting.

4.21 "**Investigations on Active Constituents of High Altitude Medicinal Plants traditionally used as Non-Toxic Drugs"** by Dr. D. D. Joshi/ Dr Harsha Kharkwal, AMITY Institute of Phytomedicine and Phytochemistry & Amity Center for Carbohydrate Research (F.No. 19-27/2009- RE).

Project Details: The project was started on 30.10.2010 for a period of 3 years for a total cost of Rs.17,73,280/-. Project was granted extension till 31st March, 2015 with additional budget of Rs. 40,000/-. The tenure of the project was over on 31.03.2015. A total of Rs. 13,94,689/- has been released so far out of approved project cost of Rs. 17,73,280/-. PI has presented the progress of project before committee on 2-9th Dec, 2014 but has not submitted FTR. FTR is awaited and final settlement is also due. Audited Consolidated UC, ES and other documents are awaited for settling of accounts.

PI had been requested to make a brief presentation before the Committee on the Outputs-Outcome of the Project, and for furnishing of documents sought above, however PI has not attended the meeting.

4.22 "**Butterfly diversity in relation to landscape changes in the Walayar valley at Palakkad Gap in the Western Ghats"** by Dr. K.R. Sasidharan, Institute of Forest Genetics & Tree Breeding, Coimbatore, Tamil Nadu Coimbatore, Tamil Nadu (F.No. 23/10/2010-RE).

Project Details: The project was started on 31st January, 2012 for a period of 3 years for a total cost of Rs.12,99,250/-. The tenure of the project was over on 31.07.2015 with extension with no additional cost. A total of Rs.7,11,000/- has been released so far in 2 instalments out of approved project cost of Rs.12,99,250/. FTR was accepted by the PAC in its 17th Meeting held on 06-07.10.2016, however details of output-outcome of the project re

not available. The division has received a DD dated13.05.2016 of unspent amount of Rs. 5,465/-, the same has been deposited in Govt. account on 19.07.2016. Audited consolidated ES&UC and other documents are still awaited.

PI had been requested to make a brief presentation before the Committee on the Outputs-Outcome of the Project, and for furnishing of documents sought above for settling of accounts, however PI has not attended the meeting.

4.23 "**Diversity and abundance of ants from North-east Himalaya"** by Dr Himender Bharti, Assistant Professor, Department of Zoology and Environment Sciences, Punjabi University Patiala Punjab (F.No. 14/35/2011-RE).

Project Details: The project was started on 16th March, 2012 for a period of 3 years for a total cost of Rs.26,68,420/-. The tenure of the project was over on 15.03.2015. A total of Rs.24,14,000/- has been released so far in 3 instalments out of approved project cost of Rs. 26,68,420/-. The PI has refunded a DD for an unspent amount of Rs.7,351/-. FTR was accepted in 15th Meeting of PAC held on 29 February to 1st March 2016, however details of output-outcome of study not availble. Details on assets acquired under the project, bills and photograph of the equipments are still awaited. Final settlement of the project is due.

PI had been requested to make a brief presentation before the Committee on the Outputs-Outcome of the Project, and for furnishing of documents sought above for settling of accounts, however PI has not attended the meeting.

4.24 "**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 23rd 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 in 2 instalments out of approved project cost of Rs.31,17,190/-. FTR was accepted by the PAC in its17th Meeting held on 06-07th October, 2016, however details of Outputs-Outcome of the project are not available. Executive summary, UC and other documents are still awaited.

PI had been requested to make a brief presentation before the Committee on the Outputs-Outcome of the Project, and for furnishing of documents sought above for settling of accounts, however PI has not attended the meeting.

4.25 "**Assessment of Biodiversity in Uttarakhand, Western Himalaya"** by Dr. Geeta Asthana, Reader, Deptt. Of Botany, University of Lucknow, Lucknow (UP) (F.No.14/30/2008-ERS/RE).

Project Details: The project was started on 06th January, 2010 for a period of 3 years for a total cost of Rs.10,17,324/-. The tenure of the project was over on 05.01.2013. A total of Rs 9,16,600/- has been released so far in 3 instalments out of approved project cost of Rs.10,17,324/-. FTR was accepted in the 15th Meeting held on 29th February and 01st March, 2016, however details of Outputs-Outcome are not available. Audited consolidated ES & UC and other documents are still awaited.

PI had been requested to make a brief presentation before the Committee on the Outputs-Outcome of the Project, and for furnishing of documents sought above for settling of accounts, however PI has not attended the meeting.

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

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ANNEXURE-1

LIST OF PARTICIPANTS OF THE SECOND MEETING OF STEERING COMMITTEE ON R&D SCHEME HELD ON 18th JULY 2018

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

Special Invitees

1. Dr. Vimal Kothiyal, ADG (RP), ICFRE, Dehradun representing, DG, ICFRE
2. Shri Abhijit Roy, Under Secretary, CS-II, MoEFCC, New Delhi

MOEFCC (RE Division)

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

PROJECT INVESTIGATORS

1. Dr. Debajyoti Paul, IIT Kanpur, Kanpur
2. Dr. M Vasanthy, Bharathidasan University, Tiruchirapalli
3. Dr. Anjana Srivastav, GB Pant University of Agriculture & Technology, Panthnagar, Uttarakhand
   Dr. A. Sharma, Co-PI, GB Pant University of Agriculture & Technology, Panthnagar, Uttarakhand
   Dr. P.C. Srivastava, GB Pant University of Agriculture & Technology, Panthnagar, Uttarakhand
4. Dr. Nilakshee Devi, Guwahati University, Guwahati
5. Dr. Chandra Singh Negi, LSM Government Post Graduate College, Pithoragarh
6. Dr. Vishal Singh, Co-PI – representing Dr. Rajesh Thadani, Centre for Ecology, Development & Research, Dehradun

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ANNEXURE-2

LIST OF PROJECTS LISTED FOR CONSIDERTION THE 2nd MEETING OF STEERING COMMITTEE HELD ON 18.07.2018

S. N.	File No. & Title of the Project	Thematic area
1.	No.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.	Hazardous Wastes
2.	No. 19/45/2010-RE Reduction of chromium toxicity using nano particles: laboratory and field scale study.	Pollution
3.	No. 19-20/2007-RE Some Mathematical Model for pollutant uptakes in plants.	Pollution
4.	No.19/48/2008- RE Cellular /molecular mechanism involved for arsenic detoxification and tolerance in rice and Indian mustard varieties.	Pollution
5.	No.19-85/2008 RE Removal of SO_2 and NO_2 from coal fired thermal power stack gases.	Pollution
6.	No.19-116/2008 -RE Utilization of soil macro and microorganism for the decomposition of cellulosic waste materials.	Pollution
7.	No. 19-22/2011-RE Efficacy validation of soil amendments and microbial culture in reducing pesticides residues in soil, crops and ground water under field conditions.	Pollution
8.	No. 19-29/2011-RE STREAT- Sustainable Semi-Decentralized Sewage Treatment-Wastewater Reuse, Nutrient Recovery and Biogas production in the Delhi Metropolitan Area.	Pollution
9.	14/28/2008-ERS/RE Impact of cell-phone technology on selected plants and animals	Pollution
10.	19-73/2005-RE Pesticides degradation using cultural and biological tools to minimize ground water pollution	Pollution
11.	No.19-13/2006-RE Developing eco-friendly microbial consortia for pathogen removal in sewage waste water and mitigation of pathogen entry into hydrological cycle	Pollution
12.	No.14/16/2006-ERS/RE Floristic studies on Macrophytic diversity of Nameri National Park (Assam) and Pakke Tiger Reserve Arunachal Pradesh.	Wildlife
13.	No.14/27/2010-ERS/RE Habitat Ecology and Species Diversity of Cordyceps in district Pithoragarh, Central Himalayas.	Forestry

14.	No.14/81/2013-RE Monitoring of biomass stocks and forest community structures in temperate zone of Western Himalaya.	Forestry
15.	No.14/3/2011-ERS/RE Studies on Abundance, Diversity and Eco-biology of Parasitic Hymenoptera of Rice ecosystems in Kerala.	Ecology
16.	No.14/9/2011-ERS/RE A study of diversity of Insect Fauna in Loktak Lake of Manipur	Ecology
17.	No.14/32/2010-ERS/RE Impact of fire and grazing on structure and function of grassland ecosystem of Cherrapunjee	Ecology
18.	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
19.	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
20.	No.19/13/2008- RE Bryophytes – tool for national multi-elemental atmospheric survey of 100 years	Biodiversity
21.	No. 19-27/2009- RE Investigations on Active Constituents of High Altitude Medicinal Plants traditionally used as Non-Toxic Drugs	Biodiversity
22.	No.23/10/2010-RE Butterfly diversity in relation to landscape changes in the Walayar valley at Palakkad Gap in the Western Ghats.	Biodiversity
23.	No. 14/35/2011-RE Diversity and abundance of ants from North-east Himalaya	Biodiversity
24.	No.14/15/2010-ERS/RE Studies on Ecology and Diversity of Nematodes ofPirPanjal Range in Jammu & Kashmir	Biodiversity
25.	No. 14/30/2008-ERS/RE Assessment of Biodiversity in Uttarakhand, Western Himalaya	Biodiversity