

NMHS Annual Progress Report – Pro forma

Kindly fill the NMHS Annual Progress Report segregated into the following 11 segments, as applicable to your project nature and outcomes.

1. Project Information
2. Project Site Details
3. Project Activities Chart w.r.t. Timeframe [Gantt or PERT]
4. Financial and Resource Information
5. Equipment and Asset Information
6. Expenditure Statement and Utilization Certificate (UC)
7. Project Beneficiary Groups
8. Project Progress Summary (as applicable to the project)
9. Project Linkages (with nearby Institutions/ State Agencies)
10. Additional (publication, recommendations, etc.)
11. Project Concluding Remark

Please let us know in case of any query at: [nmhspmu2016@gmail.com](mailto:nmhspmu2016@gmail.com)

## NMHS Progress Report

(Period from 1<sup>st</sup> April 2017 to 31<sup>th</sup> March 2018 – Second year report)

### 1. Project Information

Project ID:	NMHS/2015-16/SG09/09	Sanction Date:	31/03/2016
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Project Title:	Post-Fire Management in the Pine Forests of Indian Himalayan Region by studying, conserving and distributing culturable microbial biota to increase ecological succession and to revive forest productivity
BTG:	

PI and Affiliation (Institution):	Prof. Adesh K Saini (PI) Center of Research on Himalayan Sustainability and Development, Post Box No.9, Head Post Office, Solan (HP) – 173212	Prof. Kartar S Verma (PI) DR YSP University of Horticulture and Forestry, Nauni, Solan, HP.	Dr Anita Pandey (PI) GB Pant Institute of Himalayan Environment & Development Kosi-Katarmal, Almora 263 643, Uttarakhand
Name & Address of the Co-PI, if any:	NA		

Structured Abstract - detailing the current year progress [Word Limit 250 words]:	In the present year we characterized the microbes by 16S rDNA gene sequencing. We found <i>Burkholderia sp.</i> , <i>Bacillus sp.</i> , <i>Serratia sp.</i> , <i>Enterobacter sp.</i> and <i>Pseudomonas sp.</i> from unburnt soil samples whereas from burnt soil sample we found majorly <i>Bacillus sp.</i> and few <i>Acinetobacter sp.</i> Bacteria from unburnt region exhibited plant growth promoting (PGP) properties such as IAA production, phosphate solubilization and ammonia production, siderophore production and anti-fungal activity whereas none of the bacteria from burnt region showed PGP traits indicating that the bacteria present in unburnt region are beneficial in improving the growth of forest flora. This is also true for the rhizobacteria isolated from fodder grasses where we found absence of PGP traits carrying bacteria from fodder grasses appearing after forest fire. Another important aspect we studied is regarding the change in quality of soil owing to fire. We found that available nitrogen and phosphorus in burnt forest was low as compare to unburnt forest. But the available potassium was found to be slightly higher in burnt forest as compared to unburnt forest. These
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important information which suggest that forest fire are not fruitful for the forest ecosystem will be shared with community and for which we have developed videos, poster and brochures which will be shared with the villagers. Besides this we have also isolated mycorrhizal strains from forest and in our preliminary study we found that forest fire leads to decrease in the overall number of mycorrhizal spores and their variety also. We have also amplified the ITS sequence of fungal strains form forest which further need to be evaluated.

Project Partner Name	Affiliations	Role & Responsibilities
Prof. Adesh K Saini (PI)	Center of Research on Himalayan Sustainability and Development, Post Box No.9, Head Post Office, Solan (HP) – 173212	<ul style="list-style-type: none"> <li>• Collection of microbiota from selected pine forest regions of Himachal Pradesh.</li> <li>• Characterization and Collection of microbes from soil of forest fire.</li> <li>• Maintaining the cultures and performing the pilot scale rejuvenation attempts in control fields.</li> </ul>
Prof. Kartar S Verma (PI)	College of Forestry, DR YSP University of Horticulture and Forestry, Nauri, Solan, HP.	<ul style="list-style-type: none"> <li>• Data collection for the forest fire in the selected areas for last two years in Himachal region.</li> <li>• Involving the communities for knowing the availability and uses of the microbial resource.</li> <li>• Experiments related to soil rejuvenation.</li> <li>• Statistical analysis of data</li> </ul>
Dr Anita Pandey (PI)	GB Pant Institute of Himalayan Environment & Development Kosi-Katarmal, Almora 263 643, Uttarakhand	<ul style="list-style-type: none"> <li>• Guide the student for involving the communities for knowing the availability and uses of the microbial resource.</li> <li>• Advisor for analyzing the effectiveness of replenishment of microbes and their re-establishment</li> </ul>
[Add]		

## 2. Project Site Details

Project Site	Bajhol, Manjholi, Sultanpur, Jabli and Seri villages of Solan Districts.
IHR State Covered	Himachal Pradesh
Long. & Lat.	Range Latitude 30°51'21.2" to 30°90'59.7" Longitude 77°6'24.5" to 77°12'07.7"
Site Maps	NA
Site Photographs	NA

## 3. Project Activities Chart w.r.t. Timeframe [Gantt or PERT]

PROJECT ACTIVITIES	WORK UNDERTAKEN				
	Year 2017-2018 (Apr 2017 - Mar 2018)				
	Qtr. 1	Qtr. 2	Qtr. 3	Qtr. 4	
Project Activity 1	16S rDNA sequences were analyzed and submitted	PGPR of forest grasses were characterized.	Nitrogen, Phosphorus and Potassium estimation was done	Making videos, banners for awareness. Contacting local community.	Output for Project activity is given below*

\*OUTPUT for Project activity 1

-To confirm the biodiversity loss, bacterial strains from burnt region and from unburnt region were randomly picked and identified by 16s rDNA sequencing.

- Results of sequencing concluded that Bacillus sp. is more prominent in burnt region where as in unburnt region mixed population is present. Same result was also indicated by Gram's staining and colony morphology.

- Biofertiliser and biocontrol assay was performed for the analysis of plant growth promoting traits of bacteria isolated from burnt and unburnt region.
- Among the total isolates 90% of bacteria from unburnt region showed all the PGPR traits whereas in case of burnt region only 10% of bacteria showed PGPR activities.
- Similarly, convincingly we have found that PGP bacteria were present only in the rhizospheric region of fodder grass growing in unburnt forest. Though we have not sequenced the 16S rDNA of these beneficial bacteria but 90 % of them belong to gram negative class.
- Moreover we have also collected mycorrhizal strains as suggested in the meeting in Sep 2017, and our preliminary results strongly indicate a loss of mycorrhizal spores due to fire.
- Repository of all the PGP bacteria were maintained as 30% glycerol stocks at -80 °C.
- Nutrients estimation concluded that available nitrogen and phosphorus levels reduces after the forest fire while potassium levels is slightly increased.
- Developed Videos and Pamphlets which are going to be used to make community interaction more effective.

#### 4. Financial and Resource Information

*Note:* A separate bank account is expected to be opened for NMHS Project as per the provision of Direct Beneficiary Account (DBA) as laid out by the Govt. of India and also facilitate the audit of accounts. The interest earned out of the NMHS project funds should be reported clearly in the utilization certificate.

Total Grant:	<b>Rs 4026000.00 excluding 5% (Rs 2,01,300) grantee contribution</b>	Grant Received Date:	Rs. 28,97,400, 13/07/2017
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Project Partner(s)	Affiliations/ Institution	Budget Allocated to	Work Done
Prof. Adesh K Saini (PI)	Center of Research on Himalayan Sustainability and Development, Post Box No.9, Head Post Office, Solan (HP) – 173212	Perform Activity 1	Mentioned in project activity 1.
Prof. Kartar S	College of Forestry, DR YSP University of	Perform Activity 1	Mentioned in project activity 1.

Verma (PI)	Horticulture and Forestry, Nauni, Solan, HP.		
Dr Anita Pandey (PI)	GB Pant Institute of Himalayan Environment & Development Kosi-Katarmal, Almora 263 643, Uttarakhand	Perform Activity 1	Mentioned in project activity 1.
[Add]			

#### Project Staff Information:

S. No.	Name	Qualification	Designation	Fellowship/ Wages paid	Remarks
1.	Ms. Divya Mittal	M.Sc. Microbiology, NET	Junior project fellow	17600/month (including HRA)	NA

#### 5. Equipment and Asset Information

S. No.	Equipment Name (Qty)	Details (Make/ Model)	Cost	Date of Installation	Photographs of Equipment	Lowest Quotation, IF NOT purchased
1.	No equipment was purchased in this year					

#### 6. Expenditure Statement and Utilization Certificate

Please update the annual Expenditure Statement and Utilization Certificate (UC) periodically.

#### Expenditure Information: In Rs.

S. No.	Financial Position/Budget Head	Funds Sanctioned (2017-18)	Expenditure	% of Total cost (Rs 7,45,728)
I	Salaries/Manpower cost	211200.00	211200	28.32131823

II	Travel	15000.00	33812.00	4.53409286
III	Expendables & Consumables	500000.00	662625.00	88.8561245
IV	Contingencies	10000.00	9200.00	1.23369379
V	Activities & Other Project cost	Nil		
VI	Institutional Charges	Nil		
VII	Equipments	0	0*	0
	Total	736200	916837	122.94
	Interest earned	5446 <sup>#</sup>		
	Grand Total	745728		

Period	Expenditure Statement	Utilization Certificate (UC)
Annual (2016-2017)	[Attach]	[Attach]

## 7. Project Beneficiary Groups

Beneficiary Groups [Capacity Building]	Target	Achieved
No. of Beneficiaries with income generation:	NA	NA
No. of stakeholders trained, particularly women:	NA	NA
No. of capacity building Workshops/trainings:	NA	
No. of Awareness & outreach programs:	8	7
No. of Research/ Manpower developed:	One Ph.D. and 5 M. Sc. students were also trained	One Ph.D. and 5 M. Sc. students were trained

## 8. Project Progress Summary (as applicable to the project)

Description	Total (Numeric)	Description
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<b>IHR States Covered</b>	One	Himachal Pradesh
<b>Project Site/ Field Stations Developed:</b>		NA
<b>No. of Patents filed (Description):</b>	NA	NA
<b>Article/ Review/ Research Paper/ Publication:</b>	NA	NA
<b>New Methods/ Modellings Developed (description in 250 words):</b>	NA	NA
<b>No. of Trainings (No. of Beneficiaries):</b>	NA	NA
<b>Workshop:</b>	NA	NA
<b>Demonstration Models (Site):</b>		NA
<b>Livelihood Options:</b>	NA	NA
<b>Training Manuals:</b>	NA	NA
<b>Processing Units:</b>		NA NA
<b>Species Collection:</b>	Sixty Plant growth promoting bacteria were isolated and preserved in 30% glycerol stocks at -80 °C. Thirty PGP bacteria were preserved from rhizosphere of fodder grasses	Total 60 PGPRs were isolated and preserved. Repository were prepared for In <i>plantae</i> experiment.
<b>Species identified:</b>	16S rDNA of 28 strains is amplified and sequenced (9 from burnt and 19 from unburnt regions) Table 1	28 strains were picked to analyze biodiversity loss.
<b>Database/ Images/ GIS Maps:</b>	Submitted at NCBI database	MG051194 MG051195 MG051196 MG051197 MG051198 MG051199



	MG051200 MG051201 MG051202 MF574411 MF574412 MF574413 MF574414 MF574415 MF574416 MF574417 MF574418 MF574419 MF574420 MF574402 MF574403 MF574404 MF574405 MF574406 MF574407 MF574408 MF57449 MF574410
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Note: Photos/ maps should be attached in high quality in compatible formats viz., JPEG, .JPG, .PNG, .SHP, etc. along with a suitable figure legend/ caption.

#### 9. Project Linkages (with nearby Institutions/ State Agencies)

S. No.	Institute/ Organization	Type of Linkages	Brief Description
1.	Local Panchayat (Bhaulti and Kumarhatti, Solan),	Awareness	
2.	Women Workers in local industries and educational institutes	Awareness	

#### 10. Additional (publication, recommendations, etc.)

Time Period	Publications (Research Papers, Information Material, Policy drafts, Patents, etc.)
Annual [Year2017-18]	Pamphlet Banner Videos

#### 11. Project Concluding Remark

Kindly update the following Progress Parameters for the Reporting Period:

Project	Project Output	Progress made against
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Objectives	against each objective	Monitoring Indicators (specified in Sanction Letter)	Remarks
1. Analyze the change in microbial biodiversity in the Pine forest after fire outbreak as compared to the nearby unaffected area.	- Biodiversity loss was analyzed by evaluating colony forming unit colony morphology and Gram staining of approx. 4000 colonies In previous year 2016-2017	Indicated loss of gram negatives rods, cocci in the burnt region. Even gram staining of bacteria, isolated after one year of forest fire showed similar results concluded Gram positive bacteria is dominant in burnt region.	
2. Collection, identification and characterization of bio fertilizer and bio control properties of bacterial and fungal microbes and make their repositories based on their geographical location to serve as feeding-bank to revitalize forest soil upon fire.	Biodiversity loss was analyzed by performing biocontrol and biofertilizer assays. (Fig 1) Further we have collected 20 soil samples after 2 weeks of forest fire from burnt and unburnt forest and examined nutrient level (Fig 2)	We found that PGPR traits were lost in bacteria isolated from burnt soil sample, Indicated increased population of bacteria in burnt region is not beneficial at all.  This result was confirmed by 16Sr DNA sequencing (Table 1 and Fig 3)  - We found that fire reduces available nitrogen and phosphorus from the soil. While values of potassium increases after the forest fire. - Binding capacity and erosion ability - We also noticed that the region having repeated fire leads to medium to large landslides.(Fig 4)	
3. Involving the		Videos were made for the	

local panchayats and community people in the collection process to make them aware of the losses occurred due to fire		effected community interaction (video 1). Local panchayats were involved for the discussion regarding forest fire (Fig 5)	
4. Test different ways to apply consortium from the repositories bank to the fire affected areas and analyze its cost-effectiveness, feasibility and improvement in the forest productivity and soil parameters as compared to untreated fields.			

<b>Methodology (in brief):</b>	<p>PGPR traits (Phosphate solubilization, IAA production, ammonia production, siderophore production and Antifungal experiment) were determined in the bacterial population isolated from burnt and unburnt region. Biodiversity loss was confirmed by 16SrDNA sequencing. For that we randomly picked nine bacteria from burnt and 19 from unburnt region on the basis of their colony morphology. Extraction and purification of genomic DNA from nutrient broth culture was carried out by using Quick-DNA Fungal/bacterial Miniprep Kit (ZYMO RESEARCH Cat. No. D6005) as per the manual. For identification of bacteria 16S rDNA was amplified as described by (Sambrook et al. 1989) with universal primers 27F (5'-AGAGTTTGATCCTGGCTCAG-3') and 1492R (5'GGTTACCTTGTTACGACTT-3')</p> <p>For nutrient estimation, total nitrogen was estimated by Kjeldahl method. The available phosphorus was extracted with sodium bicarbonate (Olsen et. al. 1954). The estimation of potassium content was estimated on flame photometer (Black et al. 1965).</p>
<b>Major Research Achievements:</b>	Results of sequencing suggested that <i>Bacillus sp</i> was more prominent in burnt region whereas in case of unburnt region mixed population of

	<p><i>Burkholderia, Pseudomonas, Serratia, Enterobacter, Pantoea, Klebsiella, Acinetobacter and Bacillus</i> were present. Also bacteria isolated from burnt region showed no plant growth promoting traits as compare to bacteria isolated from unburnt region. From questionnaire we came to know that villagers bought fodder grass from the market for two months after forest fire. It ultimately affects the cost of milk production. We have developed videos for the community interaction. Also an initial survey was done with the Panchayat leaders. - We found that fire reduces available nitrogen and phosphorus from the soil. While values of potassium increases after the forest fire. We also noticed that the region having repeated fire leads to medium to large landslides approx. 14'6" ft.</p>
<p><b>Brief Conclusion</b> - the current year progress – during the reporting period (point-wise)</p>	<ul style="list-style-type: none"> <li>-In nutshell we found that forest bed is depleted of beneficial plant growth promoting bacteria and mycorrhizal strains due to forest fire.</li> <li>-This fact is further verified by the fact that there is loss of PGP rhizobacteria in fodder grasses also.</li> <li>-PGP bacteria have been shown to be beneficial for growth of all the plants including grasses.</li> <li>-Moreover the forest bed is also depleted for essential nutrients like N and P.</li> </ul>
<p><b>Progress Achieved (%)</b></p>	<p>70%</p>
<p><b>Remaining work to be</b></p>	<ul style="list-style-type: none"> <li>- For the next year we plan to organize awareness by using effective means of videos and small plays. In agreement with the forest department, we would be installing road side banners showing whom to contact in case of fire and what are the legal and environmental repercussions of lighting fire in forest area.</li> <li>-We will analyse the effect of forest fire on mycorrhizal population.</li> <li>-ITS sequencing of isolated fungal strains.</li> <li>-We will study different ways to apply consortium from the repositories bank to the fire affected areas after laboratory <i>In plantae</i> experiment on Seedlings of pea, gram and wheat and analyze its cost-effectiveness.</li> </ul> <p>Effect of consortium will be made and its effectiveness will be tested.</p>

**Submitted to:**

Nodal Officer, NMHS-PMU  
National Mission on Himalayan Studies (NMHS)

**Submitted by:**

Project PI (Signature):  
Institution (Seal):

	<p><i>Burkholderia, Pseudomonas, Serratia, Enterobacter, Pantoea, Klebsiella, Acinetobacter and Bacillus</i> were present. Also bacteria isolated from burnt region showed no plant growth promoting traits as compare to bacteria isolated from unburnt region. From questionnaire we came to know that villagers bought fodder grass from the market for two months after forest fire. It ultimately affects the cost of milk production. We have developed videos for the community interaction. Also an initial survey was done with the Panchayat leaders. We found that fire reduces available nitrogen and phosphorus from the soil. While values of potassium increases after the forest fire. We also noticed that the region having repeated fire leads to medium to large landslides approx. 14'6" ft.</p>
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Submitted to:  
 Nodal Officer, NMHS-PMU  
 National Mission on Himalayan Studies (NMHS)

Submitted by:  
 Project PI (Signature)  
 Institution (Seal):

Shoolini University of Technology  
 & Management Sciences  
 Anand Campus, The Mall  
 Solan-173212 (H.P.)

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*E-mail:* [nmhspmu2016@gmail.com](mailto:nmhspmu2016@gmail.com)

Dated (28/05/2018):

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Please fill the NMHS Progress Report pro forma as applicable with respect to time and other requirements and return via post/ e-mail. In case of any query, please contact at: [nmhspmu2016@gmail.com](mailto:nmhspmu2016@gmail.com)