Template/Pro format for Submission

NMHS-Himalayan Institutional Project Grant

NMHS-FINAL TECHNICAL REPORT (FTR)

Demand-Driven Action Research and Demonstrations

NMHS Reference No.:	NMHS-2017-18/MG-33/567

Date of Submission:	1	2	0	1	2	0	2	3
	d	D	m	m	y	y	y	y

PROJECT TITLE (IN CAPITAL)

MAINSTREAMING LANDSCAPE APPROACH FOR BIODIVERSITY, CONSERVATION IMPROVED LIVELIHOODS AND ECOSYSTEM HEALTH IN KAILASH SACRED LANDSCAPE PART OF INDIA

Project Duration:*from* (**26.02.2018**) *to* (**30.11.2021**).

***Submitted to*:**
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***Submitted by*:**
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NMHS-Final Technical Report (FTR) *template*

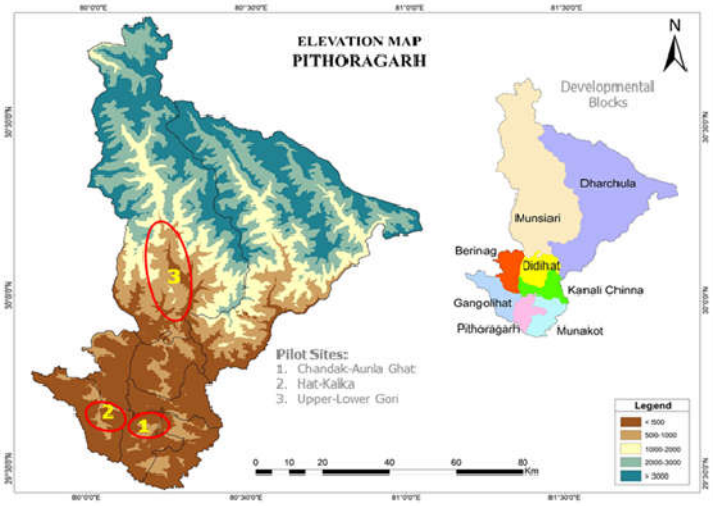
Demand-Driven Action Research Project

DSL: Date of Sanction Letter							
2	6	0	2	**2**	**0**	**1**	**8**
d	d	m	m	y	y	y	y

DPC:Date of Project Completion							
3	0	1	1	**2**	**0**	**2**	**1**
d	d	m	m	y	y	y	y

Part A: Project Summary Report

1. Project Description

i.	**Project Reference No.**	NMHS-2017-18/MG-33/567							
ii.	**Type of Project**	Small Grant		Medium Grant	√	Large Grant			
iii.	**Project Title**	Mainstreaming landscape approach for biodiversity conservation, improved livelihoods and ecosystem health in Kailash Sacred Landscape part of India							
iv.	**State under which Project is Sanctioned**	Uttarakhand							
v.	**Project Sites (IHR States covered)** **(Maps to be attached)**	Pithoragarh District, Uttarakhand (1 State Covered) Long. & Lat. - 29°40.507' N 80°30.210' E 							
vi.	**Scale of Project Operation**	Local		Regional	√	Pan-Himalayan			
vii.	**Total Budget/ Outlay of the Project**	INR 295,80,960							
viii.	**Lead Agency**	Uttarakhand Biodiversity Board, Dehradun							

	Principal Investigator (PI)	Chairman, Uttarakhand Biodiversity Board, Dehradun
	Co-Principal Investigator (Co-PI)	Member Secretary, Uttarakhand Biodiversity Board, Dehradun
ix.	**Project Implementing Partners**	**Uttarakhand Biodiversity Board**
	Key Persons / Point of Contacts with Contact Details, Ph. No, E-mail	Member Secretary, Uttarakhand Biodiversity Board Dehradun. Ph No.: 0135-2769886 email: sbbuttarakhand@gmail.com

2. Project Outcomes

2.1. Abstract

The proposed project aims at protecting and enhancing biodiversity conservation through sustainable use of ecosystem services in an integrated and a multidisciplinary manner, combining natural resource management with environmental and livelihood considerations across Kailash scared landscape (KSL) part of India. There is an ongoing need for performance information from the partnering agencies of NMHS project. The main objective of the project is to identify, develop& promote positive externalities (Intensive based mechanism; Biodiversity Management sites of cultural & biological diversity; Establish and Strengthen community institutions; Ecosystem Services; Identify critical ecosystem and suggest management plans: Institutionalize landscape level Biodiversity Knowledge network. For the above mentioned objectives, intensive studies/interventions is carried out in the three pilot sites namely: (i) Chandak Aunla Ghat watershed (Bin Block, Pithoragarh); (ii) Hat- Kalika watershed (Gangolihat Block, Pithoragarh); (iii) Upper and Lower Gori watershed (Munsiyari Block, Pithoragarh). The report highlights the progress made in the three years of the project period owing to the long term project vision and envisages to promote biodiversity conservation, ecosystem management and sustainable livelihoods of dependent communities in the target landscape and beyond. The selected in the Indian part of KSL is extremely rich in biodiversity, socio-cultural and transboundary historical linkages. The spiritual and sacred values of this landscape attract tens of thousands of pilgrims every year. However, at the same time the landscape is also known for its extreme vulnerability to changing faces of development and climate. As a result, the rich biological diversity, the ecosystem goods and services and the value based cultural heritage of this landscape are under severe pressure. The achievements of the project will be consolidated and developed further and translated into real physical outputs on the ground by UBB in collaboration with other partners, line departments and the Biodiversity Management Committees at local level.The partner institutions are being encouraged to help the local BMCs to formulate concrete proposals for

conservation of Biodiversity, Climate Resilience and Livelihood to be supported by Biodiversity fund of the Uttarakhand Biodiversity Board.

2.2. Objective-wise Major Achievements

S. No.	Objectives	Major achievements (in bullets points)
1	**To develop and promote Incentive based Mechanisms (IBM) for Biodiversity Conservation and Benefit Sharing.**	• Constitution of 10 BMCs in 03 pilot sites • Capacity Building/Training of the BMCs on Biodiversity Act 2002 and BMC functioning and management. • Preparation of 10 PBRs and 03 BCPs in consultation with local people. • The BMC are in process of formulating a Biodiversity Conservation and Livelihood projects to be supported by UBB. • The concerned Forest Department of the region has been entrusted with the task of supporting the BMCs in this endeavor.

2	**To strengthen community Institutions and establish convergence or restoration of degraded habitats and management of ecosystems.**	I. Prepared training modules for different types of restoration interventions • Five training modules: Silvi-pastoral, Silvi-medicinal, Silvi-Horticulture, Nursery Development and management, Invasive species Management module) have been prepared for the use of the locals. • These modules have also been prepared for different types of restoration interventions. However, funds required for the publication of these modules. II. Organized field workshops/hands-on trainings in selected pilot sites to community institutions • Through 25 training/field workshops and 15 meetings/Awareness programmes - Developed skills and capacity of 1051 villagers (622 Male, 429 Female) from 38 villages in the landscape. III. Conducted needs assessment of communities and development of Restoration Opportunity Map. • Base line information related to geographical and ecological attributes with special reference to forest resources were collected from all 3 pilot sites. • Restoration opportunity Map was prepared and prioritization of degraded land and species has been done. IV. Conducted participatory interventions in pilot sites for establishment of restoration models. • Around 30 ha demonstration site has been developed in the Gram Panchayats: Chandak Aunla Ghat Watershed (Naikina, Digtoli), Lower Gori Valley (Lumti, Baram), Haat Kalika Watershed (Rawalgaon, Kamad and Jajut) through participatory approach • A total of 23,500 tree and herb species were planted in 30 hectare of degraded land which are surviving at the rate of 69.8% among three pilot sites after three years of plantation. V. Organized district-level synergy-building events to converge with various on-going

		and proposed restoration activities in the landscape • Three block and one district level synergy-building events were organised to converge with various on-going and proposed restoration activities in the landscape. • Willingness of relevant Block level agencies to follow the management/ restoration models for up-scaling across landscape has been obtained.

3	**To harness heritage value of cultural and biological diversity, i.e., wild and domesticated for livelihood promotion and conservation of biodiversity.**	• Regular Meetings were done with SHGs in Lumti, Baram, Metali, Bangapani and Jarajibli. The partners opinion and inputs were also incorporated to initiate home stay and also to strengthen the livelihood activities in area based on local products i.e. spices and millets. The nature tourism with WII for Orchid area promotion as tourism site was taken up. • People's Biodiversity Register (PBR) in 3 BMCs completed by TAG (Bera, Jamrari and Khitoli). The PBR documentation is supported by GIZ. • SHGs of village Lumti has been encouraged to market their quality value added product such as turmeric, chilly, coriander, etc. The packaging and branding was attempted by the SHGs. • Participation in the Jauljibi International Trade Fair, for showcasing the output of project. Members of SHG Jai Nanda, Lumti exhibited and sold their packaged value-added spices such as Turmeric, Chilly, Garam Masala, Coriander, Cumin under the Kailash Brand. • Packaged large cardamoms of Jajurali have also been exhibited and sold in the fair. The chyura soap produced by the Panchashwer Ghati Self Reliant Cooperative was also exhibited and sold out in the Jauljibi International Trade fair. • Participation in Uttarakhand Spring Bird Festival in Pawalgarh Conservation Reserve (Chunakhan), Ramnagar and exhibited the products of project villages such as packed valued added spices, bamboo articles and chyura soap. • The survey of caves in vertical landscape i.e. Narayan Ashram and Himkhola conducted for scoping the tourism. • Visit of Chiplakedar carried out for caves and scope for allied tourism. • The registration process with the Tourism Department has been completed by submitting all the relevant documents such as land/property papers, Identification documents of the beneficiaries, Domicile and character certificates, etc., the registration certificate is awaited after that the home stay will become functional. • Two days training on Community based tourism was conducted at village Lumti. In all 20 beneficiaries participated including trainer and members of project team.

		• Support from Chief Development Office, Pithoragarh for processing unit operated by women SHG. Support for value addition planned. • In 3 villages the OSV value chain under execution in Chandak watershed with BMCs and SHGs/FIGs. • The scope for convergence towards plantation of large cardamom and support for infrastructure well made in 2 villages. • Oak acorn sowing in 30 ha area in a VP supported from other programme. • In 3 villages Bans, Jujrauli and Nakina to promote the OSV value chain seeds of Cauliflower, Cabbage, Radish etc have been distributed which covered almost 1.5 ha of land. • Processing and Sale centre is established by the ILSP in Munakot with support of Horticulture Department under its Border Area Development Programme. We are supporting the unit by developing and designing product for the unit. • Regular monitoring of Oak acorn sowed in 30 ha area in a Bans VP supported from other programme has been conducted with the help of BMCs and VP members. • Under the promotion of OSV value chain resulted in producing 4500 kg of fresh vegetables for marketing in Pithoragarh town. • Two farmers of Jajrauli demonstrated broccoli in 1.5 nali area for the first time and can be expanded in coming season. • A six-day Vegetable and fruit processing training organized at village Jajurali with support of Multidisciplinary Training Centre, Khadi and Village Industries Commission, (MDTC, KVIC) Haldwani. A total of 24 members from different women SHGs participated in the training • On demand of SHGs seed of Capsicum, Tomato and Chilly provided to diversify the cropping pattern and also to ensure income as vegetable demand is high in Pithoragarh. • Process for GI of Chyura completed and meeting at Delhi was attended by the consultant and cooperative members. • 2 exposure visits and 3 trainings for Cooperative organized and Chyura based value chain has been established.

4	**To identify critical ecosystems/habitats, biodiversity corridors and suggest evidence based management plans.**	• Based on the extensive survey of the Kailash Sacred Landscape (KSL – India), Wildlife Institute of India has identified 12 important bio-corridors. These bio-corridors are of high conservation significance and also represent Key Biodiversity Areas (KBAs): 1. Ramganga Riverine Corridor 2. Upper Gori- Pitli River Corridor Ghosi 3. Lower Gori- Ghosi- Kanar Riverine Corridor 4. Budi-Palang Gad- Rongkong Corridor 5. Shandev – Humdhura Corridor 6. Namik – Khaliya – Poting Corridor 7. Rajramba - Buidhura – Dhunkhan Corridor 8. Burphu Dhura – Barjikang – Ralam Corridor 9. Chhiplakedar – Najuri – Balchi Dhura Corridor 10. Kalapani – Upper Kutti Corridor 11. Karangdang- Nasamarti Corridor 12. Dung – Untadhura – Girthi Corridor • Landscape level assessment was done using RS/GIS tools for identification and extent assessment of critical ecosystems/habitats/sites (including sites of invasion/ human wildlife conflict). Analysis of the data-sets was generated and detailed maps were also prepared. • Identified pilot watersheds and provided baseline maps to the partner organization. • Preliminary base maps of two watersheds (Chandak Aunlaghat and Hat-Kalika watersheds) was prepared • Preliminary map for Upper and lower Gori valley prepared. • Rapid Assessment of High altitude Darma valley for treeline vegetation and Medicinal and aromatic plants (MAPs). • Field survey in the Thamari Kund area for long term Biodiversity assessment and monitoring. • Sacred Groves/ Sacred Natural Sites (SNS) of KSL-India • Ecosystem Services (ESs) assessment of Thalkedar Sacred Natural Site (SNS)-A case Study

5	**To develop and institutionalize landscape level biodiversity knowledge network and create a data and information centre for strengthening science-policy-practice linkages.**	I. Landscape level stakeholders mapping for developing biodiversity knowledge network; identification of willing and enthusiastic stakeholders and conducted SWOT assessment • SWOT Analysis through Literature review of all the studies that has been conducted in the Landscape II. Awareness workshops for willing stakeholders; obtaining formal agreements for participation; and preparation of templates for information generation/sharing • Feasibility assessment of Harkot village for innovative livelihood, ecosystem services monitoring and long term biodiversity assessment. III. Created a multi-location, multi-stakeholder based (i.e., students/teachers; farmers/villagers; NGOs/CSOs; and GOs), knowledge networking platform • Creating a multi-location, multi-stakeholder based (i.e., students/teachers; farmers/villagers; NGOs/CSOs; and GOs), knowledge networking platform. IV. Network partner's synergy building event and finalization of mechanism for data/ information generation, banking and sharing • Meeting with the Conservator of Forest (Research) for strengthening cooperation for conservation and management of Rare, Endangered and Threatened Species of the landscape. V. Negotiations at district level for owning and hosting the created knowledge platform as Model Biodiversity Data Center (MBDC). • Information generated on Model Biodiversity Data Center (MBDC) • Field Survey of developmental Blocks of Pithoragarh for collection of Secondary Socio-Economic data, NGO list in order to form a Model Biodiversity Data Centre (MBDC). VI. Demonstration workshops organized on knowledge exchange and communication pathways for diverse stakeholders.

		Demonstrations on potential inputs for conservation and development decisions in the landscape. • Organized Block level workshop was at Block Hall, Dharchula, Pithoragarh on December 20, 2018 for showcasing various information generated for Kailash Sacred landscape-India. Several village, block level people representatives and Block Line Departments Have participated in the workshop

2.3. Outputs in terms of Quantifiable Deliverables*

S. No.	Quantifiable Deliverables*	Monitoring Indicators*	Quantified Output/ Outcome achieved	Deviations made, if any, & Reason thereof:
1	**At least 10 BMCs formed in 03 sites**	No. of New Database/Datasets generated on the identified/proposed dynamics, eg. BMCs, PBRs, BCPs, etc.	• Completed	
2	**Impart training to BMCs to prepare the PBR/BCPs; atleast 10 PBRs and 03 BCPs (01 in each pilot sites) prepared and duly approved.**	No. of Capacity Building/ Awareness Programmes/ Trainings conducted/ organized, including No. of stakeholders benefitted (No. of Rural Youth, No. of Women and Total No. of Beneficiaries.	• Capacity Building of the BMCs conducted on the BMC management and functioning, 10 BMCs financially motivated @Rs. 60,000 each for the BMC office establishment. • 10 PBRs and 03 BCPs duly prepared and is now under upgradation/fine tuning.	
3	**Eco-restoration models developed (20 ha); community conservation reserves developed (02)**	Eco-restoration models developed (Ha)	• 30 ha degraded land put under resotration by GBPNIHE in different locations of Haat Kalika watershed, Chandak Aunla ghat Watershed and Lowe Gori Valley • 01 community conservation reserve developed at Lower Gori	

			Valley for Orchid Conservation by WII	
4	**Modules/Manuals on diverse restoration interventions**	Periodic submission on region-specific best practices/ demonstrative models (No.) with analytical findings and outcomes e.g. " Restoration Intervention Modules)	• Five training modules prepared (Silvi-pastoral, Silvi-medicinal, Silvi-Horticulture, Nursery Development and management, Invasive species Management module) for different types of restoration interventions are in the process for fine tuning.	
5	**Progression report on landscape level Biodiversity Knowledge Network etc**	Other publications and knowledge products	• A web based model Biodiversity Centre (MBDC) has been created at USAC, Dehradun.(https://www.mbdc-kslindia.in). • Where the Geospatial information created on various themes viz., Physiographic features, Culture and tourism, Land use/land cover, vegetation, Change analysis, landscape vulnerability and Management of the KSL-India under the project have been placed (geospatial format) for wide dissemination and a platform for information sharing as Biodiversity Knowledge Network created. Other relevant information generated by various partners and information on published literature of the project is being placed In the MBDC.	
6	**Biodiversity Heritage Sites declared.**	Policy framework/draft (No.) assisting the regional decision-making in "Critical ecosystems/	• Studies conducted in Thalkedar Sacred Forest as per the BHS Guidelines laid by NBA. Preliminary Notification for the same is	Declaration process is to be taken up by Lead agency.

		habitats, biodiversity corridors etc and their management plans etc. Biodiversity and culture based heritage tourism development plans prepared and value chain established (two sites)	in motion in the Govt. of Uttarakhand. • Total three plan prepared i.e., i. Plan for Cultural and Biodiversity based Tourism in Gangolihaat; ii. Planning for Pollination Services and Beekeeping Value Chain; iii. Value Chain Development of Medicinal Plants and Aromatic Herbs For the Farmers of Dharchula, Block, Uttarakhand	
7	**Medicinal Plant, Wild Edible, Orchid Value Chain established (02 sites); Income level increased upto 15% through value chain development.**	Appreciation for cultural and biological diversity among visitors increased by 25-30%; income level of involved households increased by 15-20%. Pollination services and bee keeping value chain established (1 site); income level of involved households increased up-to 15%). Value chain models (Nos) of Medicinal Plants, Wild Edibles, Orchids, etc. for	• In all 21 members were benefited with 4 developed their expertise in soap manufacturing and initiated the marketing link with AAROHI. • 3 Demonstration Models (Site) developed One village in Chandak watershed, 1 village in Chyura cluster, 1 village in Lower Gorey is under development as model site for further extension. • In all 4 livelihood options of livelihood are being identified i.e. Spice and off season Vegetables; Bee Keeping and by products of Chyura; Nature and culture based	Due to pandemic visitors number was limited.

		the identified sites linking with income generation of local stakeholders (percentage of increased up-to 15%)	tourism with MAP and orchid promotion with technical guidance from partners. • 3 processing units established i. A spice grinding unit has been established in Lumti supported by CDO office. ii. Oil extraction unit is operational in Jamrari village for Chuyra supported from GIZ and contribution by group. iii. Chyura processing unit at Munakot with support of district administration • In all 4 options of livelihood are being identified i.e. Spice and off season Vegetables; Bee Keeping and by products of Chyura; Nature and culture based tourism with MAP and orchid promotion with technical guidance from partners. • With support of District administration, NABARD got GI for Chyura.	

2.4. Strategic Steps with respect to Outcomes (in bullets)

S. No.	Particulars	Number/ Brief Details	Remarks/ Attachment
1.	New Methodology developed	NA	

S. No.	Particulars	Number/ Brief Details	Remarks/ Attachment
2.	New Models/ Process/ Strategy developed	Yes	On field demonstration models for ecological restoration
3.	New Species identified	NA	-
4.	New Database established	NA	-
5.	New Patent, if any	NA	-
	I. Filed (Indian/ International)	NA	-
	II. Granted (Indian/ International)	NA	-
	III. Technology Transfer(if any)	(01)	GI for Chyura
6.	Others (if any)	NA	-

3. Technological Intervention

S. No.	Type of Intervention	Brief Narration on the interventions	Unit Details (No. of villagers benefited / Area Developed)
1.	Development and deployment of indigenous technology	NA	--
2.	Diffusion of High-end Technology in the region	NA	-
3.	Induction of New Technology in the region	NA	-
4.	Publication of Technological / Process Manuals	NA	-
5.	Others (if any)	Chyura based micro enterprise	5 villages

4. Demonstrative Skill Development and Capacity Building/ Manpower Trained

S.	Type of Activities	Details	Activity Intended for	Participants/Trained

No.		with number		SC	ST	Woman	Total
1.	Workshops	**48**	• 07 village level consultation and awareness workshops were organized facilitated by experts on specific themes for planning the VCs in different clusters. • 2 workshops on Homestay promotion • 3 Promotional and showcasing workshops were organized jointly with partners. • 3 workshops for OSV and spice production/value addition	**-**	**-**	**451**	**1188**
2.	On Field Trainings	**15**		**38**	**43**	**115**	**272**
3.	Skill Development	**20**	• Homestay promotion • Food processing • Book keeping • BMC strengthening • Chyura product development	**43**	**46**	**124**	**298**
4.	Academic Supports	**7**	• (5 as Rural Resource Persons) in diverse sectors and 2 project staff leading in execution with skill building				
	Others (if any)						

5. Linkages with Regional & National Priorities (SDGs, INDC, etc)/ Collaborations

S. No.	Linkages /collaborations	Details	No. of Publications/ Events Held	Beneficiaries

1.	Sustainable Development Goal (SDG-)	The projects directly or indirectly fulfils the following SDGs: SDG 1 (No Poverty); SDG 2 (Zero Hunger); SDG 3 (Good Health and Well Being); SDG 5 (Gender Equality); SDG 6 (Clean Water and Sanitation); SDG 8 (Decent Work and Economic Growth); SDG 10 (Reduced Inequalities); SDG 11 (Sustainable Cities and Communities); SDG 12 (Responsible Consumption and Production); SDG 13 (Climate Action); SDG 15 (Life on Land)		
2.	Climate Change/INDC targets	The project contributes towards India's INDC - By 2030, we also intend to increase our carbon sinks by creating an additional capacity equivalent to 2.5 to 3 billion tonnes of CO_2 through significant afforestation efforts.		

3.	International Commitments	The project directly or indirectly contributes towards the following Aichi Biodiversity Targets: **Target 1 -**By 2020, at the latest, people are aware of the values of biodiversity and the steps they can take to conserve and use it sustainably; **Target 2 -** By 2020, at the latest, biodiversity values have been integrated into national and local development and poverty reduction strategies and planning processes and are being incorporated into national accounting, as appropriate, and reporting systems; **Target 4 -** By 2020, at the latest, Governments, business and stakeholders at all levels have taken steps to achieve or have implemented plans for sustainable production and consumption and have kept the impacts of use of natural resources well within safe ecological limits; **Target 5 -** By 2020, the rate of loss of all natural habitats, including forests, is at least halved and where feasible brought close to zero, and degradation and fragmentation is significantly reduced; **Target 7-** By 2020 areas under agriculture, aquaculture and forestry		

		Biodiversity; **Target 9 -** By 2020, invasive alien species and pathways are identified and prioritized, priority species are controlled or eradicated, and measures are in place to manage pathways to prevent their introduction and establishment; **Target 14 -** By 2020, ecosystems that provide essential services, including services related to water, and contribute to health, livelihoods and well-being, are restored and safeguarded, taking into account the needs of women, indigenous and local communities, and the poor and vulnerable; **Target 15 -** By 2020, ecosystem resilience and the contribution of biodiversity to carbon stocks has been enhanced, through conservation and restoration, including restoration of at least 15 per cent of degraded ecosystems, thereby contributing to climate change mitigation and adaptation and to combating desertification.		
4.	Bilateral engagements	Nil		
5.	National Policies	Nil		

6.	Others collaborations	Nil		

6. Project Stakeholders/ Beneficiaries and Impacts

S. No.	Stakeholders	Support Activities	Impacts
1.	Gram Panchayats	Land provided for plantation	Restoration models developed
2.	Govt Departments (Agriculture/ Forest)	Bhesaj Sangh, Pithoragarh, Uttarakhand (5000 seedlings of *Cinnamomum tamala* weredistributed to 120 villagers of Lower Gori valley watershed through convergence)	Plants distributed and planted
3.	Villagers	Plantation activities	Restoration model will provide fodder, fuel wood and medicine, which ultimately help villagers to reduce drudgery, earn income and receive clean environment.
4.	SC Community	Plantation activities	-
5.	ST Community	Plantation activities	-
6.	Women Group	Plantation activities	-
	Others (if any)		-

7. Financial Summary (Cumulative)

S.No.	Budget head	Amount Carried forward	Bank Interest	Amount received	Amount received+ amount carried forward	Expenditure	Amount Balance/ excess expenditure
1	Salaries	89948/-			89948/-	417982/-	-328034/-
2	Permanent Equipment Purchased	211500/-		300000/-	511500/-	135307/-	376193/-
3	Travel	6231/-		467500/-	473731/-	134713/-	339018/-

4	Others (Consumables & Contingency)	17078/-		300000/-	317078/-	159506/-	157132.80
7	Activities & Other Project Cost	1338074.88	**66380/-**	4210320/-	5614774.88	2818150.90	2798623.98
8	Accrued bank Interest (till December, 2022)			-	**156066.50**	-	**156066.50**
9	**Total**	**1662831.88**	**66380/-**	**5277820/-**	**7163098.38**	**3665658.90**	**3497439.48**
10	Amount to be surrendered		**3497439.48**				

8. Major Equipment/ Peripherals Procured under the Project

S. No.	Name of Equipments	Cost (INR)	Utilisation of the Equipment after project
1.	Garmin GPS Exterx-30x (1 pc) Garmin GPS Oregon (1 pc)	1300.00 31400.00 18% GST = 52746	They will be used for other projects.
2.	Lenovo Idea pad 520 Core i7 (1 pc)	94391	They will be used for other projects.
3.	Spherical Grown Densitometer density Range 0-4.00 (2 pcs.)	28910	They will be used for other projects.
4.	Soil Sampler SAC (2 pcs) Digital PH Caducity meter (2 pcs) Bosch GLM Laser range Finder (2 pcs)	13800 40790 29914 16% GST = 99715	They will be used for other projects.
5.	Sony LCD UX 560 F Digital voice recorder with built in USB (1 pc)	5835.00 1050.41 **= 6886.00**	Document case studies as success stories and to record issues of rural community.
1.	Binocular (2) Olympus 8x4 DPSI	9400	To promote bird watching in adjacent area where the project implemented

2.	Hard Disk 2 TB Seagate	5899	Store data of the project
3.	Hard Disk 1TB Seagate	3798	Store data of the project
4.	Point Shoot Digital Camera (1) Sony	13990	Picture documentation of success stories, case studies and rural perception

10. Quantification of Overall Project Progress

S. No.	Parameters	Total (Numeric)	Remarks/ Attachments/ Soft copies of documents
1.	IHR States Covered	1	Uttarakhand
2.	Project Site/ Field Stations Developed	6	Digtoli, Naikina, Lumti, Rawal goun, Kamad, Jajut
3.	New Methods/ Modeling Developed	-	-
4.	No. of Trainings arranged	15+ 05+ 08	Report attached as Annexure I
5.	No of beneficiaries attended trainings	272+388+ 99	
6.	Scientific Manpower Developed (Phd/M.Sc./JRF/SRF/ RA):	1-SPF,1-JPF and 1-Field Assistant	
7.	SC stakeholders benefited	38+29	Report attached as Annexure I
8.	ST stakeholders benefited	43+88	
9.	Women Empowered	115+39	
10.	No of Workshops Arranged along with level of participation	25 +15	
11.	On field Demonstration Models initiated	-	-
12.	Livelihood Options promoted	04	Livelihood of the target sites is like to increase in the upcoming years when the planted saplings of the economically important species will grow.
13.	Technical/ Training Manuals prepared	5	Silvi-pastoral, Silvi-medicinal, Silvi-Horticulture, Nursery Development and management, Invasive species management module Mapping of important Bio Corridors within Indian part of KSL. Attached as Annexure II.
14.	Processing Units established	01	-
15.	No of Species Collected	*Nil*	-
16.	New Species identified	*Nil*	-
17.	New Database generated (Types):	*Nil*	-
	Exposure Visits	02	-
	Others (if any)		-

11. Knowledge Products and Publications:

S. No.	Publication/ Knowledge Products	*Number*		*Total Impact Factor*	*Remarks/* Enclosures
		National	International		
1.	Journal Research Articles/ Special Issue:		3	6.78	1. "Forest restoration enhances plant diversity and carbon stock in the sub-tropical forests of western Himalaya" January 2022 Trees Forests and People 7(art75):100201 DOI:10.1016/j.tfp.2022.100201 2. Challenges and opportunities under COVID-19 on rural populace in Kailash Sacred Landscape (KSL)-India February 2022 Environmental Challenges - Journal - Elsevier DOI:10.1016/j.envc.2022.100497 3. "Restoration of degraded land: A case from west Himalaya", Aug 2020
2.	Book Chapter(s)/ Books:		1	-	"Promoting Nature-Based Solution (NbS) Through Restoration of Degraded Landscapes in the Indian Himalayan Region" July 2020 DOI:10.1007/978-981-15-4712-6_12 In book: Nature-based Solutions for Resilient Ecosystems and Societies (pp.197-211)
3.	Technical Reports				10 PBRs developed.
4.	Training Manual (Skill Development/ Capacity Building)	5	-	-	1.Silvi-pastoral 2.Silvi-medicinal 3.Silvi-Horticulture 4.Nursery Development and management 5.Invasive species Management

S. No.	Publication/ Knowledge Products	*Number*		*Total Impact Factor*	*Remarks/* Enclosures
		National	International		
5.	Papers presented in Conferences/Seminars	Nil			
6.	Policy Drafts/Papers	Nil			
7.	Others:	Nil			

12. Recommendation on Utility of Project Findings, Replicability and Exit Strategy

Particulars	Recommendations
Utility of the Project Findings	• The project has contributed towards SDGs, INDC and Aichi Biodiversity Targets. • The project findings will help in providing approach for developing restoration models in the wasteland of Indian Himalayan region. • The restoration models developed in the different community land will help in reducing women drudgery, improve livelihood and provide clean air in nearby areas • The farmers are keen to adopt the options and looking for holistic support and open for improving their skills.
Replicability of Project	• The project can be replicated in other areas of Himalayan region • Synergy with ongoing program of government can lead to create viable options for communities.
Exit Strategy	• The project strongly considers community institution building and institutionalization of mechanisms, it is expected that this will help sustaining the project interventions beyond its completion. • The success of envisaged models of restoration and sustainable use will have replication value and concerned beneficiaries will continue to sustain the interventions. Knowledge network platform and its ownership with district/state agencies will sustain the same beyond project. • The partner agencies, with their respective mandates for conservation and development of Himalayan region will continue to provide technical support to the intervention areas and community institutions. • The potential need to be tapped for nature-based livelihoods by strengthening the linkages and also to establish collaboration with others.

(**PROJECT PROPONENT/ COORDINATOR**)

(Signed and Stamped)

(**HEAD OF THE INSTITUTION**)

(Signed and Stamped)

Place: ……..

Date: …../……/……

Annexure I

Capacity Building Training Workshop Reports

The Detailed report includes an Executive Summary and hasseparate chapters on (i) Introduction (ii) Methodologies, Strategy and Approach (iii) Key Findings and Results (iv) Overall Achievements (v) Project's Impacts in IHR (vi) Exit Strategy and Sustainability (vii) References and (viii) Acknowledgement. Further, description of Technical Activities, List of Trainings/ Workshops/ Seminars with details of trained resources, list of New Products developed under the project, Manual of Standard Operating Procedures (SOPs) developed, Technology developed/Transferred etc enclosed as Appendix.

1 EXECUTIVE SUMMARY

The Executive Summary of the project should not be more than 3–5 pages, covering all essential features in precise and concise manner as stated in Part A (Project Summary Report) and Part B (Comprehensive Report). The forests provide goods and services to the Himalayan people and fulfill their increasing demand of fuel, fodder, timber, fiber, food and medicines. However, growing demand and changing environmental conditions in the region, the forests are facing tremendous pressure. Therefore, there is a need to initiate such programmes which may promote restoration so that biodiversity of the region can be conserved. The total geographical area of India is 328.7 million ha, of which about 96.4 million ha land is under degradation i.e., 29.3%. Therefore, restoration programmes are important to rehabilitate the 29.3% area in the country. Restoration of degraded lands is important from local to global dimensions. It is also important to contribute in sustainable development goal 15, which aims to "protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss". Therefore, successful restoration of degraded landscapes is urgently required. In view of this, the GBP-NIHE initiated land restoration activities on the degraded land through multipurpose and economically important species in three different watersheds of district Pithoragarh. These include 2 villages (Digtoli and Naikina) in Chandak- Aunlaghat watershed, 3 villages (Rawal Goun, Jajut and Kamad) in Haat-Kalika watershed and 2 villages (Lumti and Baram) in Lower Gori watershed. A participatory action plan was developed based on scientific and community based knowledge for implementation of restoration programme. Participatory Rural Appraisal (PRA) tools were used in this study for data generation on the bio-resources of the region. Household interview, group interview, resource mapping, transect walk and questionnaire survey were also carried out for the identifications of key factors related to land degradation. Participation of

the local stakeholders in the various steps of land restoration viz. site identification, involvement in restoration intervention planning and capacity building of the local communities were ensured. A total of 40 meetings/ workshops were organized in all three pilot sites, in which a total of 1051 villagers (622 Male, 429 Female) from 38 villages participated. After several meetings, Memorandum of Understanding (MoUs) were signed between village representatives, villagers and GBP-NIHE for the establishment of restoration model in common degraded land. Collectively about 30 hectare community and Van-Panchayat land (17 h in Lower Gori valley, 7 h in Chandak-Aulaghat watershed and 6 h in Haat-Kalika watershed) from 6 villages at three different pilot sites were selected for development of restoration model.

Results of survey indicated that the silvi-medicinal-pastoral system was mostly preferred by the community as a restoration site. On the basis of need assessment of the community, 23 plant species were selected for restoration purpose. Of these, 10 plants species (*Cinnamomum tamala, Pittosporum eriocarpum, Myrica esculenta,, Terminalia chebula, Terminalia bellirica, Phyllanthus emblica, Quercus leucotrichophora, Quercus glauca, Bauhiniavariegate* and *Zanthoxylum armatum)* were selected based on the habitat suitability for those sites, economic potential, market demand and conservation importance. Soil data were collected from all the sites for assessment of soil quality and future reference. To protect the restoration model at different sites, barbed wire and stone wall fencing was done in 8 ha lands of 4 villages (Digtoli, Naikina, Rawal Goun and Kamad). Under the soil and moisture conservation work, two rain water harvesting pond (Chaal-khal) were constructed at Kamad and Naikina with the help of MGNREGA scheme. Grass like *Cymbopogon citratus* was introduced between the gaps in the plantation sites aiming to stabilize slopes, prevent soil erosion, reduce run-off, improve percolation and fodder availability. For preventing soil from erosion, bunding and gully pluging techniques were adopted in restoration sites. Staggered contour trenches were dug in plantation sites for maintaining soil moisture. Thawalas were made around all the saplings having inward slopes to store water around the plant to help in retaining the moisture for the plants. For this purpose a semicircular pit about 5 inch deep and 12 inch in diameter was dug around plant. The soil taken out from the pit was put around the base of the plant.

Plantation of 23,500 saplings of 10 multipurpose plants species was done on 30 hectare community land which are surviving at the rate of 69.8% among three pilot sites after two years of plantation. *Cinnamomum tamala* showed maximum survival percentage (89%) in Rawal Gaon followed by Digtoli (78.28%) as compared to other sites. Most of the species planted at Lumti site showed better survival with an average of 73.18% as compared to Digtoli (67.17%) and Naikina (62.2%). *Quercus leucotrichophora* and *Quercus glauca* showed maximum survival rate of 77% and 72%, respectively

after two year of plantation.Growth of *C. tamala* showed maximum avg. height (45.15 cm) and avg. girth (6.76 mm) at Rawal Gaon site whereas *P. emblica* showed maximum height (33.23 cm) and girth (4.67 mm) at Lumti site compared to other sites after the one year of plantation. Growth of *C.tamala* showed maximum height (45.15 cm) and girth (6.67mm) at Rawal Gaon site whereas *P. emblica* showed maximum height (33.23 cm) and girth (4.67 mm) at Lumti site compared to other sites after the 2 year of plantation. *Quercus leucotrichophora* and *Quercus glauca* showed maximum height (95.41±1.63 and 91.56±2.27, respectively) and girth (12.32±1.83 and 11.88±1.45, respectively) at Jajut site.

We have also used organic (Vermicomposting, cow dung manure and organic fertilizer from sea weeds) and inorganic fertilizers (Diammonium Phosphateand NPK) for better growth and survival of the plant. The capacity building of 779 villagers (465 Male and 314 Female) from 38 villages were enhanced through hands on training programmes on plantation and nursery technique, moisture and water conservation work and plant growth monitoring. Three block and one district level synergy-building events were organised to converge with various on-going and proposed restoration activities in the landscape. Fencing was done in 3 hectare land of Kamad village of Haat Kalika watershed through convergence with MGNREGA scheme of Gangolihat block. 5000 seedlings of *Cinnamomum tamala* weredistributed to 120 villagers of Lower Gori valley watershed through convergence with Bhesaj Sangh, Pithoragarh.

2 INTRODUCTION

2.1 Background of the Project: Land degradation is one of the most disturbing problems the world is facing. The results of the 1991 *Global Assessment of Human-induced Soil Degradation* (GLASOD) assessment indicated that 15% of the land surface is degraded. More recent estimates of the *Global Assessment of Land Degradation and Improvement* (GLADA) have revealed that 24% of land is degrading, of which 20% are cultivated areas; 23% broadleaved forests, 19% needle-leaved forests, and 20–25% rangelands (Bai Dent, Olsson & Schaepman, 2008). The Rio conference in 1992 recognized the crucial role played by mountain ecosystems by highlighting that the livelihood of about 10% of the world's population depended directly on mountain resources such as water, forests and agricultural products and minerals (United Nations, 2001).

The Indian Himalayan Region (IHR) represents one of the richest natural heritage sites in the world, with one-tenth of the world's known species of higher altitude plants and animals occur in the Himalayas (IPCC, 2001). This rich environmental heritage of the IHR is under pressure. The impact of these pressures is illustrated by declining forest cover, loss of wildlife habitats and the loss of life

and property. The impacts of human activity on ecosystem services and land degradation are most reflected at the local and regional levels. Causes of land conversion are broadly categorized as related to population, personal preferences, policies, developmental activities and economic considerations, and result in impacts such as environmental degradation. Restoration of degraded land has been an important item on the agenda since the early 1980s. In order to reclaim degraded and waste land and to meet biomass demands, India launched the Social Forestry Programme (SFP) in 1980, followed by the more participatory Joint Forest Management (JFM) Programme. Out of 59 million ha land constituting the total geographical area of Indian Himalaya, 7.3 million ha are degraded community lands, 13.5 million ha land are degraded government forests, and 1.2 million are abandoned private agricultural lands. The effect of land degradation in uplands are felt locally as shortage of food, fodder, and also well away in the Indo-Gangatic lowlands as damage to agriculture, property and human life due to floods. Taking the consequences part in consideration and to adopt rehabilitation strategies, linking community-based forest rehabilitation and management was felt (Semwal et al., 2013; Maikhuri & Dhyani, 2013; Negi et al., 2015).

Rehabilitation of degraded lands in the IHR is important from local as well as national/regional/global dimensions towards sustainable development approach. Though numerous land rehabilitation projects have been implemented in the Himalaya, the impact has largely been poor because of inappropriate technologies, policies and implementation mechanism. The interplay of various aspects such as: ecology, sociology, economics, anthropology and culture needs to be tied up together in order to constitute a meaningful rehabilitation strategy. Therefore, successful restoration of degraded landscapes requires the accommodation of different land uses, such as agriculture, tree plantations, and protected landscape areas. Setting rehabilitation targets in these “multifunctional landscapes” requires addressing trade-offs among a variety of ecosystem services and stakeholders. Given that conservation and avoiding deforestation is no longer a viable option the loss of biodiversity and ecosystem services, forest restoration activities should be considered as an important component in national strategies and action plan for degraded land rehabilitation programme (Palni & Rawal, 2013).

2.2 Overview of the Major Issues to be Addressed : The major issue which was addressed in the project was to restore the degraded land in the target landscape. The project aimed to develop different types of restoration models to motivate the communities in the landscape towards planning and acting to develop their own community land as a restoration site. The project also envisaged livelihood enhancement of the community by the goods which will they get form the restoration site, although it is long processes but sooner or later when the site will be converted into a full grown

forest, the forest produce can be a mean of livelihood. Community people were engaged in planning and implementation of the restoration interventions so that in future if they feel they can develop their restoration site by their own, for this field workshops and trainings were organized in different places. To aid in the restoration process the prepared modules will play an important role because they are a complete package for all the what to do, how to do, why to do steps involved in any restoration planning.

2.3 Baseline Data and Project Scope:

Table 1: Collection of base line information related to Soil properties of restoration sites

Parameters	Jajut	Naikina	Digtoli	Rawal gaon	Lumti	Kamad
Moisture Content (%)	22.4	21.13	21.56	5.87	5.62	10.5
Bulk Density	0.075	0.007	0.044	0.5	0.68	0.62
Water Holding Capacity %	34.6	35.88	36.33	39.85	30.32	35.53
Organic Carbon %	2.78	3.17	3.45	2.04	2.46	2.41
pH	6.62	6.56	6.31	6.56	5.46	5.56
Available Nitrogen (kg/ha)	246.6	263.42	209.06	144.2667	168.5	164.4
Total Nitrogen %	0.37	0.377	0.39	0.21	0.186	0.15
Available Phosphorus	256.8	327.21	259.06	261.75	219.91	251.66
Available K (kg/ha)	237.8	202.04	199.69	268.7	181.23	168.03

2.4 Project Objectives and Target Deliverables (as per the NMHS Sanction Order):

S.No.	Project Objectives	Target Deliverables
1	Prepare training modules for different types of restoration interventions	Modules on diverse restoration interventions and benefits are ready for use (5 modules).
2	Organize field workshops/hands-on trainings in select pilot sites to community institutions	Through field workshops and trainings at least 30 institutions (10 in each pilot site) made ready to undertake restoration actions
3	Conduct needs assessment of communities and development of Restoration Opportunity Map	Base line information related to geographical and ecological attributes with special reference to forest resources were collected from all 3 pilot sites. Restoration opportunity Map will prepare and prioritization of degraded land and species will do.

4	Conduct participatory interventions in pilot sites to establish restoration models	Interventions made as per the Restoration Opportunity maps of pilot sites, 30 hectare land put under restoration
5	Organize district-level synergy-building events to converge with various on-going and proposed restoration activities in the landscape	Relevant district level agencies agreed to follow the management/ restoration models for up-scaling

3 METHODOLOGIES, STARTEGY AND APPROACH

3.1 Methodologies used for the study

Activity 1. Identification and selection of common degraded land

The study was carried out in 6 villages of Chandak- Aunlaghat watershed, Haat-Kalika watershed and Lower Gori watershed in Pithoragarh district, Uttarakhand, Western Himalaya, India. After analysis of census 2011 data (Figure 1), we have found that 22%, 33% and 45% land was degraded in Haat- Kalika watershed (total land area 2830.52 hectare), Lower Gori valley watershed (total land area 3174.44 hectare) and Chandak-Aulaghat watershed (total land area 1745.37 hectare), respectively (Figure 2).

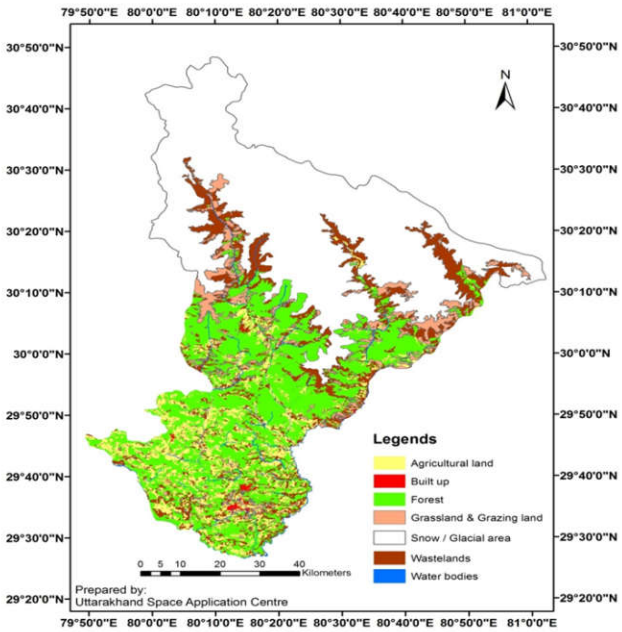


Figure 1: Map of the study area

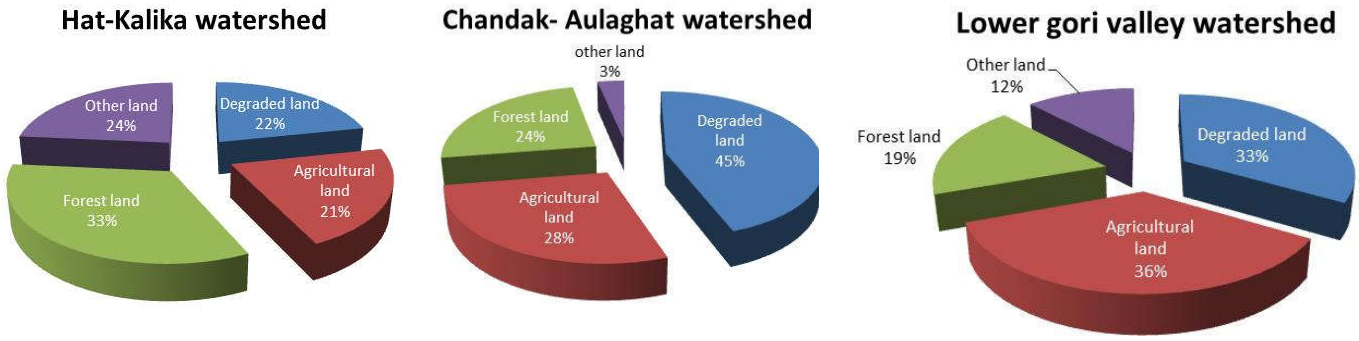


Figure 2: Land use pattern in all three watersheds

Table 2: Selected target sites and their geographical locations and legal status

Target sites	Village	Geo- Coordinate		Altitude (m asl)	Legal status
		Latitude (N)	Longitude(E)		
Haat- Kalik Watershed (Gangolihat Block, Pithoragarh)	Rawal gaon	29°39'366"	80°02'908"	1652 – 1670	Community Pasture land
	Kamad Gaon	29°40'740"	80°01'460"	1431 – 1450	Community Pasture land
	Jujut	29°39'55.35''	80°3'17.05''	1480-1510	Community Pasture land
Chandak-Aunlanghat Watershed (Bin Block, Pithoragarh)	Digtoli	29°37'45.71"	80°9'1.05"	1670 -1700	Community Pasture land
	Naikina	29°37'45.72"	80°10'10.51"	1760 – 1775	Van-Panchayat Pasture land
Upper & Lower Gori Watershed (Munsiyari Block, Pithoragarh	Lumti	29°53'370"	80°19'330"	950 -980	Community and Van-Panchayat Pasture land

Methodology

1.1 Meetings with Gram pradhan, Sarpanch and villagers for selection of degraded lands

For the promotion of restoration programme on degraded land, a participatory action plan was developed based on scientific and community based knowledge with practical implementation. This includes (a) collection of base line information related to geographical and ecological attributes of study area; (b) Participatory Rural Appraisal (PRA) survey was conducted through focus group discussion, questionnaire survey, house hold survey for identification and procurement of village common degraded land, (c) selection of suitable plants species based on priority of the community, scientific possibility of the species to grow under these macro and micro climatic condition, high market demands and economic potential, (d) protection and management of plantation site (e) Bioengineering measures for soil and moisture conservation work, (f) capacity building of local people and ensuring their participation in implementations of restoration programme (g) policies and knowledge sharing between villagers, NGOs, and line departments and (h) livelihood opportunity through medi-silvi-pastoral system. Participation of local community in each step of restoration programme is essential for sustaining of restoration model. PRA tools included in this study such as secondary data collection, household interview, group interview, resource mapping, transect walk and questionnaire survey for the identifications of key factors related to land degradation and development of implementation strategies for appropriate restoration model were used. In various meetings, the villagers were informed about the aim, objectives, and benefits of the project on restoration programme and highlighted the importance and threats for biodiversity, including habitat loss, over-exploration, deforestation, pollution, and climate change. The awareness programme was focused on threats and benefits of restoration interventions. It was suggested that restoration is likely to reverse the loss of biodiversity, improve ecosystem resilience, enhance the provision of ecosystem services, mitigate the effects of climate change, combat desertification and land

degradation and improve human well-being while reducing environmental risks and scarcities. Experts requested to villagers for enhancing people participation in conservation and management of biodiversity through restoration intervention.

Activity 2. Soil and moisture conservation work

Methodology

For irrigation requirement, low-cost water harvesting pond with a size of 12x8x3 ft. were constructed at plantation site of Kamad and Naikina to ensure better survival rate of planted saplings. Grass like *Cymbopogon citratus* was introduced between the gaps in the plantation sites aiming to stabilize slopes, prevent soil erosion, reducerun-off, improve percolation and fodder availability. For

preventing soil from erosion, bunding and gully pluging techniques were adopted in restoration sites. Staggered contour trenches were dug in plantation sites for maintaining soil moisture. Thawalas were made around all the saplings having inward slopes because of the rain water collected around the plant will help in retaining the moisture for the plants. For this purpose a semicircular pit about 5 inch deep and 12 inch in diameter was dug around plant. The soil taken out from the pit was put around the base of the plant.

Activity 3. Protection of plantation sites

For the protection of plantation sites against open grazing, three types of fencing were carried out in different sites (Fig.3). Stone wall fencing with 3 feet height and 400 meter length were done at Naikina sites. In 6 h land of Digtoli, Kamad, Rawal goun and Lumti, barbed-wire fencing was made. For this purpose with a length of 7.5 feet iron angles were dug 45 cm deep and placed 3 m apart. Six strands of barbed wire at the height of 9 inch for lower wire, then 1 foot above up to 5 feet from the ground level were stretched and fixed with the help of iron staples. To make this barbed wire fencing more effective, thorny bushes were put along the fencing which will work as biofencing in future. Social fencing was done in the rest of all sites along with other types of fencing and the participation of villagers towards protection of plantation sites was ensured. For this type of fencing, local villagers were encouraged to not send their cattle in plantation areas. Protection of grasses in the plantation areas to be taken by villagers after maturity on mutual agreement. Van Panchayats were agreed to make models of such social fencing efforts. The grasses so produced were shared by the villagers as per the mutual agreement. In case of frost, a green shade net with 50% of light penetration was used to wrap the plants to protect from frost i.e., *Cinnamomum tamala*.

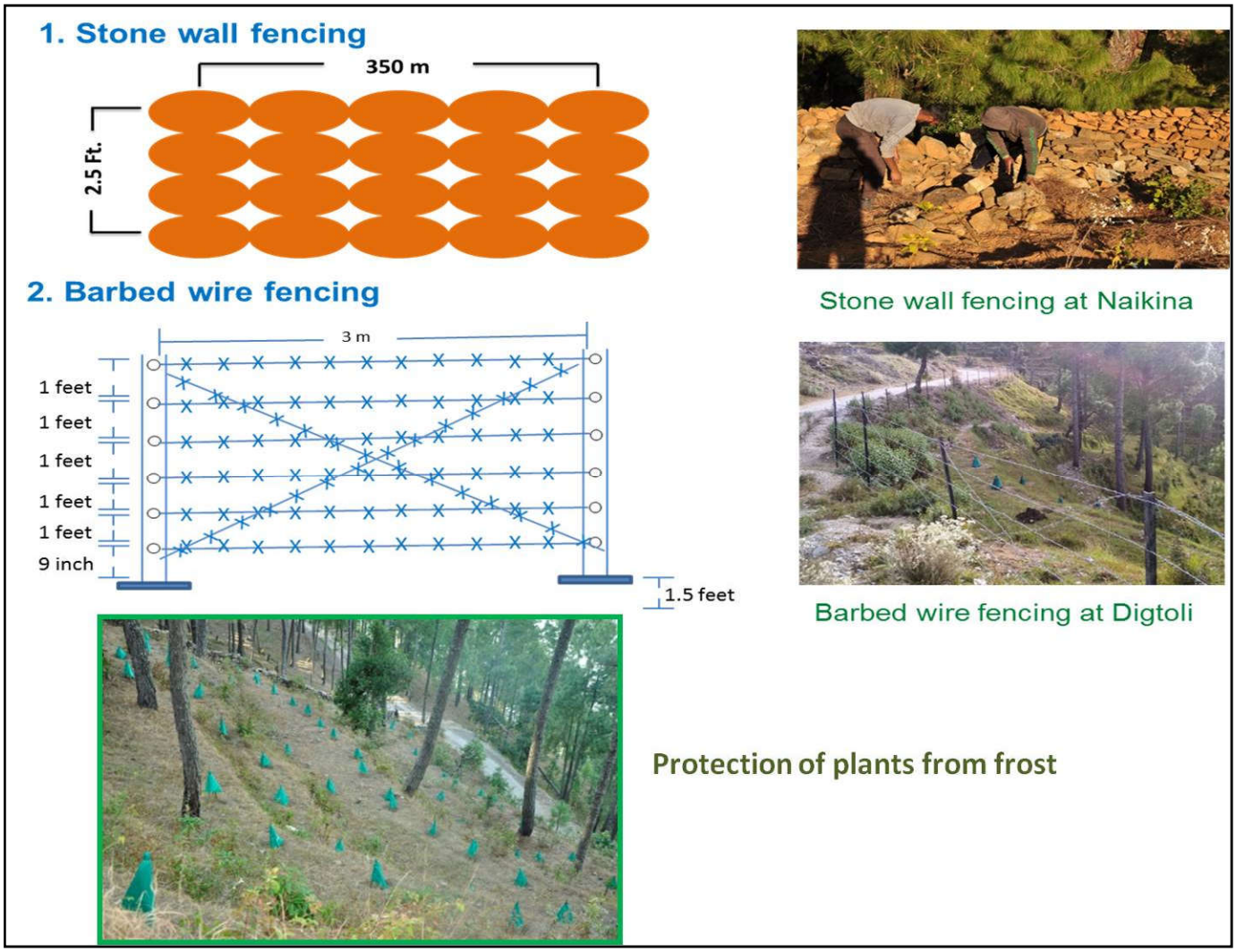


Figure 3: Interventions done for protection of plants from grazing and frost

Activity 4. Selection of suitable Plants species

Methodology

The plants species were selected for restoration programme based on the species prioritized by the community, scientific possibility of the species to grow under these macro and micro climatic condition, high market demands, ecological and economic potential. A total of 10 medicinal tree, shrub and herb species were planted at 6 villages of three pilot sites. *Cinnamomum tamala, Pittosporum eriocarpum, Myrica esculenta,, Terminalia chebula, Terminalia bellirica and Phyllanthus emblica* were selected for plantation due to their medicinal properties, high market demands and economical potential to enhance livelihood of local people. *Zanthoxylum armatum* was given preference for restoration purpose due to its bio-fencing property, high medicinal value, used as spices and economical potential. Apart from the large-scale plantation in common lands, the saplings were also provided to the villagers for plantation on nearby private or common lands.

Activity 4. Site preparation and plantation activity

Methodology

Site preparation includes clearance of planting site, bush cutting, control burning and lopping of tree branches. After clearing the land, pits of the size 30 cm x 30 cm and 45 cm depth were dug out at 3 to 5 m regular intervals. The triangular planting method was applied in all the plantation sites, which is specially practiced in the hills and checks the flow of rain water and facilitates its percolation in the ground. Mixed plantation of 9 tree species was done by the local people as voluntary and as a labor. Two year old seedlings were planted after 20 days of pit digging. Before plantation, 2 kg Farm yard Manure (FYM) was applied in each pit. Bagged plants were sprayed with water before planting. The polythene was carefully removed so that the plant is not damaged. The plants with the soil intact were then being placed in the pit in straight position, the collar of the plant being in level with the ground. The soil around the plants was then pressed firmly by hands. Pressing by feet is likely to disturb the soil of the plant. Weeding was done during the first year following plantation. Dead saplings were replaced by new saplings in second year of the plantation.

Activity 5. Plants growth monitoring: Survival rate and morphological parameters (Plant height and girth) were recorded from all the restoration sites after first and second year of plantation. Forty representative individuals of each species were selected for growth measurements.

B. To enhance capacity of the diverse group of stakeholders on restoration of degraded land

Activity 5. Capacity building and social awareness

Adoption of any technology by farmers largely dependson demonstration and training, transfer of knowledge, awareness generated and level of strengthening of capacity. Apart from the informal meetings and discussions, 40 formal meetings including 25 training programmes were organized to promote activities of the programme among the wider range of stakeholders; a total of 1051 participants (622 Male and 429 Female) from 38 villages were trained to improve their skills. The participants were trained on simple technologies of land restoration, followed by subsequent demonstration of these technologies in the field. Hands-on training was given to villagers on measurement of growth and long- term monitoring for developing a restoration model. Communities in each site were trained for regular monitoring of planted species i.e., height, diameter and number of leaves of each planted sapling and counting of each sapling. Also the communities were trained on how periodic monitoring of growth of plants, removal/ replacement of dead and diseased plants, weeding etc. The villagers were participated in training programmes on stone wall and barbed wire fencing, Pit digging, nursery technique, plantation technique, moisture and water conservation. The programme facilitated regular interactions among scientists and farmers during the entire study period, ensuring to establish close linkages with the community for transfer of necessary technical know-how on restoration of degraded lands under the prevailing conditions. As a result, active participation of the local stakeholders was achieved not only up to the implementation of the programme, but also seen as an adoption and extension of the activities in their private agricultural lands through plantation of medicinally important species.

Figure 4: Capacity building programme

Activity 6. Synergy-building workshops

Four block level synergy-building events were organised to converge with various on-going and proposed restoration activities in the landscape. Also, obtain willingness of relevant Block level agencies to follow the management/ restoration models for up-scaling across landscape.

3.2 **Preparatory Actions and Agencies Involved (max. 1000 words):** G.B. Pant National Institute of Himalayan Environment (NIHE) Kosi-Katarmal, Uttarakhand; State Biodiversity Board (UBB) Dehradun; Uttarakhand Space Application Centre (USAC) Dehradun; Wildlife Institute of India (WII) Dehradun; Uttarakhand Forest Department (UKFD), Central Himalayan Environment Association (CHEA), Nainital

3.3 **Details of Scientific data collected and Equipments Used (max 500 words):**

Vernier caliper was used for measurement of plants girth. GPS was used for taking Geo-coordinates and Altitudes of target sites.

Table 3: Selected target sites

Target sites	**Village**	**Geo- Coordinate**		**Altitude (m asl)**
		Latitude (N)	**Longitude(E)**	
Haat- Kalik Watershed (Gangolihat Block, Pithoragarh)	Rawal gaon	29°39'366"	80°02'908"	1652 – 1670
	Kamad Gaon	29°40'740"	80°01'460"	1431 – 1450
	Jujut	29°39'55.35''	80°3'17.05''	1480-1510
Chandak- Aunlanghat Watershed (Bin Block, Pithoragarh)	Digtoli	29°37'45.71"	80°9'1.05"	1670 -1700
	Naikina	29°37'45.72"	80°10'10.51"	1760 – 1775
Upper & Lower Gori Watershed (Munsiyari Block, Pithoragarh	Lumti	29°53'370"	80°19'330"	950 -980

Table 4: Plants height (cm) in different target sites

Species	**Rawal goun**	**Kamad**	**Jajut**	**Digtoli**	**Naikina**	**Lumti**	**Inisial avg. height**
Cinnamomum tamala	80.15±1.87	65.88±3.25		69.2±2.17	68.63±2.87	73.72±4.02	30.48±1.12
Pittosporum eriocarpum				19±1.44	21.1±0.87	22.3±2.13	14.5±0.67

Zanthoxylum armatum				56.43±4.81	48.29±2.28	40.1±1.93	20±1.33
Myrica esculenta				41.4±0.54	12.75±0.65		9.6±0.35
Phyllanthus emblica				35.21±1.60	32.82±2.44	43.23±3.11	19.11±1.09
Terminalia chebula						19.5±1.27	10±0.25
Terminalia bellirica						22±0.86	10±0.28
Bauhinia variegate	17.83±3.44						15.04±2.17
Quercus leucotrichophora			95.41±1.63	75.46±1.73	73.41±1.82	85.5±2.05	33.8±1.38
Quercus glauca			91.56±2.27	75.76±2.14	79.18±1.24	89.33±1.71	30.77±1.14

Table 5: Plants girth (mm) in different target sites

Species	Rawal goun	Kamad	Jajut	Digtoli	Naikina	Lumti	Inisial avg. girth
Cinnamomum tamala	9.76±0.37	6.1±0.54		7.52±0.73	7.83±0.78	9.24±0.54	4.5±0.23
Pittosporum eriocarpum				4.35±0.94	5±1.18	4.40±1.02	2.4±0.41
Zanthoxylum armatum				8.34±1.25	7.7±1.15	7.06±0.89	3±0.88
Myrica esculenta				5.01±0.46	5.54±0.34		2.7±0.62
Phyllanthus emblica				6.55±0.87	6.49±0.73	7.67±1.32	2.8±0.56
Terminalia chebula						3.9±0.83	2±0.14
Terminalia bellirica						4.19±0.99	2±0.11
Bauhinia variegate	8.7±0.51					7.1±0.59	5.3±0.19
Quercus leucotrichophora			12.32±1.83	9.2±1.43	8.51±1.54	9.45±0.91	3.67±0.75
Quercus glauca			11.88±1.45	10.46±1.22	9.3±1.29	8.38	3.8±0.79

3.4 Primary Data Collected (max 500 words):

Parameters	Jajut	Naikina	Digtoli	Rawal gaon	Lumti	Kamad
Moisture Content (%)	22.4	21.13	21.56	5.87	5.62	10.5

Bulk Density	0.075	0.007	0.044	0.5	0.68	0.62
Water Holding Capacity %	34.6	35.88	36.33	39.85	30.32	35.53
Organic Carbon %	2.78	3.17	3.45	2.04	2.46	2.41
pH	6.62	6.56	6.31	6.56	5.46	5.56
Available Nitrogen (kg/ha)	246.6	263.42	209.06	144.2667	168.5	164.4
Total Nitrogen %	0.37	0.377	0.39	0.21	0.186	0.15
Available Phosphorus	256.8	327.21	259.06	261.75	219.91	251.66
Available K (kg/ha)	237.8	202.04	199.69	268.7	181.23	168.03

Table 6: Plants height (cm) in different target sites

Species	Rawal goun	Kamad	Jajut	Digtoli	Naikina	Lumti	Inisial avg. height
Cinnamomum tamala	80.15±1.87	65.88±3.25		69.2±2.17	68.63±2.87	73.72±4.02	30.48±1.12
Pittosporum eriocarpum				19±1.44	21.1±0.87	22.3±2.13	14.5±0.67
Zanthoxylum armatum				56.43±4.81	48.29±2.28	40.1±1.93	20±1.33
Myrica esculenta				41.4±0.54	12.75±0.65		9.6±0.35
Phyllanthus emblica				35.21±1.60	32.82±2.44	43.23±3.11	19.11±1.09
Terminalia chebula						19.5±1.27	10±0.25
Terminalia bellirica						22±0.86	10±0.28
Bauhinia variegate	17.83±3.44						15.04±2.17
Quercus leucotrichophora			95.41±1.63	75.46±1.73	73.41±1.82	85.5±2.05	33.8±1.38
Quercus glauca			91.56±2.27	75.76±2.14	79.18±1.24	89.33±1.71	30.77±1.14

Table 7: Plants girth (mm) in different target sites

Species	Rawal goun	Kamad	Jajut	Digtoli	Naikina	Lumti	Inisial avg. girth
Cinnamomum tamala	9.76±0.37	6.1±0.54		7.52±0.73	7.83±0.78	9.24±0.54	4.5±0.23
Pittosporum eriocarpum				4.35±0.94	5±1.18	4.40±1.02	2.4±0.41
Zanthoxylum armatum				8.34±1.25	7.7±1.15	7.06±0.89	3±0.88
Myrica esculenta				5.01±0.46	5.54±0.34		2.7±0.62
Phyllanthus emblica				6.55±0.87	6.49±0.73	7.67±1.32	2.8±0.56
Terminalia chebula						3.9±0.83	2±0.14
Terminalia bellirica						4.19±0.99	2±0.11
Bauhinia variegate	8.7±0.51					7.1±0.59	5.3±0.19
Quercus leucotrichophora			12.32±1.83	9.2±1.43	8.51±1.54	9.45±0.91	3.67±0.75
Quercus glauca			11.88±1.45	10.46±1.22	9.3±1.29	8.38	3.8±0.79

3.5 **Details of Field Survey arranged (max 500 words**): Field Survey details is attached along with meeting and workshops details

3.6 Strategic Planning for each Activities (max. 1000 words): Strategic planning for each activities have been given along with Methodology.

3.7 Activity wise Time frame followed [using Gantt/ PERT Chart (max. 1000 words)]

4 KEY FINDINGS AND RESULTS

4.1 Major Research Findings (max. 1000 words):

Meetings with Gram pradhan, Sarpanch and villagers for selection of degraded lands

40 formal meetings including 25 training programmes were organized to promote activities of the programme among the wider range of stakeholders; a total of 1051 participants (622 Male and 429 Female) from 38 villages participated (Fig.5). The villagers were aware and interested in restoration interventions and agreed for their participation in restoration intervention. After several meetings, Memorandum of understanding (MoUs) was signed (Fig. 6) between village representatives, villagers and GBP-NIHE for the establishment of restoration model in common degraded

land.Collectively about 30 hectare community land (17 h in Lower gori valley, 7 h in Chandak aulaghat watershed and 6 h in Haat-Kalika watershed) from 6 villages at three different pilot sites were selected for development of restoration model.

Figure 5: Meetings and workshop with villagers

Table 6: Plant species and number of saplings planted in different target sites:

Target sites	Village	Altitude (m asl)	Legal status	Land area (Hectare)	Planted species	No. of species planted
Haat- Kalik Watershed (Gangolihat Block, Pithoragarh)	Rawal Gaon	1652 - 1670	Community Pasture land	2	*Cinnamomum tamala, Bauhinia variegata, Julgans regia, Hedychium spicatum*	1500
	Kamad Gaon	1431 - 1450	Community Pasture land	3	*Cinnamomum tamala, Zanthoxylum armatum*	2400
	Jajut	1480-1510	Community Pasture land	1	*Quercus leucotrichophora, Quercus glauca*	500

Upper & Lower Gori Watershed (Munsiyari Block, Pithoragarh	Lumti	950 - 980	Community and Van-Panchayat Pasture land	17	*Pittosporum eriocarpum, Zanthoxylum armatum, Myrica esculenta, Phyllanthus emblica, Cinnamomum tamala, Quercus leucotrichophora, Quercus glauca, Terminalia chebula, Terminalia bellirica, Hedychium spicatum*	15,700
Chandak-Aunlanghat Watershed (Bin Block, Pithoragarh)	Digtoli	1670 - 1700	Community Pasture land	4.5	*Pittosporum eriocarpum, Zanthoxylum armatum, Myrica esculenta, Phyllanthus emblica, Cinnamomum tamala, Quercus leucotrichophora, Quercus glauca, Julgans regia*	2200
	Naikina	1760 - 1775	Van-Panchayat Pasture land	2.5	*Pittosporum eriocarpum, Zanthoxylum armatum, Myrica esculenta, Phyllanthus emblica, Cinnamomum tamala, Quercus leucotrichophora, Quercus glauca, Julgans regia, Hedychium spicatum*	1200
Total				**30 hectare**		**23,500/-**

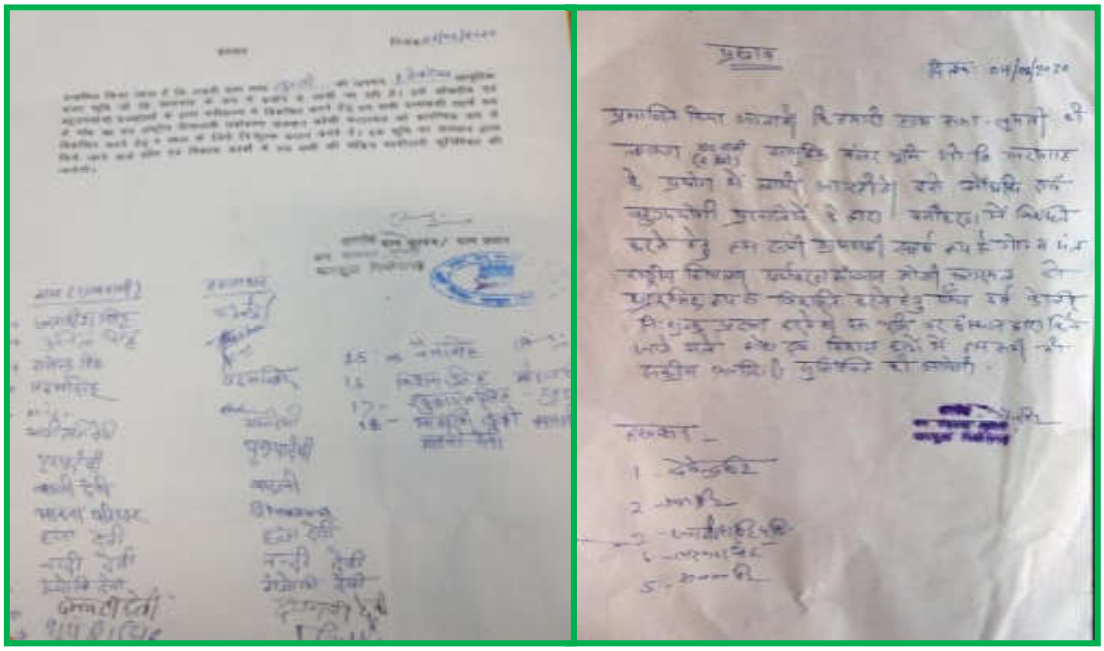


Figure 6: MoUs with villagers

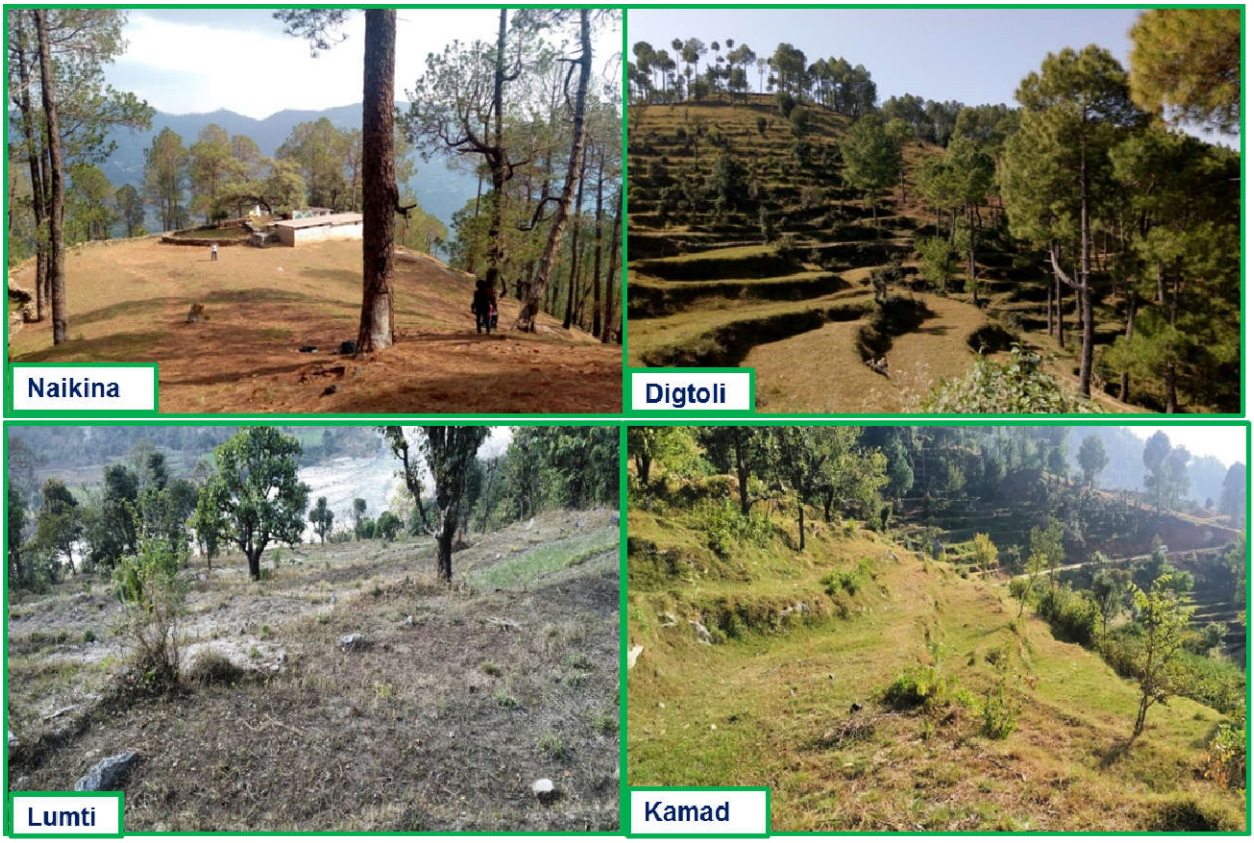


Figure 7: Selected villages for development of restoration model

Activity 2. Soil and moisture conservation work

For rain water harvesting, two ponds (Chaal-khal) was constructed at Kamad and Naikina with the help of MGNREGA scheme (Fig. 8 A). *Cymbopogon citratus grass* was introduced between the gaps in the plantation sites of Lumti village. Tranches and bunding was done at Kamad, Naikina, Digtoli and Lumti sites. Thawalas were made around all the saplings of all the sites (Fig. 8 B).

Figure 8: (A) Water harvesting pond at Kamad (B) Thawala preparation

Activity 3. Protection of plantation sites

Stone wall fencing with 3 feet height and 400 meter length was done at Naikina site. In 8 ha selected land for fencing at Digtoli, Kamad, Rawal goun and Lumti, barbed-wire fencing was constructed. Social type of fencing at all pilot sites was ensured. In Digtoli and naikina sites, *Cinnamomum tamala and Zanthoxylum armatum* were protected from frost in winter season.

Activity 4. Species prioritization for restoration as per need of community

After PRA survey of 666 people of 9 villages, silvi-medicinal-pastoral system was preferred by the community of restoration sites (Fig. 9). In priority of plants selection for restoration, 23 species were selected by the community (Fig. 10). Assessing the priority of community, scientific possibility and economical potential, 10 species (Fig. 11) were selected according to different sites (*Cinnamomum tamala, Pittosporum eriocarpum, Myrica esculenta,, Terminalia chebula, Terminalia bellirica, Phyllanthus emblica, Quercus leucotrichophora, Quercus glauca and Bauhiniavariegate* and *Zanthoxylum armatum).*

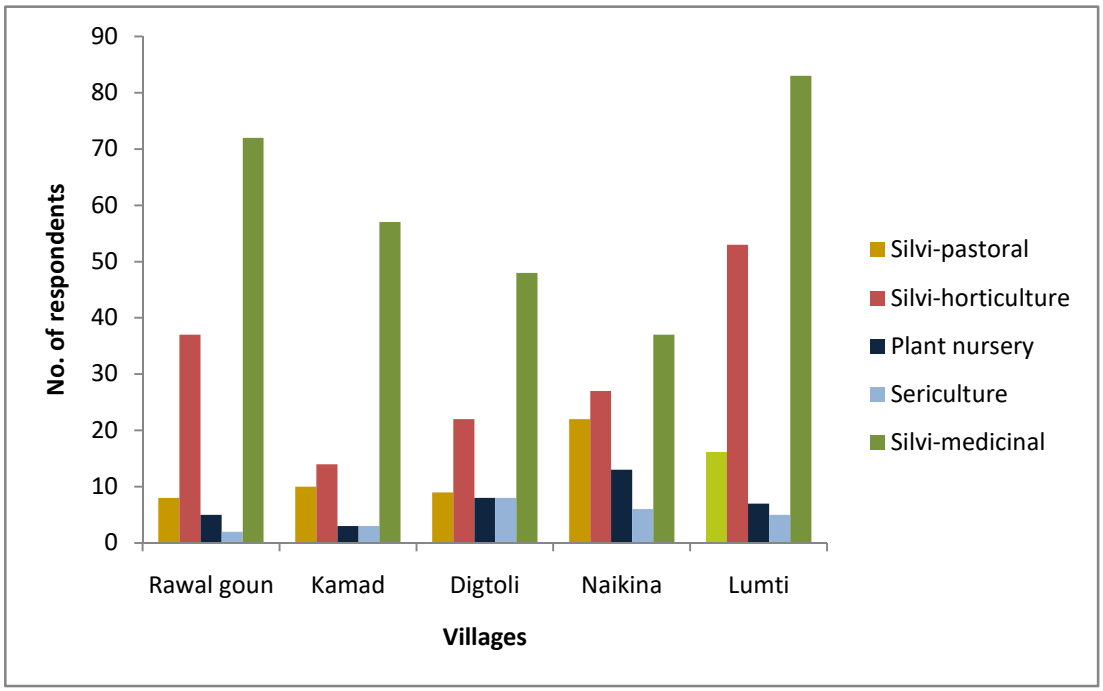


Figure 9: Restoration models proposed based on needs assessment of community

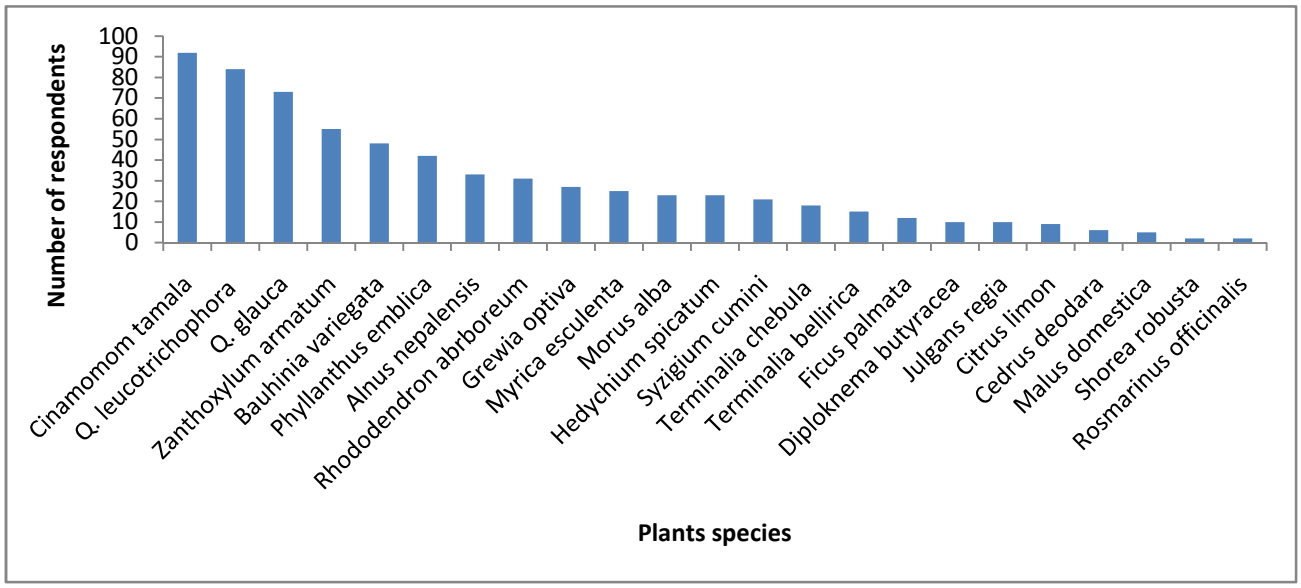


Figure 10: Species selection based on need assessment

Figure 11: Selected Plants species for restoration interventions

Table 7: Selected plant species for plantation on restoration sites

S. No	Plants species	Habitat suitability	Economic potential	Market demand	Restoration potential
1	***Cinnamomum tamala***	Chandak- Aunlanghat Watershed, Haat-Kalika Watershed and Lower Gori Valley Watershed	High	High	Yes
2	***Pittosporum eriocarpum***	Chandak- Aunlanghat Watershed, Haat-Kalika Watershed and Lower Gori Valley Watershed	Medium	Medium	Yes
3	***Myrica esculenta***	Chandak- Aunlanghat Watershed, Haat-Kalika Watershed	High	High	Yes
4	***Terminalia chebula***	Lower Gori Valley Watershed	High	High	Yes
5	***Terminalia***	Lower Gori Valley Watershed	High	High	Yes

	bellirica				
6	***Phyllanthus emblica***	Chandak- Aunlanghat Watershed, Haat-Kalika Watershed and Lower Gori Valley Watershed	High	High	Yes
7	***Bauhinia variegate***	Haat-Kalika Watershed	Medium	Low	Yes
8	***Quercus leucotrichophora***	Chandak- Aunlanghat Watershed, Haat-Kalika Watershed and Lower Gori Valley Watershed	High	Low	Yes
9	***Quercus glauca***	Chandak- Aunlanghat Watershed, Haat-Kalika Watershed and Lower Gori Valley Watershed	High	Low	Yes
10	***Zanthoxylum armatum***	Chandak- Aunlanghat Watershed, Haat-Kalika Watershed and Lower Gori Valley Watershed	High	High	Yes

Market demand in term of estimated annual trade in India

High: > 200 MT, **Medium: 100 – 200 MT**, **Low: < 100 MT**

Activity 5. Site preparation and plantation activity

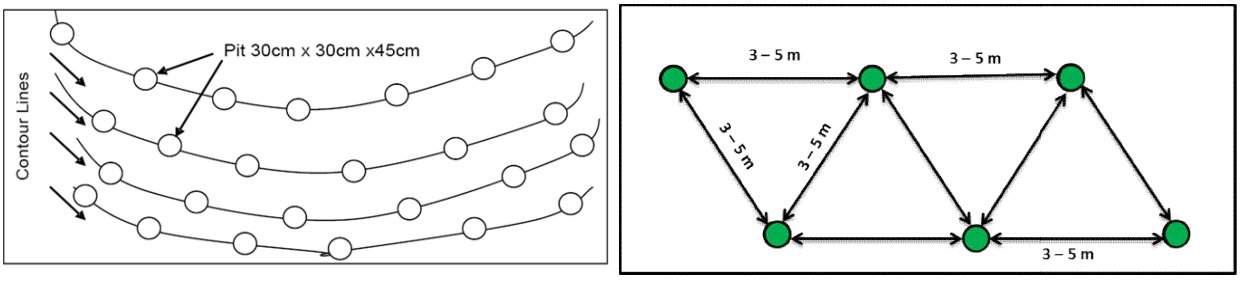


Figure 12: Geometry and alignment of the pits

Activity 6. Plants growth monitoring

Plants survival

10 medicinal plants species were selected and planted at 6 villages of three pilot sites based on the species prioritized by community, scientific possibility of the species to grow under these macro and

micro climatic condition, high market demands and economic potential. A total of 23,500 tree and herb species were planted at 6 villages of three pilot sites and survival rate were recorded subsequently 1 and 2 year after plantation. *Cinnamomum tamala* showed maximum survival percentage (89%) in Rawal goun followed by Digtoli (78.28%) as compared to other sites. Most of the species planted at Lumti site showed better survival with an average of 73.18% as compared to Digtoli (67.17%) and Naikina (62.2%). Details of survival percentage in different sites are given in Figure 13.

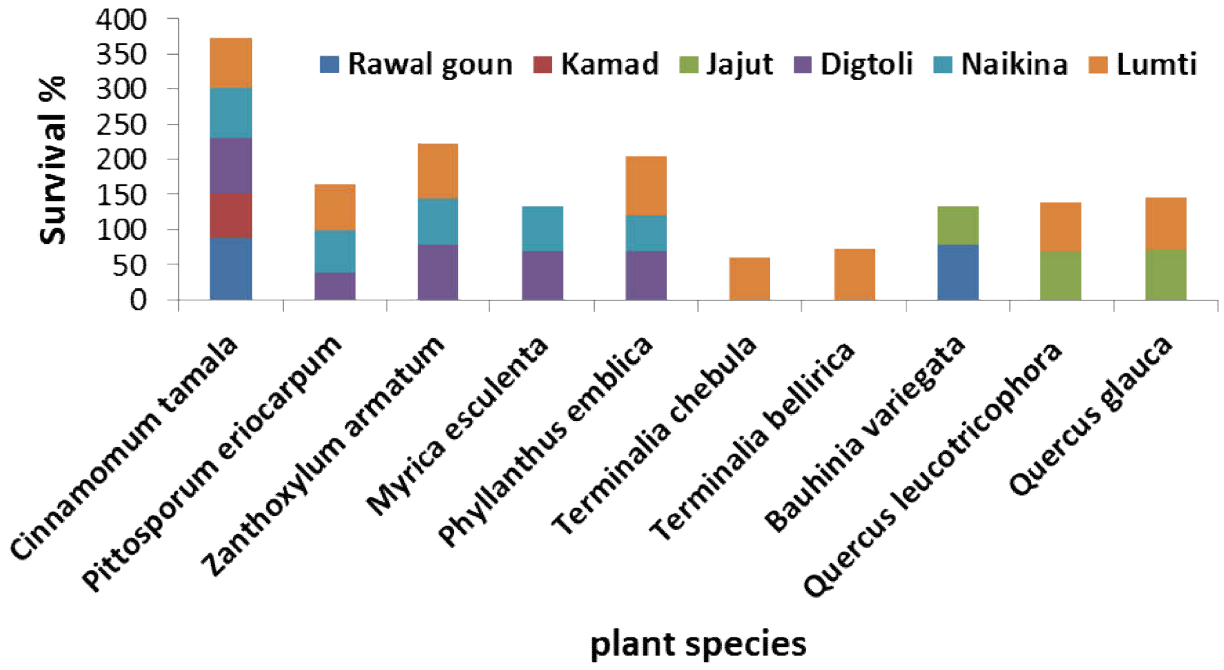


Figure 13: Survival percentage of planted species after 2 year of establishment

Plants survival (3 years of study)

In three villages namely Jajut, Digtoli and Naikina, five species were planted accordingly habitat suitability in Year 2018. The results of survival percentage illustrated that most of the species planted at Jajut site showed better survival with an average of 69% as compared to Digtoli (59%) and Naikina (62.25%) after 3 year of plantation. *Quercus leucotrichophora* showed maximum survival percentage (72.33) at all the sites followed by *Q. glauca* (63.66%), whereas minimum survival (49%) was observed in *Zanthoxylum armatum* at Naikina site. Details are given in fig. 14.

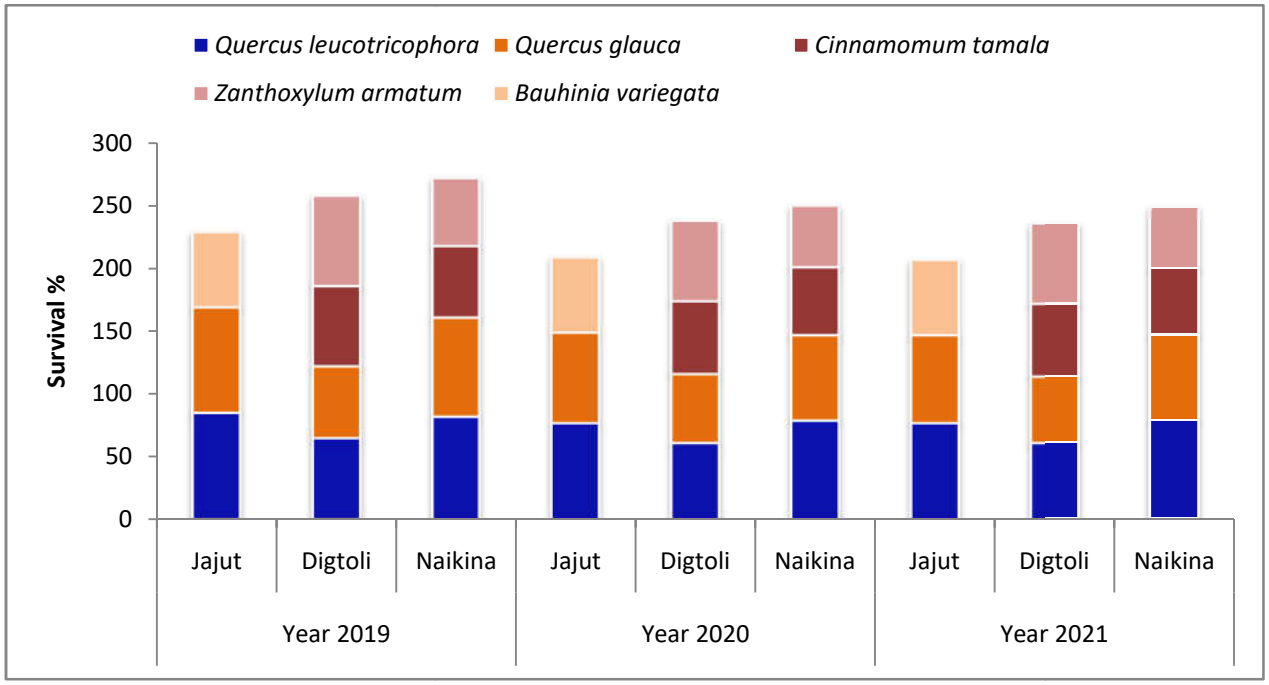


Figure 14: Survival percentage of planted species after 3 year of establishment

Growth performance

Growth of *C. tamala* showed maximum height (45.15 cm) and girth (6.67mm) at Rawal Gaon site (Table 4) whereas *P. emblica* showed maximum height (33.23 cm) and girth (4.67 mm) at Lumti site compared to other sites after the 2 year of plantation. *Quercus leucotrichophora* and *Quercus glauca* showed maximum height (95.41±1.63 and 91.56±2.27, respectively) and girth (12.32±1.83 and 11.88±1.45, respectively) at Jajut site.

Activity . Capacity building and social awareness

Adoption of any technology by farmers largely depends on demonstration and training, transfer of knowledge, awareness generated and level of strengthening of capacity. Apart from the informal meetings and discussions, 40 formal meetings including 25 training programmes were organized to promote activities of the programme among the wider range of stakeholders; a total of 1051 participants (622 Male and 429 Female) from 38 villages were trained to improve their skills. The participants were trained on simple technologies of land restoration, followed by subsequent demonstration of these technologies in the field. Hands-on training was given to villagers on measurement of growth and long- term monitoring for developing a restoration model. Communities in each site were trained for regular monitoring of planted species i.e., height, diameter and number of leaves of each planted sapling and counting of each sapling. Also the communities were trained

on how periodic monitoring of growth of plants, removal/ replacement of dead and diseased plants, weeding etc. The villagers were participated in training programmes on stone wall and barbed wire fencing, Pit digging, nursery technique, plantation technique, moisture and water conservation. The programme facilitated regular interactions among scientists and farmers during the entire study period, ensuring to establish close linkages with the community for transfer of necessary technical know-how on restoration of degraded lands under the prevailing conditions. As a result, active participation of the local stakeholders was achieved not only up to the implementation of the programme, but also seen as an adoption and extension of the activities in their private agricultural lands through plantation of medicinally important species.

Figure 15: Plants growth monitoring, Nursery training/workshop at different sites

4.2 Key Results:

- Five training modules prepared (Silvi-pastoral, Silvi-medicinal, Silvi-Horticulture, Nursery Development and management, Invasive species Management module) for different types of restoration interventions are in the process for fine tuning
- Developed skills and capacity of 1051 villagers (622 Male, 429 Female) from 38 villages in the landscape through 25 training/field workshops and 15 meetings/Awareness programmes
- Base line information related to geographical and ecological attributes with special reference to forest resources were collected from all 3 pilot sites.
- Restoration opportunity Map was prepared and prioritization of degraded land and species were done

- Around 30 ha demonstration sites developed in the Gram Panchayats: Chandak Aunla Ghat Watershed (Naikina, Digtoli), Lower Gori Valley (Lumti, Baram), Haat Kalika Watershed (Rawalgaon, Kamad and Jajut) through participatory approach
- A total of 23,500 tree and herb species were planted in 30 hectare of degraded land which are surviving at the rate of 69.8% among three pilot sites after three years of plantation
- Three block and one district level synergy-building events were organised to converge with various on-going and proposed restoration activities in the landscape. Also, obtain willingness of relevant Block level agencies to follow the management/ restoration models for up-scaling across landscape

4.3 Conclusion of the study (maximum 500 words in bullets): The project not only initiated the restoration in the landscape but also contributed towards the global agendas like Sustainable Development Goals, Aichi Biodiversity Targets and India's Intended Nationally Determined Contribution. Although with respect to the countrywide degraded land the area restored through the present project is very small, but its impacts are broad and long-lasting. By sighting the restoration models the people from another nearby villages are also willing to develop such models in their respective villages. This means people are understanding the importance of restoration interventions and the wealth which they can earn from the degraded land.

5 OVERALL ACHIEVEMENTS

5.1 Achievement on Project Objectives [Defining contribution of deliverables in overall Mission]:

- Five training modules prepared (Silvi-pastoral, Silvi-medicinal, Silvi-Horticulture, Nursery Development and management, Invasive species Management module) for different types of restoration interventions.
- Developed skills and capacity of 779 villagers (465 Male, 314 Female) from 38 villages in the landscape through 25 training and field workshops
- Around 30 ha demonstration sites developed in the Gram Panchayats: Chandak Aunla Ghat Watershed (Naikina, Digtoli), Lower Gori Valley (Lumti, Baram), Haat Kalika Watershed (Rawalgaon, Kamad and Jajut) through participatory approach
- Assessing the priority of community, scientific possibility and economical potential, 10 species were selected according to different sites (*Cinnamomum tamala, Pittosporum eriocarpum, Myrica esculenta, Terminalia chebula, Terminalia bellirica, Phyllanthus emblica,*

Quercus leucotrichophora, Quercus glauca and Bauhiniavariegata and *Zanthoxylum armatum).*

- For the protection of plantation sites against open grazing, Stone wall fencing with 3 feet height and 400 meter length were done at Naikina sites. 6 ha land of Digtoli, Kamad, Rawal goun and Lumti, were fenced with barbed-wire fencing.
- A total of 23,500 tree and herb species were planted in 30 hectare of degraded land which are surviving at the rate of 69.8% among three pilot sites after three years of plantation
- Three block and one district level synergy-building events were organised to converge with various on-going and proposed restoration activities in the landscape
- Fencing were done in 3 hectare land of Kamad village of Haat Kalika watershed through convergence with MGNREGA scheme of Gangolihaat block
- 5000 seedlings of *Cinnamomum tamala* weredistributed to 120 villagers of Lower Gori valley watershed through convergence with Bhesaj Sangh, Pithoragarh

5.2 Establishing New Database/Appending new data over the Baseline Data (max. 1500 words, in bullet points) - NA

5.3 Generating Model Predictions for different variables (if any) (max 1000 words in bullets) - NA

5.4 Technological Intervention (max 1000 words) - NA

5.5 On field Demonstration and Value-addition of Products (max. 1000 words, in bullet points): The project has developed different types of restoration models and has tried to showcase how the value addition of a degraded land can be done.

5.6 Promoting Entrepreneurship in IHR - NA

5.7 Developing Green Skills in IHR: The project has built capacity of locals in nursery development and management.

5.8 Addressing Cross-cutting Issues (max. 500 words, in bullet points) - Best practices of the restoration will be shared with different stakeholders. That will help in promoting restoration, reducing climate change impact and improving livelihood

6 PROJECT'S IMPACTS IN IHR

6.1 Socio-Economic Development (max. 500 words, in bullet points):

- 30 hectare land area of the KSL was restored.
- Income generation of 43 villagers from 6 villages through adoption of plantation and nursery techniques.

- Livelihood of the villagers will be increased by selling of produce from medicinal plants species after maturation of crops.
- Restoration of a degraded land will increase the amount of fodder, fuelwood, non-timber forest products in the area which can be directly used by the communities for their own requirements or they can sell it for income generation
- The project envisages to directly benefiting 38 villages from 3 pilot sites through plantation of multipurpose and economically important plants species that will benefit approximately 1,200 households with a population of about 7,000 women, men and children.
- 4-6 villages of Scheduled Tribes and 2-3 villages of Scheduled Castes will be specifically targeted thereby providing direct benefits to over 1,800 persons of these socially marginalized groups.
- In each case, it will be ensured to include 30-35% women as beneficiaries.
- The biological diversity of the area will increase.
- Improved health of ecosystem service providers of the landscape will benefit millions of people living in and regions lying downstream of the KSL.

6.2 Scientific Management of Natural Resources In IHR (max. 500 words, in bullet points)

- Land is one among the major and most important natural resources; if the land is productive it can be changed into wealth.
- The project has sensitized the village communities towards the benefits of restoration.
- Various training were given to the village communities on different aspects of restoration interventions for a proper management of the land.
- The 5 modules prepared in the project are complete guide on how to do restoration scientifically on a degraded land, so that it can be more productive and long lasting.

6.3 Conservation of Biodiversity in IHR (max. 500 words, in bullet points)

- If a degrade land is restored the biodiversity of that area will automatically increase.
- The restored land provides habitats and food for different biodiversity elements like animals, birds etc.
- As a pilot study 30 hectare land has been restored though the project i.e. 30 hectare of waste has been converted into long term wealth.
- The population of endemic species viz. *Pittosporum eriocarpum* will be increased in the landscape.

6.4 Protection of Environment (max. 500 words, in bullet points)

- The restoration models developed will act as a carbon sink, and contribute towards clean water, air and protection of land erosion.

6.5 Developing Mountain Infrastructures (max. 500 words, in bullet points) - NA

6.6 Strengthening Networking in IHR (max. 700 words, in bullet points) - NA

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8 ACKNOWLEDGEMENT

APPENDICES

Appendix 1 – Details of Technical Activities

Appendix 2 – Copies of Publications duly Acknowledging the Grant/ Fund Support of NMHS

Appendix 3 – List of Trainings/ Workshops/ Seminars with details of trained resources and dissemination material and Proceedings

Table 1: Workshop details

S.No.	Training/workshop details	Venue	No. of participants
1	One day block level workshop on "Synergy building with line agencies for promoting restoration programmes"	HGVS, Gangolihaat, Pithoragarh, Uttarakhand, October10, 2018	67 Villagers (54 Male , 13 Female)
2	Hands on training on plantation technique and Nursery preparation and management	Rawal goun, Gangolihat, Pithoragarh, Uttarakhand October 31, 2018	22 Villagers (6 Male , 16 Female)
3	Meeting with villagers for selection of degraded land, Sensitization and awareness workshop	Naikina, Chandak, Pithoragarh, Uttarakhand June 15, 2019	16 Villagers (4 Male , 12 Female)
4	Meeting with villagers for selection of degraded land, prioritization of plants	Naikina, Chandak, Pithoragarh,	27 Villagers (11 Male , 16 Female)

	species and promotion of their participation in restoration intervention	Uttarakhand June 18, 2019	
5	Meeting with villagers for selection of degraded land, prioritization of plants species and promotion of their participation in restoration intervention	Digtoli, Chandak, Pithoragarh, Uttarakhand June 19, 2019	32 Villagers (12 Male , 20 Female)
6	Hands on training on plantation technique and Nursery preparation and management	Naikina, Chandak, Pithoragarh, Uttarakhand June 23, 2019	30 Villagers (15 Male , 15 Female)
7	Meeting with villagers for selection of degraded land, prioritization of plants species and promotion of their participation in restoration intervention	Bans, Gangolihat, Pithoragarh, Uttarakhand July 24, 2019	12 Villagers (10 Male , 2 Female)
8	Meeting with villagers for selection of degraded land, prioritization of plants species and promotion of their participation in restoration intervention	Pali, Gangolihat, Pithoragarh, Uttarakhand August 8, 2019	20 Villagers (18 Male , 2 Female)
9	Meeting with villagers for selection of degraded land, prioritization of plants species and promotion of their participation in restoration intervention	Chitgal, Gangolihat, Pithoragarh, Uttarakhand August 8, 2019	12 Villagers (11 Male , 1 Female)
10	Hands on training on plantation technique and Nursery preparation and management	Digtoli, Chandak, Pithoragarh, Uttarakhand August 8, 2019	4 Villagers (4 Male , 0 Female)
11	Hands on training on plantation technique and Nursery preparation and management	Naikina, Chandak, Pithoragarh, Uttarakhand August 28, 2019	30 Villagers (12 Male , 18 Female)
12	Meeting with villagers for selection of degraded land, prioritization of plants species and promotion of their	Lumti, Gori valley, Pithoragarh, Uttarakhand	27 Villagers (11 Male , 16 Female)

	participation in restoration intervention	January 28, 2020	
13	Meeting with villagers for selection of degraded land, prioritization of plants species and promotion of their participation in restoration intervention	Rawal goun, Gangolihat, Pithoragarh, Uttarakhand February 09, 2020	50 Villagers (46 Male , 04 Female)
14	Meeting with villagers for selection of degraded land, prioritization of plants species and promotion of their participation in restoration intervention	Digtoli, Chandak, Pithoragarh, Uttarakhand February 10, 2020	36 Villagers (23 Male , 13 Female)
15	Meeting with villagers for selection of degraded land, prioritization of plants species and promotion of their participation in restoration intervention	Naikina, Chandak, Pithoragarh, Uttarakhand February 25, 2020	28 Villagers (06 Male , 22 Female)
16	Training on soil sampling, stone wall and barbed wire fencing, Pit digging, Plantation technique, moisture and water conservation work	Naikina, Chandak, Pithoragarh, Uttarakhand July 29, 2020	26 Villagers(05 Male , 21 Female)
17	Training on soil sampling, stone wall and barbed wire fencing, Pit digging, Plantation technique, moisture and water conservation work	Lumti, Gori valley, Pithoragarh, Uttarakhand July 30, 2020	23 Villagers (15 Male , 08 Female)
18	Training on soil sampling, stone wall and barbed wire fencing, Pit digging, Plantation technique, moisture and water conservation work	Digtoli, Chandak, Pithoragarh, Uttarakhand 8July 31, 2020	18 Villagers (09 Male , 09 Female)
19	Training on soil sampling, stone wall and barbed wire fencing, Pit digging, Plantation technique, moisture and water conservation work	Chitgal, Gangolihat, Pithoragarh, Uttarakhand August 04, 2020	20 Villagers (16 Male , 04 Female)
20	Training on soil sampling, stone wall and barbed wire fencing, Pit digging, Plantation technique, moisture and	Rawal goun, Gangolihat, Pithoragarh,	21 Villagers (12 Male , 09 Female)

	water conservation work	Uttarakhand August 08, 2020	
21	Training on soil sampling, stone wall and barbed wire fencing, Pit digging, Plantation technique, moisture and water conservation work	Kamad, Gangolihat, Pithoragarh, Uttarakhand August 11, 2020	23 Villagers (23 Male)
22	Hands-on training workshop on CRA technique, Soil sampling, Measurements of plants	Digtoli, Chandak, Pithoragarh, Uttarakhand September 3, 2020	12 Villagers (2 Male, 10 Females)
23	Hands-on training workshop on CRA technique, Soil sampling, Measurements of plants	Naikina, Chandak, Pithoragarh, Uttarakhand September 4, 2020	11 Villagers (4 Male, 7 Females)
24	Hands-on training workshop on CRA technique, Soil sampling, Measurements of plants	Lumti, Gori valley, Pithoragarh, Uttarakhand September 8, 2020	20 Villagers (14 Male, 6 Females)
25	Meeting with villagers for selection of degraded land, prioritization of plants species and promotion of their participation in restoration intervention	Chitgal, Gangolihat, Pithoragarh, Uttarakhand January 29, 2021	25 Villagers (18 Male, 7 Females)
26	Meeting with villagers for selection of degraded land, prioritization of plants species and promotion of their participation in restoration intervention	Chitgal, Gangolihat, Pithoragarh, Uttarakhand February 08, 2021	35 Villagers (20 Male, 15 Females)
27	Meeting with villagers for selection of degraded land, prioritization of plants species and promotion of their participation in restoration intervention	Lumti, Gori valley, Pithoragarh, Uttarakhand February 10, 2021	22 Villagers (7 Male, 15 Females)
28	One day workshop on “Promoting Restoration Programmes on Degraded Lands and livelihood opportunities” and	HGVS, Gangolihaat, Pithoragarh, Uttarakhand,	71 Villagers (60 Male and 11 Female)

	training on preparation of biobriquetting	April 3, 2021	
29	Celebration of Uttarakhand lok parv, HARELA (Meeting with villagers for promotion of their participation in restoration intervention and plantation activity)	Digtoli, Bin block, Pithoragarh, Uttarakhand, July 16, 2021	16 Villagers (7 Male and 9 Female)
30	Celebration of Uttarakhand lok parv, HARELA (Meeting with villagers for promotion of their participation in restoration intervention and plantation activity)	Naikina , Bin block, Pithoragarh, Uttarakhand, July 16, 2021	13 Villagers (8 Male and 5 Female)
31	Celebration of Uttarakhand lok parv, HARELA (Meeting with villagers for promotion of their participation in restoration intervention and plantation activity)	Lumti , Gori valley, Uttarakhand, July 16, 2021	27 Villagers (3 Male and 24 Female)
32	Meeting with villagers for promotion of their participation in restoration intervention and plantation activity	Lumti , Gori valley, Uttarakhand, Aug 2, 2021	28 Villagers (14 Male and 14 Female)
33	Distribution and Plantation of *Cinnamomum tamala* andmeeting with villagers for promotion of their participation in restoration intervention	Lumti , Maitali, Toli, baram, Gori valley, Uttarakhand, Aug 5, 2021	120 Villagers (65 Male and 55 Female)
34	Hands on training on plantation technique and Nursery preparation and management	Digtoli, Bin block, Pithoragarh, Uttarakhand, Aug 7, 2021	49 Villagers (41 Male and 8 Female)
35	Hands on training on plantation technique and Nursery preparation and management	Lumti , Maitali, Toli, baram, Gori valley, Uttarakhand, Aug 10, 2021	38 Villagers (24 Male and 14 Female)
36	Hands on training on plantation	Naikina, Bin block,	18 Villagers (12

	technique and Nursery preparation and management	Pithoragarh, Uttarakhand, Aug 12, 2021	Male and 6 Female)
37	One day workshop on “Culture and Biodiversity” for promoting restoration programmes on degraded lands	Meeting Hall, H.G.V.S., Gangolihaat, Pithoragarh, Uttarakhand, November 12, 2021	51 Villagers and Officials of various Line agencies (33 Male and 18 Female)
38	One day block level workshop on "Synergy building with line agencies for promoting restoration programmes”	Meeting Hall, Dharchula block, Pithoragarh, Uttarakhand, November 24, 2021	54 Villagers and Officials of various Line agencies (39 Male and 15 Female)
39	One day workshop on "Management of Invasive species”	Digtoli, Bin- block, Pithoragarh, Uttarakhand, November 25, 2021	17 Villagers (6 Male and 11 Female)
40	One day block level workshop on "Synergy building with line agencies for promoting restoration programmes”	Meeting Hall, Bin-block, Pithoragarh, Uttarakhand, November 26, 2021	40 Villagers and Officials of various Line agencies (32 Male and 8 Female)

Proceeding of all meetings and workshops

1. **An awareness programme was organized for promotion of restoration programme on degraded land through medicinally important species with the participatory approach at Chitgal, Gangolihat, Pithoragarh, Uttarakhand on January 29, 2021.** A total of 25 Villagers (18 Males, 7 Females) participated in this meeting. Experts from the GBP-NIHE informed about the aim, objectives and benefits of the restoration programme on degraded land. It was suggested that participation of local people at every step of restoration interventions is the most important thing for successful restoration programme. The awareness programme was focused on threats and benefits of restoration interventions. It

was suggested that restoration is likely to reverse the loss of biodiversity, improve ecosystem resilience, enhance the provision of ecosystem services, mitigate the effects of climate change, combat desertification and land degradation and improve human well-being while reducing environmental risks and scarcities. Experts requested the villagers for enhancing people participation in such programmes.

2. **Another awareness programme was organized for promotion of restoration programme on degraded land through medicinally important species with participatory approach at Chitgal, Gangolihat, Pithoragarh, Uttarakhand on February 08, 2021**. A total of 35 Villagers (20 Male, 15 Females) participated in this meeting. Experts from the GBP-NIHE informed about the aim, objectives and benefits of the restoration programme on degraded lands. He suggested that participation of local peoples in each and every steps of restoration interventions are the most important thing for successful restoration program and highlighted the importance and threats for biodiversity, including habitat loss, over-exploration, deforestation, pollution, and climate change. The awareness programme was focused on threats and benefits of restoration interventions. It was suggested that restoration is likely to reverse the loss of biodiversity, improve ecosystem resilience, enhance the provision of ecosystem services, mitigate the effects of climate change, combat desertification and land degradation and improve human well-being while reducing environmental risks and scarcities. Experts requested to villagers for enhancing people participation

3. **An awareness programme was organized for promotion of restoration programme on degraded land through medicinally important species with the participatory approach at Lumti, Gori valley, Pithoragarh, Uttarakhand on February 10, 2021.** A total of 22 Villagers (7 Male, 15 Females) were participated in this meeting. Experts from the GBP-NIHE informed about the aim, objectives and benefits of the restoration programme on degraded lands. He suggested that participation of local peoples in each and every steps of restoration interventions are the most important thing for successful restoration programme and highlighted the importance and threats for biodiversity, including habitat loss, over-exploration, deforestation, pollution, and climate change. The awareness programme was focused on threats and benefits of restoration interventions. It was suggested that restoration is likely to reverse the loss of biodiversity, improve ecosystem resilience, enhance the provision of ecosystem services, mitigate the effects of climate change, combat desertification and land degradation and improve human well-being while reducing environmental risks and scarcities. Experts requested to villagers for enhancing people participation.

4. **The one day workshop on Promoting Restoration Programmes on Degraded Land and livelihood opportunities was conducted in conference hall of Himalayan Gram Vikas Samiti, Gangolihaat on April 3, 2021.** A total of 71 participants (60 male and 11 Female) from 27 villages of Hat-Kalika watershed and 6 line agencies (including GBP-NIHE and HGVS) namely, Forest department, Horticulture department, Veterinary department and Nagar Panchayat were present on this occasion. Besides, Chairman of the HGVS and their staff were also present in this event.

   Shri Rajendra Singh Bisht (Chairman HGVS) welcomed the participants and informed about the research and development work done for promoting restoration of degraded lands in the region from many years by GBP-NIHE. He highlighted that the institute want to make the better opportunity in future for the villagers in form of ecosystem goods and services

which will be also helpful for livelihood enhancement of the community. He highlighted that how GBP-NIHE and HGVS together worked on biodiversity conservation and livelihood opportunities in different region of Pithoragarh district.

Dr. I.D. Bhatt (Scientist GBP-NIHE) welcomed the participants and gave the brief introduction of the programme. In his introductory talk, he informed about aim, objectives and benefits of the workshop. He highlighted the importance of biodiversity, different life forms and threats for the biodiversity, including habitat loss, over-exploration, deforestation, pollution and climate change. He said restoration is likely to reverse the loss of biodiversity, improve ecosystem resilience, enhance the provision of ecosystem services, mitigate the effects of climate change, combat desertification and land degradation and improve human well-being while reducing environmental risks and scarcities. He informed that Hat-Kalika watershed have 2830 hectare land area in which 613 hectare is degraded land. He suggested that it is important to restore this degraded area which will be helpful for reducing the pressure on natural resources, play an important role in conservation of biodiversity and uplift the economic condition of people and provide ecosystem goods and services for well-being of people. He informed about partners institution which are the part of KSLCDI projects. He also highlighted the use of pine needle based products for livelihood enhancement and reducing forest fire.

Dr. R.S. Rawal (Director, GBP-NIHE) welcomed and greeted to all the participants on behalf of the coordinating Institute. He gave 3 basic *Mantras* for successful restoration program - Partnership, participation and responsibility. He suggested that partnership between villagers/village representatives and respective line agencies is most important thing for successful restoration program. Participation and responsibility of everyone should be clearly decided. He informed about upcoming challenges of life, environmental risk and scarcity of natural resources and effects of climate change. He gave example of Cape-Town, south-Africa facing problem of curfew for scarcity of water from two years. He highlighted that Forests in IHR faces several threats in the form of over exploitation, unmanaged utilization, illegal trade, increased demand for fuel, fodder, timber, fiber, wild edibles, medicinal and

aromatic plants, land use changes, forest fire, climate change etc., which have resulted in degradation and depletion of forests and biodiversity resources. He said restoration is likely to reverse the loss of biodiversity, improve ecosystem resilience, enhance the provision of ecosystem services, mitigate the effects of climate change, combat desertification and land degradation and improve human well-being. Therefore, it would be pertinent to undertake land restoration, which will be helpful for reducing the pressure on natural resources, play an important role in conservation of biodiversity and uplift the economic condition of people and provide ecosystem goods and services for well-being of people. He gave example of Chandak watershed where institute participate with other line agencies and villagers for recharging water resources at Naikina village of Pithoragarh district. He made a great success and gave the great example of synergistic efforts between different line agencies and villagers. He informed about pine needle based products and suggested to the villagers to enhance livelihood through these products as well as reduce the risk of forest fire. At the end of his final remarks, he suggested to the villagers that promoting restoration on degraded lands through medicinally important species is the most suitable strategy for biodiversity conservation as well as livelihood enhancement.

Technical session 1. Restoration of degraded lands for livelihood enhancement

Three parallel sessions were organized for this technical session. For this, all the participants were divided in three groups.

First Group: In the first group, all the participants from the Line agencies were grouped together and discussed about different policies government schemes for synergy building with community for successful restoration interventions. For this group, moderator was Dr. I.D. Bhatt,

GBP-NIHE. In this group 5 members from different Line agencies namely, Forest, Nagar Panchayat, Veterinary and Horticulture departments participated.

Second Group: In the second group, all the representatives of the Gram/Van Panchayat were grouped together and discussed about need of the community and synergy building with Line agencies. For this group, moderator was Mr. Rajendra Singh Bisht, HGVS. In this group 31 members participated from 20 Villages.

Suggestions comes from this group -

- Chal-Khal and Khanti should be constructed on the peaks of the hilly regions.
- Prevention should be done to avoid spreading of pine species inside the oak forests
- Fruit plants should be planted in the forests, especially Pear grafts in mehal's plants.
- Construction of check dams and bushwood check dams should be done to protect soil erosion.
- Development should be done for mixed species forests instead of single species forests.
- To protect agricultural land from wild animals, 2-meter-hight and 60-cm-wide wall should be constructed through the MNREGA scheme.
- Fruit plants should be planted in barren land (agricultural land which is barren due to wild animals). Two to four youth should be appointed to look after them and the minimum area should be 4 hectares.
- Rain water harvesting should be mandatory for all families in villages located in high altitude areas along with conservation of different sources of water and ground water, special schemes should be prepared by the government for this.
- Special encouragement should be given to the villagers of the hilly region for connecting them to conservation of the forests.

Third Group: In the third group, all the Self Help Group members were grouped together and discussed about need of community working together as a Self Help Group and synergy building with Line agencies for successful restoration interventions. For this group, moderator was Mr. Vibhash Dhyani, GBP-NIHE. In this group 9 members participated from Kamdhenu Swayatt Sahkarita Samooh, Gangolihat. This group was working on collection and selling of

dairy products. For agricultural point of view, the main problems in front of the group are monkeys and other animals and second one is scarcity of water. The group was interested in restoration programmes.

Suggestions from this group

- Plantation of Fodder species along with medicinal plants should be done in Gangolihat area.
- The Plantation should be done on non-agricultural land.
- Cultivation of spice's species should be done in this area.
- All the plantation activity should be done through participatory approach.
- Special schemes should be prepared by the government for Self Help Groups.
- The selected plants species ofsuggested by the group were Sahtoot, Keemu, Kafal, Aadu, Burans, Reetha, Tejpaat, Amla, Haldi, Adarak, Baanj, Bheemal.

Technical session 2. Pine needles products and livelihood enhancement

In this session Mr. Darbaan Singh Bisht, Technical expert, GBP-NIHE**,** organized a hands on training on preparation of Bio-briquettes. He highlighted the benefits of the use of biobriquettes. He informed that it saves LPG gas, it is used as energy source, help in conservation of biodiversity and used as livelihood option. He trained villagers for making biobriquettes and how they can take it as a livelihood option.

3. **Celebration of Uttarakhand Lok Parv, HARELA (Meeting with villagers for promotion of their participation in restoration intervention and plantation activity) at Digtoli, Bin block, Pithoragarh, Uttarakhand,, July 16, 2021.** A total of 16 Villagers (7 Male and 9 Female) participated in plantation activity. 1200 saplings of 5 medicinal plants species (*Cinnamomum tamala, Pittosporum eriocarpum, Myrica esculenta, Phyllanthus emblica*and *Zanthoxylum armatum* were planted in 2.5 hectare of common degraded land at Digtoli site through participation of local people.

4. **Celebration of Uttarakhand Lok Parv, HARELA (Meeting with villagers for promotion of their participation in restoration intervention and plantation activity) at Naikina, Bin block, Pithoragarh, Uttarakhand on July 16, 2021.** A total of 13 Villagers (8 Male and 5 Female) participated in plantation activity. 700 saplings of 6 medicinal plants species (*Cinnamomum tamala, Pittosporum eriocarpum, Myrica esculenta, Phyllanthus emblica, Hedychium spicatum* and *Zanthoxylum armatum)* were plantedin 1 hectare of common degraded land at Naikina site through participation of local people.

5. **Celebration of Uttarakhand Lok Parv, HARELA (Meeting with villagers for promotion of their participation in restoration intervention and plantation activity) at Lumti, Gori valley, Uttarakhand on July 16, 2021.** A total of 27 Villagers (3 Male and 24 Female) participated in plantation activity. 7000 saplings of 8 medicinal plants species (*Cinnamomum tamala, Pittosporum eriocarpum, Terminalia chebula, Terminalia bellirica, Phyllanthus emblica, Diploknema butyracea, Hedychium spicatum* and *Zanthoxylum armatum)* were plantedin 7 hectare of common degraded land at Lumti site through participation of local people.

6. **A meeting was organized for "promotion of restoration programme on degraded land through medicinally important species with the participatory approach" in lower gori valley watershed (Lumti, Baram), Pithoragarh, Uttarakhand on August 2, 2021.** A total of

28 Villagers (14 Male, 14 Females) participated in this meeting. Experts from the GBP-NIHE informed about the aim, objectives and benefits of the restoration programme on degraded lands. He suggested that participation of local peoples in each and every steps of restoration interventions are the most important thing for successful restoration programme and highlighted the importance and threats for biodiversity, including habitat loss, over-exploration, deforestation, pollution, and climate change. The awareness programme was focused on threats and benefits of restoration interventions. It was suggested that restoration is likely to reverse the loss of biodiversity, improve ecosystem resilience, enhance the provision of ecosystem services, mitigate the effects of climate change, combat desertification and land degradation and improve human well-being while reducing environmental risks and scarcities. Experts requested to villagers for enhancing people participation.


7. **Distribution and Plantation of *Cinnamomum tamala* seedlingsfor promotion of restoration programmes on degraded land through medicinally important plants species at 5 villages of Gori valley, Uttarakhand on Aug 5, 2021.** A total of 5000 seedlings of *Cinnamomum tamala* were distributed among120 Villagers (65 Male and 55 Female) of 5 villages (Lumti, Baram, Toli, Maitali and Kalika) through convergence between GBP-NIHE and Jila Bhesaj Sangh, Pithoragarh. The villagers planted this plant species in their 5 hectare of personal and community land.


Fig. Distribution of Planting material and plantation activity

8. **Hands on training on plantation technique and Nursery preparation and management were given to villagers of Digtoli, Bin block, Pithoragarh, Uttarakhand on August 7, 2021.** A total of 49 Villagers (41 Male and 8 Female) participated in training programme. Two parallel technical sessions were organized for this training programme. First technical training session was focused on nursery preparation and management i.e., Design and layout of nursery, nursery bed preparation, equipment and machinery, soil preparation, species selection, preparation of potting mixture, Composting, seed collection, Storage and sowing, weeding and pesticides and other nursery management practices. Second technical session was focused on Plantation techniques i.e., soil sampling, plants species selection, field preparation, pit digging, fertilizer application, plantation and plant growth monitoring.


9. **Hands on training on plantation technique and Nursery preparation and management were given to villagers of Lumti , Gori valley, Uttarakhand on August 10, 2021.** A total of 38 Villagers (24 Male and 14 Female) participated in training programme. Two parallel technical sessions were organized for this training programme. First technical training session was focused on nursery preparation and management i.e., Design and layout of nursery, nursery bed preparation, equipment and machinery, soil preparation, species selection, preparation of potting mixture, Composting, seed collection, Storage and sowing, weeding and pesticides and other nursery management practices. Second technical session was focused on Plantation techniques i.e., soil sampling, plants species selection, field preparation, pit digging, fertilizer application, plantation and plant growth monitoring.


10. **Hands on training on plantation technique and Nursery preparation and management were given to villagers of Naikina, Bin block, Pithoragarh, Uttarakhand on August 12, 2021.** A total of 18 Villagers (12 Male and 6 Female) participated in training programme. Two parallel technical sessions were organized for this training programme. First technical training session was focused on nursery preparation and management i.e., Design and layout of nursery, nursery bed preparation, equipment and machinery, soil preparation, species selection, preparation of potting mixture, Composting, seed collection, Storage and sowing, weeding and pesticides and other nursery management practices. Second technical session was focused on Plantation techniques i.e., soil sampling, plants species selection, field preparation, pit digging, fertilizer application, plantation and plant growth monitoring.


11. **One day workshop on "Culture and Biodiversity" for promoting restoration programmes on degraded lands was organized at Meeting Hall, H.G.V.S., Gangolihaat, Pithoragarh, Uttarakhand on November 12, 2021.** A total of 51 Villagers and officials of various Line agencies (33 Male and 18 Female) participated in this workshop. The expert from GBP-NIHE informed that the G B Pant National Institute of Himalayan Environment has initiated restoration of the degraded land in the KSL part of India for the conservation of natural resources in 2018. The project is led and coordinated by the Uttarakhand State Biodiversity Board with other

partner agencies namely GBP-NIHE Almora, Wildlife Institute of India (WII) Dehradun, Uttarakhand Space Application Centre (USAC) Dehradun, Central Himalayan Environment Association (CHEA) Nainital, and Uttarakhand Forest Department (UKFD). As the year 2021-22 is the concluding year of the project, and the project partners of this initiative are making collaborative efforts to consolidate upon the outputs to come-up with outcomes and exhibit the impacts. In this context, project partners have realized that there is a need to reach-out local stakeholder constituencies with the 'Stories of Success' from pilots. Considering this, project partners agreed to disseminate the information and lessons learnt to the local community and implementing agency by way of organizing a workshop on '**Culture and Biodiversity'**, at Gangolihat, District-Pithoragarh on 12 October, 2021. The programme was designed to interact with diverse stakeholder groups *viz.,* representatives of community organizations, scholars, implementers, and policy planners. Realization of this has been thought through organization of series of lectures and discussions by project partners. The major activities in this workshop included: (1) ***'Culture and Biodiversity value'*** *interaction on to harness heritage value of cultural and biological diversity for livelihoods promotion and conservation. (2)****'Strengthen community institutions'*** *establishing convergence for restoration of degraded habitats and management of ecosystem in Gangolihat region.*


12. **One day block level workshop was organized on "Synergy building with line agencies for promoting restoration programmes" at Meeting Hall of Dharchula block, Pithoragarh, Uttarakhand on November 24, 2021.** A total of 54 participants (39 Male and 15 Female) from 7 villages of Lower Gori valley watershed and officials of various Line agencies namely, Forest department, Horticulture department, Veterinary department, Agriculture department and Block officials (MGNREGA and other schemes) were present on this occasion. At the outset of the programme, Dr. Subodh Airi

(Tech. Gr-IV, GBP-NIHE) welcomed the participants and expressed his pleasure at hosting the workshop. He informed about the workshop session and introduced respective speaker to the participants. In his introductory talk, Dr I. D. Bhatt (Scientist-F, GBP-NIHE) welcomed and greeted to all the participants and gave the brief introduction of the programme. He informed about aim, objectives and benefits of the workshop. He suggested that synergy building between villagers/village representatives and respective line agencies is most important thing for successful restoration program. Participation and responsibility of everyone should be clearly decided. He informed about upcoming challenges of life, environmental risk and scarcity of natural resources and effects of climate change. He highlighted that forests in IHR face several threats in the form of over exploitation, unmanaged utilization, illegal trade, increased demand for fuel, fodder, timber, fiber, wild edibles, medicinal and aromatic plants, land use changes, forest fire, climate change etc., which have resulted in degradation and depletion of forests and biodiversity resources. Therefore, it would be pertinent to undertake land restoration, which will be helpful for reducing the pressure on natural resources, play an important role in conservation of biodiversity and uplift the economic condition of people and provide ecosystem goods and services for well-being of people. He informed about pine needle based products and suggested to the villagers to enhance livelihood through these products as well as reduce the risk of forest fire. At the end of his final remarks, he suggested to the villagers that promoting restoration on degraded lands through medicinally important species is the most suitable strategy for biodiversity conservation as well as livelihood enhancement. One technical session was organized on **"**Development of strategies for convergence with line departments for Promoting Restoration Programmes on Degraded Lands and Livelihood Opportunities".For this, all the participants from the Line agencies and representatives of the Gram/Van Panchayat were grouped together and discussed about need of the community, different policies of government currently running in the landscape and synergy building between community and line agencies for successful restoration interventions. For this session, moderator was Dr Vikram S. Negi (Scientist-E, GBP-NIHE).

Suggestions from the group discussion:

- Plants used for restoration purpose should have great water holding capacity.
- Chal-Khal and Khanti should be constructed on the peaks of the hilly region.
- Fruit plants should be planted in the forests.
- Construction of check dams should be done to protect soil erosion.

- Fencing of the plantation site, pit digging and plantation activity could be done through MGNREGA scheme with help of Job Card holders of the villages
- Development should be done for mixed species forests instead of single species forests.
- Fruits plants should be planted in barren land (agricultural land which is barren due to wild animals).
- Special encouragement should be given to the villagers of the hilly region for connecting them to conservation of the forests.

13. **One day workshop on "Management of Invasive species" Digtoli, Bin- block, Pithoragarh, Uttarakhand on November 25, 2021,**17 Villagers (6 Male and 11 Female) **Dr I. D. Bhatt, Scientist-F, GBP-NIHE** welcomed the participants and gave the brief introduction of the programme. In his introductory talk, he informed about aim, objectives and benefits of the workshop. He informed about the invasive species and their adverse effect on ecosystems, habitats, and other species. He also informed that from Uttarakhand 163 species of invasive plants have been reported out of which 137 are herbs, 21 are shrubs and 5 are trees. 84 species of invasive plants are used for different purposes by local communities in Uttarakhand. Maximum species (48%) of invasive plants are found in waste lands, 20 % species are found in agriculture lands, 14 % are found in road sides and 8 % are found in forests. During recent years a large proportion of agriculture land has been converted into waste land which is a reason for higher diversity and increased extent of invasive species in hilly regions of Uttarakhand. For better environmental conditions it is necessary to eradicate invasive species from various ecosystems.

Dr. Subhodh Airi (ech. Gr-IV, GBP-NIHE) gave demonstration about management of Invasive species. He informed that the proper management of invasive species is necessary for the wellbeing of ecosystems, cattle and human society. In a particular ecosystem the management of invasive species can be done through various practices which include eradication, site selection, timing of eradication, cutting the plants, removal of young plants, ecological restoration of the site, monitoring of the site. He also informed that forest ecosystems with gaps within vegetation are highly prone to invasion. The invasive species find the gaps in vegetation and proliferate very quickly. Thereafter these species spread over large areas in forests. Whenever due to any anthropogenic or natural cause's viz. deforestation, forest fire, overgrazing etc. any gap is created in the forest ecosystem; these gaps should be filled by planting the native vegetation of that forest. Reforestation of degraded and disturbed forests prevents the invasion of invasive species. For better management of invasive species, control on overgrazing in rangelands is very important factor.

14. **One day block level workshop was organized on "Synergy building with line agencies for promoting restoration programmes" at Meeting Hall of Bin- block, Pithoragarh, Uttarakhand, on November 26, 2021.** A total of 40 participants (32 Male and 8 Female) from 6 villages of Chandak-Aunlaghat watershed and officials of various Line agencies namely, Forest department, Horticulture department, Veterinary department, Agriculture department and Block officials (MGNREGA and other schemes) were present on this occasion. At the outset of the programme, Dr. Subodh Airi (Tech. Gr-IV, GBP-NIHE) welcomed the participants and expressed his pleasure at hosting the workshop. He informed about the workshop session and introduced respective speaker to the participants. In his introductory talk, Dr I. D. Bhatt (Scientist-F, GBP-NIHE) welcomed and greeted to all the participants and gave the brief introduction of the programme. He informed about aim, objectives and benefits of the workshop. He suggested that synergy building between villagers/village representatives and respective line agencies is most important thing for successful restoration program. Participation and responsibility of everyone should be clearly decided. He informed about upcoming challenges of life, environmental risk and scarcity of natural resources and effects of climate change. He highlighted that forests in IHR face several threats in the form of over exploitation, unmanaged utilization, illegal trade, increased demand for fuel, fodder, timber, fiber, wild edibles, medicinal and aromatic plants, land use changes, forest fire, climate change

etc., which have resulted in degradation and depletion of forests and biodiversity resources. Therefore, it would be pertinent to undertake land restoration, which will be helpful for reducing the pressure on natural resources, play an important role in conservation of biodiversity and uplift the economic condition of people and provide ecosystem goods and services for well-being of people. He informed about pine needle based products and suggested to the villagers to enhance livelihood through these products as well as reduce the risk of forest fire. At the end of his final remarks, he suggested to the villagers that promoting restoration on degraded lands through medicinally important species is the most suitable strategy for biodiversity conservation as well as livelihood enhancement.

One technical session was organized on **"**Development of strategies for convergence with line departments for Promoting Restoration Programmes on Degraded Lands and Livelihood Opportunities".For this, all the participants from the Line agencies and representatives of the Gram/Van Panchayat were grouped together and discussed about need of the community, different policies of government currently running in the landscape and synergy building between community and line agencies for successful restoration interventions. For this session, moderator was Dr Vikram S. Negi (Scientist-E, GBP-NIHE).

Suggestions and outcomes from the group discussion:

- Medicinal plants of economic and high market demand should be planted nearby barren land of villages.
- Plantation should be done as much as can be protected by villagers.
- Soil analysis of farmers' fields can be done from soil analysis lab of agriculture department of block or district in free of cost.
- Chal-Khal and Khanti should be constructed on the peaks of the hilly region.
- Fruits plants should be planted in the forests for monkeys and wild animals.
- Construction of check dams should be done to protect the soil erosion.
- Fencing of the plantation site, Pit digging and plantation activity could be done through MGNREGA scheme with help of Job Card holders of the villages
- Development should be done for mixed species forests instead of single species forests.
- Fruit plants should be planted in barren land (agricultural land which is barren due to wild animals).
- Special encouragement should be given to the villagers of the hilly region for connecting

them to conservation of the forests.

Appendix 4 – List of New Products (utilizing the local produce like NTFPs, wild edibles, bamboo, etc.)
Appendix 5 – Copies of the Manual of Standard Operating Procedures (SOPs) developed
Appendix 6 – Details of Technology Developed/ Patents filled
Appendix 7 – Any other (specify)

Annexure II

Identification and Mapping of Important Bio-Corridors within Indian Part of KailashSacred Landscape

1. Background

The Indian part of Kailash Sacred Landscape (KSL) encompasses a wide range of ecosystemsandhabitatsrangingfromsub-tropicaltoalpineandsub-nivalzones.Eachhabitattypecomprisespeculiarbiophysicalconditionstosuitasingleorgroupofspecies(floralandfaunalcommunities)which are adapted to such conditions. In a mountain landscape species are adapted to disperseeither along with the valley habitats or ridge systems depending upon their fundamental orrealized niche and ability to disperse. Contiguity of habitats along vertical or horizontal planesthus servesas dispersalpathwaysorbio-corridors.

Methodology

Based on the extensive survey of the KSL – India, WII has identified the following important bio-corridors. These bio-corridors are of high conservation significance and also represent KeyBiodiversityAreas(KBAs):

2. RamgangaRiverineCorridor
3. UpperGori–PiltiRiver Corridor Ghosi
4. Lower Gori-Ghosi–KanarriverineCorridor
5. Budi–PalangGad–RongkongCorridor
6. Shandev– HumdhuraCorridor
7. Namik–Khaliya–PotingCorridor
8. Rajramba-Buidhura–DhunkhanCorridor
9. BurphuDhura–Barjikang–RalamCorridor
10. Chhiplakedar –Najuri –BalchiDhuraCorridor
11. Kalapani–Upper KuttiCorridor
12. Karangdang-NasamartiCorridor
13. Dung–Untadhura –GirthiCorridor

Keyfeaturesofthesecorridors aresummarizedinTable1.

Table1. Bio-corridorsandtheircharacteristicfeaturesinKSL–India.

SN	Name of the bio-corridor	CharacteristicFeatures
1	**Ramganga Riverine Corridor**	SarayuandRamgangariverssupportrichriverinevegetationoneitherbank.Theseforestsserveasimportantcorridorsformigratorybirdsaswellasdispersal routes for a variety of orchids. Hence, theextantriverinestretchesareofutmostconservation significance.
2	**UpperGori–PiltiRiverCorridor**	Cool temperate and sub-alpine forests on either slopeofupperGoriandPiltiriversarepristineandbiodiversity-richareasservingasimportantcorridors foravarietyoffloraandfauna.
3	**LowerGori-Ghosi–KanarriverineCorridor**	The riverine forests along lower Gori connecting withGhosi gad on way to Kanar and the base of Najurikotrepresent a wide altitudinal range (1200 to 3600 m asl)at a short distance. This area is used by threatenedspeciessuchasAssamesemacaqueandseveralflor al communitiese.g.,2 speciesof*Macaranga*.
4	**Budi–PalangGad–RongkongCorridor**	Thisareaconnectsthesub-alpinevalleyoftheKaliriverwiththatofinnerdryrangesinupperBy ansvalley.Theareaisrichinthefaunalcommunitiesof Greateras well asTrans-Himalayanaffinity.
5	**Shandev–HumdhuraCorridor**	Alongridgeformingthewaterdividebetween GoriandRamganga basins.Thisareasupportsaluxuriant temperateforest,richinorchidsandferns.

6	**Namik – Khaliya – PotingCorridor**	Thisareaisinterlinkedthroughanarrowalpinebelt.Itis hometoanumberofwestHimalayanmammalsand avifauna.Contiguityofthislandscapeisextremely

		criticalforthegeneticexchangeofvariousHimalayan fauna.
7	**Rajramba-Buidhura–DhunkhanCorridor**	This is one of the most rugged and least traversedstretchofalpineecosystemintheKSL–India.Reportedto berichinHimalayantahr,Bluesheepand snowleopard.
8	**Burphu Dhura – Barjikang – RalamCorridor**	Oneofthemostlocalitiesforthealpineflora, especiallytheCrassulaceaeandSaxifragaceaeandSaussureaspecies.
9	**Chhiplakedar–Najuri–BalchiDhuraCorridor**	ThisareafepresentsthelowestlatitudeinWestern Himalayahavinginterestingbiogeographicaffinities,connectingtothehigher Himalaya.
10	**Kalapani–UpperKuttiCorridor**	Thisisthetrans-frontierregionofKSL–Indiaconnectingto Tibetan plateau as well as Nepal. It is rich in trans-HimalayanspeciessuchasTibetanwoollyhare,Himalayanmarmot,Tibetansnowcock,snowleopard etc.
11	**Karangdang-NasamartiCorridor**	The ridge that separates the waters of Kali and DhauliGangabeyondHirigomriandRunglingReservedForestsconnects the lower areas with that of Chhota Kailash.This area is extremely rugged yet supports quite a fewsizable alpine meadows which are used by the wildungulatesaswellasdomesticlivestock(duringsummer).
12	**Dung – Untadhura – GirthiCorridor**	SimilartotheKalapani–UpperKuttiCorridorintermsoffloraandfauna,thisareaconnectsGoriBasinwith UpperGirthiGangaValley.

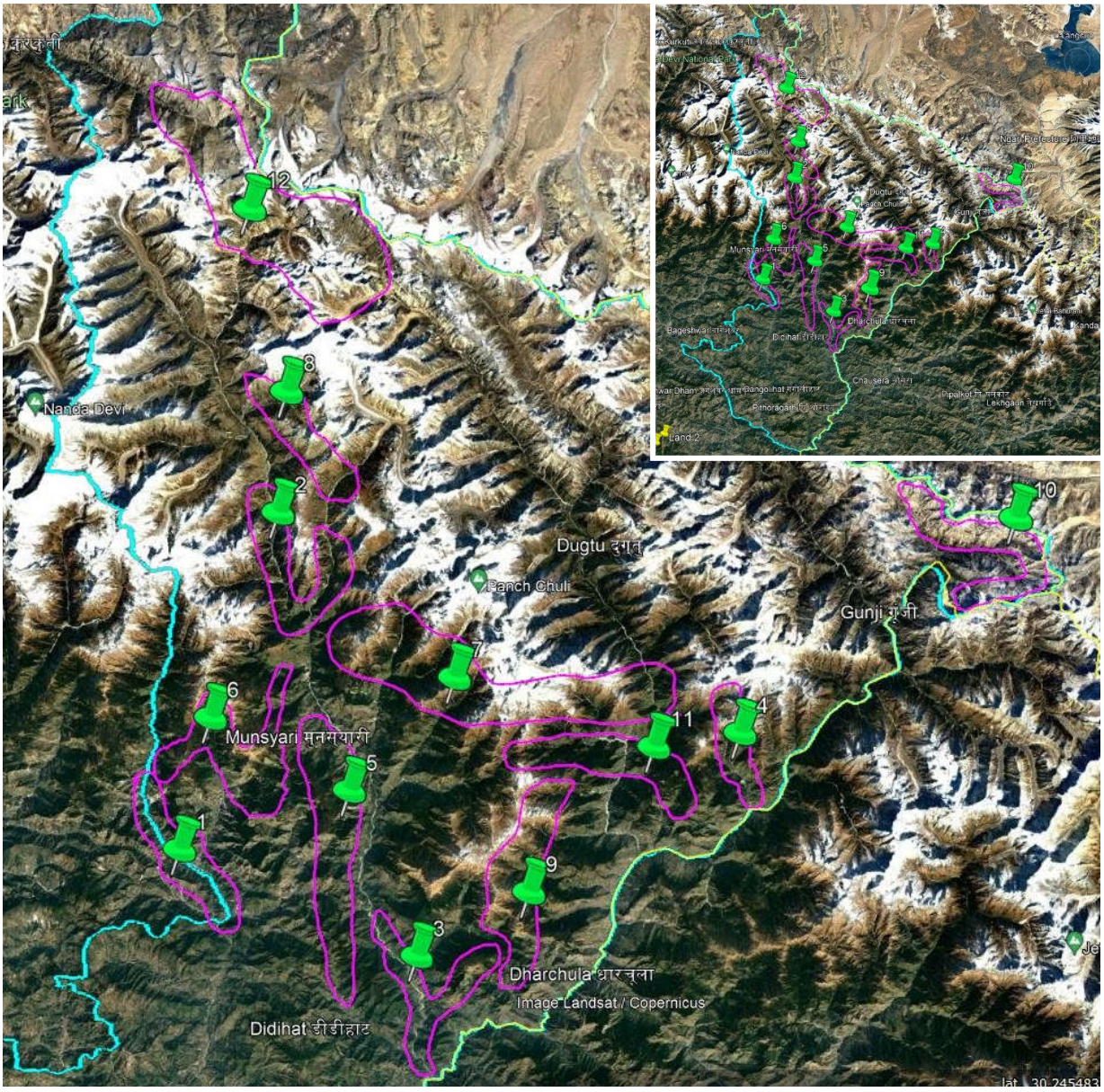
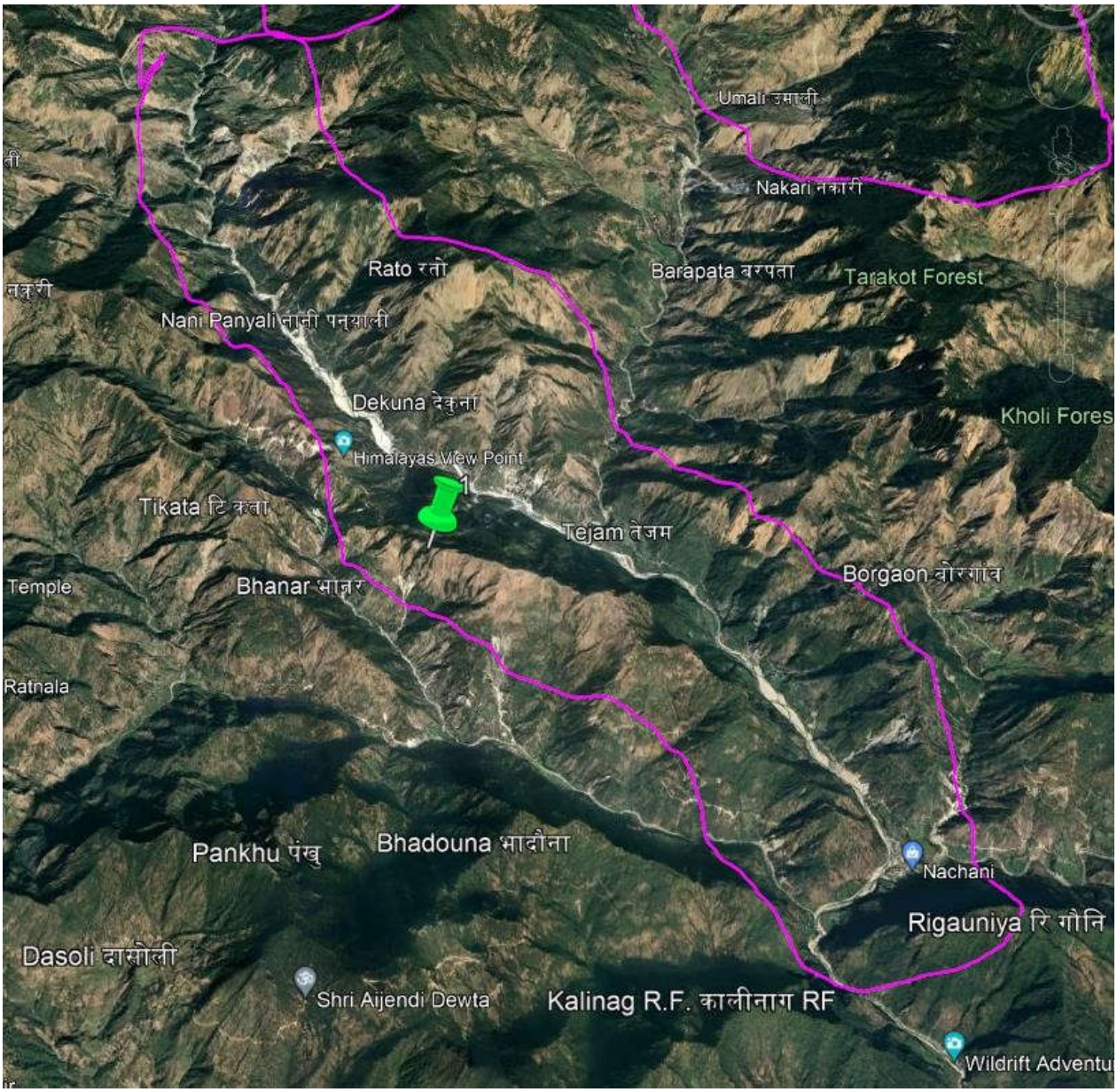
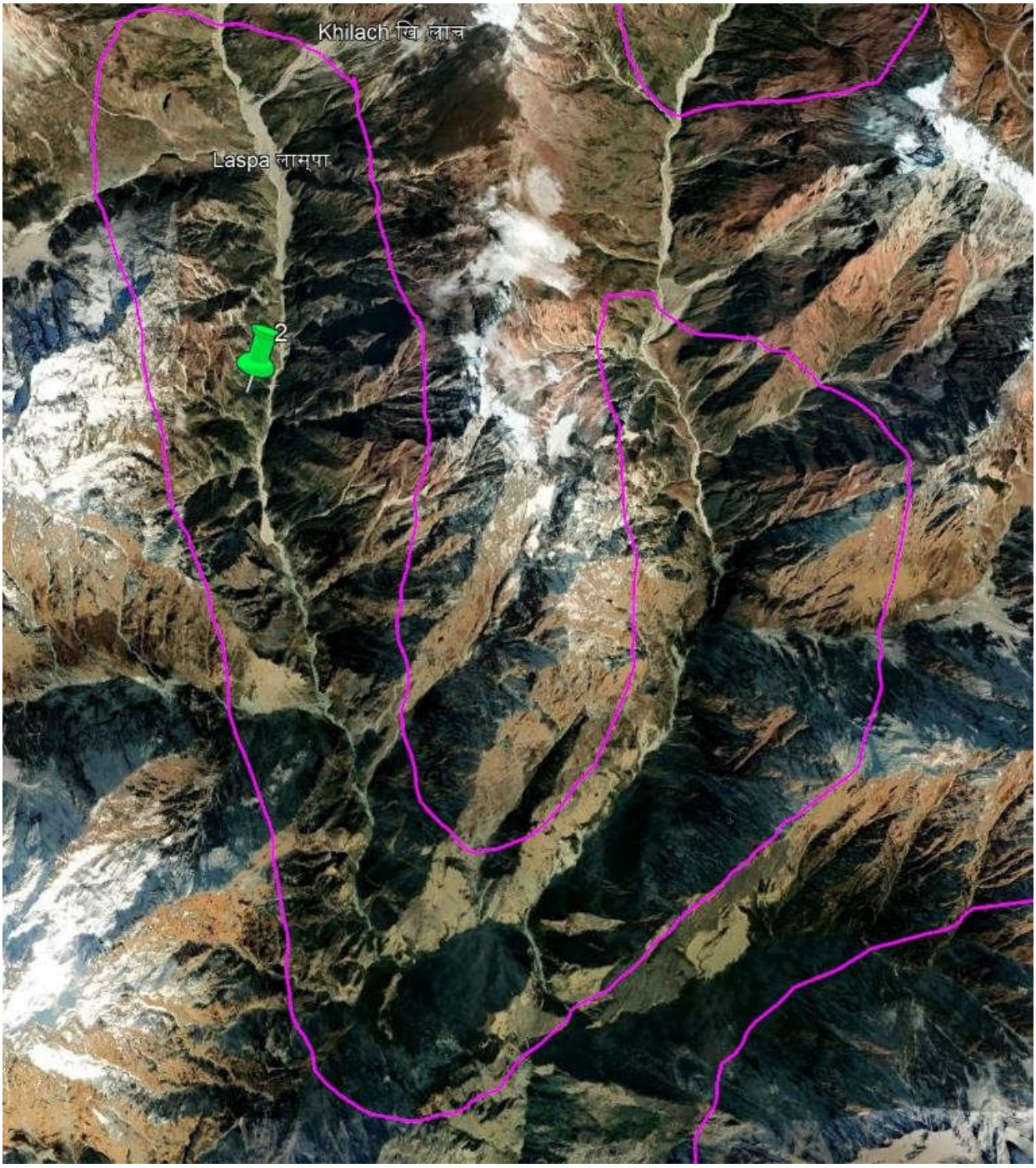


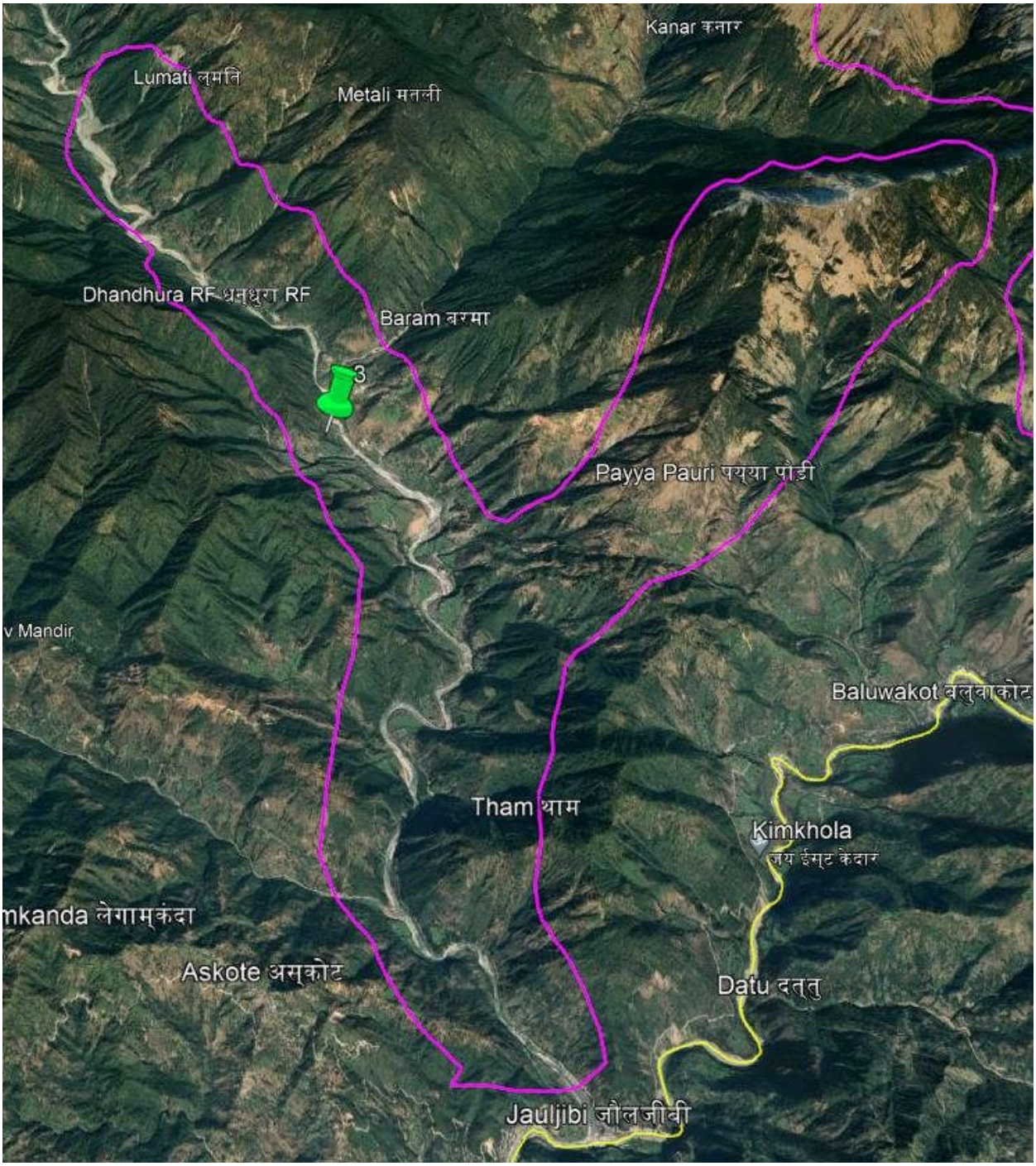
Figure1:Aschematicrepresentationofmajorbio-corridors(Inset)andinupperpartofKSL-India.Numberscorrespond totheserial numbersgiven inTable1.



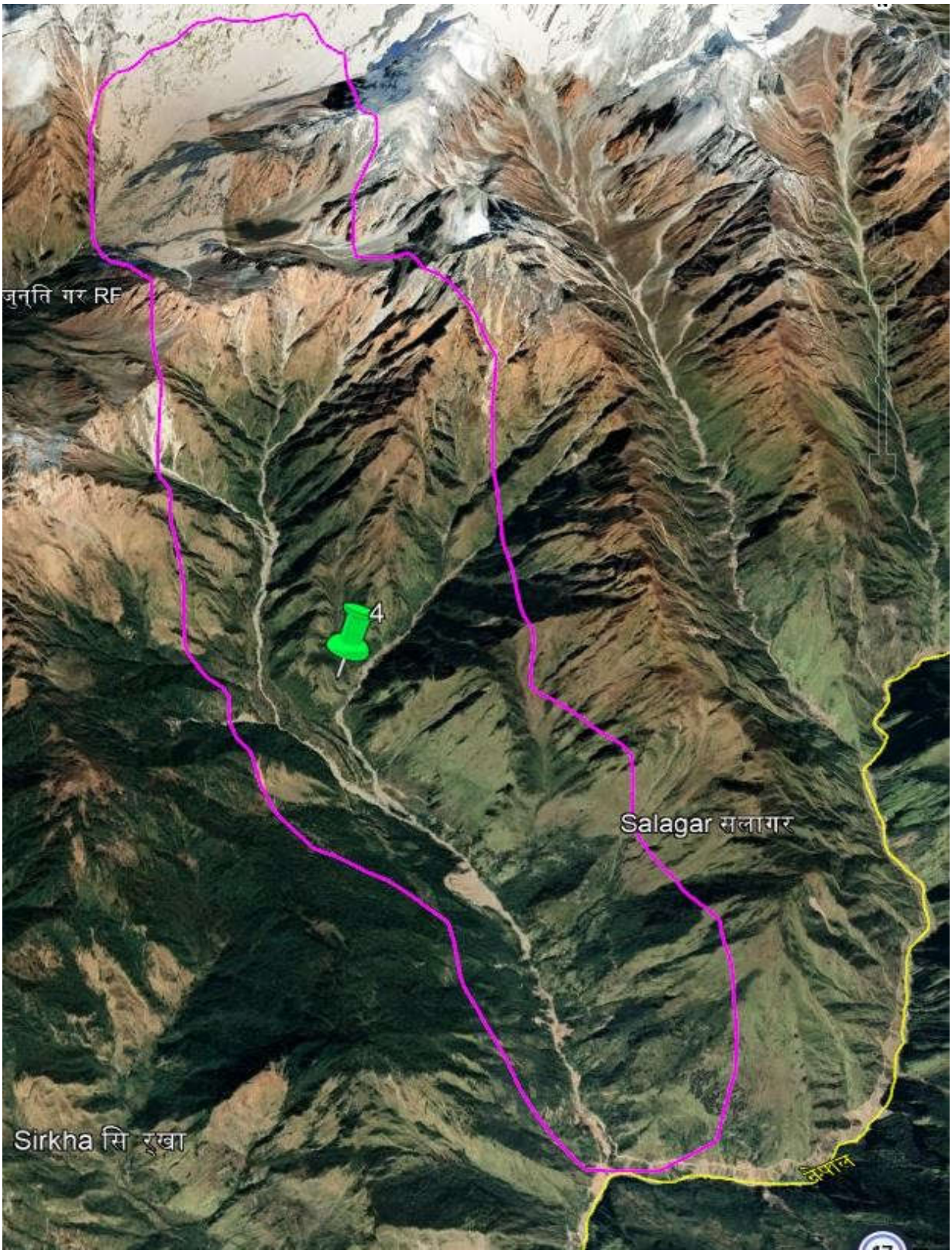
1. RamgangaRiverinebio-corridor



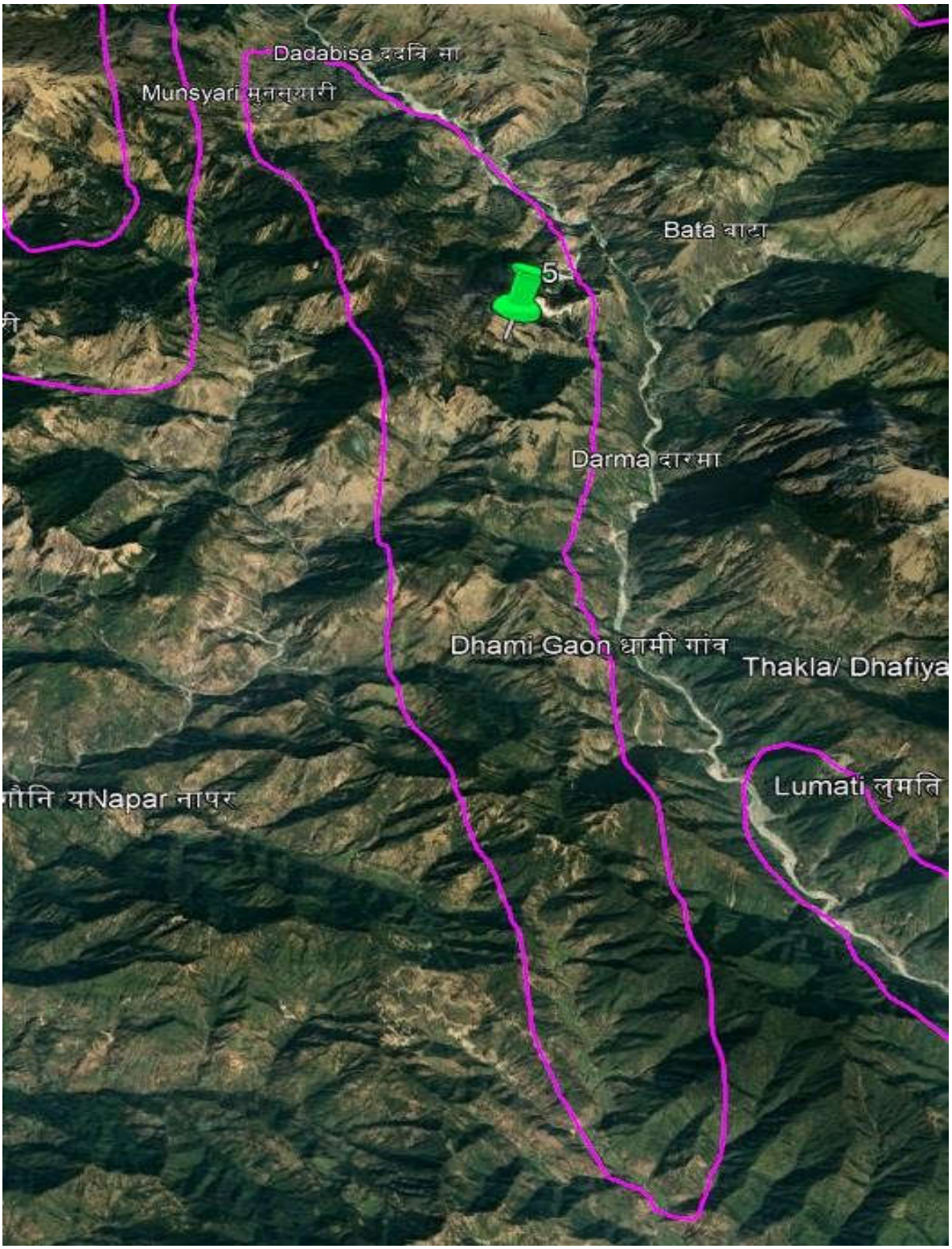
2. UpperGori–PiltiRiverbio-corridorGhosi



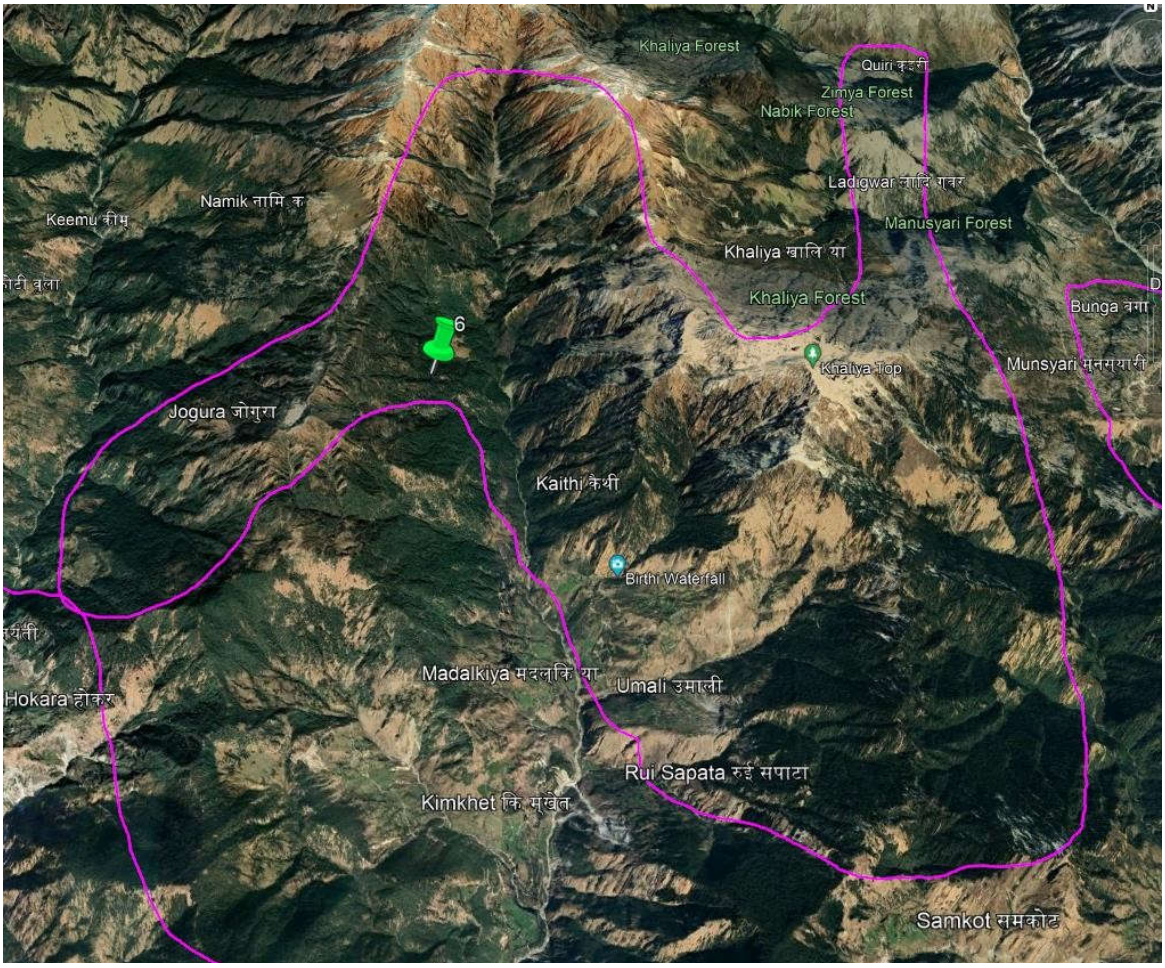
3. Lower Gori-Ghosi–Kanarriverinebio-corridor



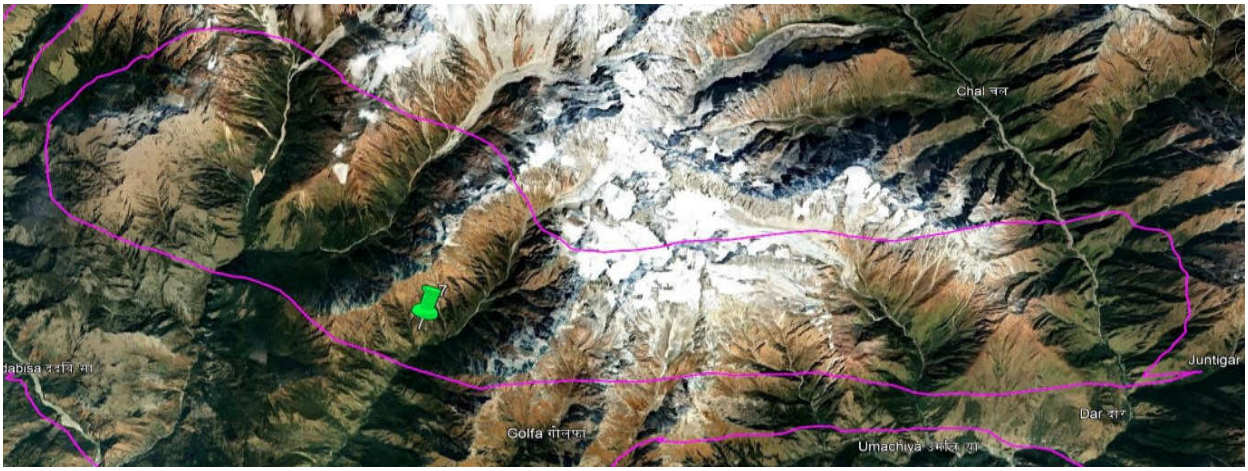
4. Budi–PalangGad–Rongkongbio-corridor



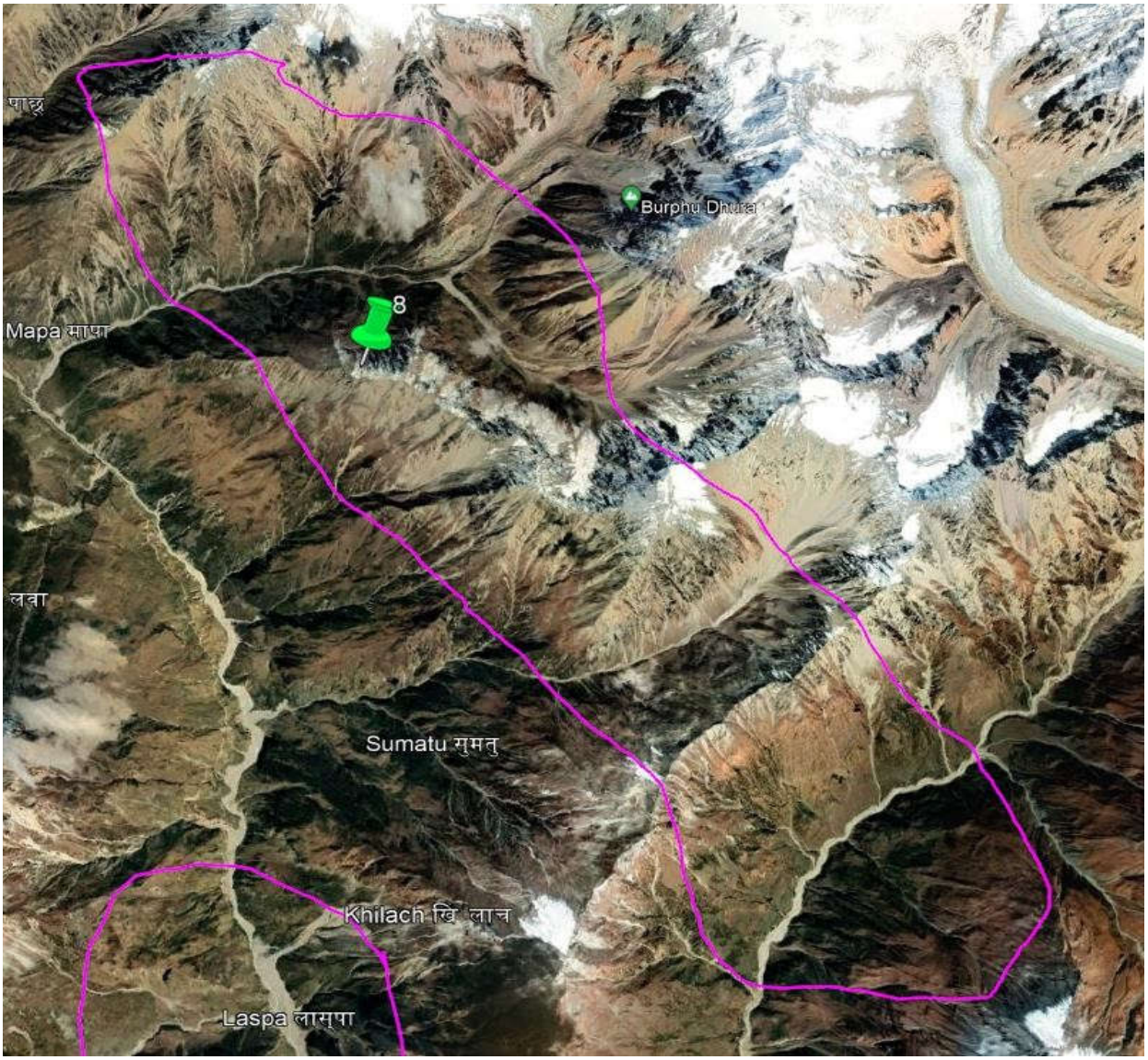
5. Shandev– Humdhurabio-corridor



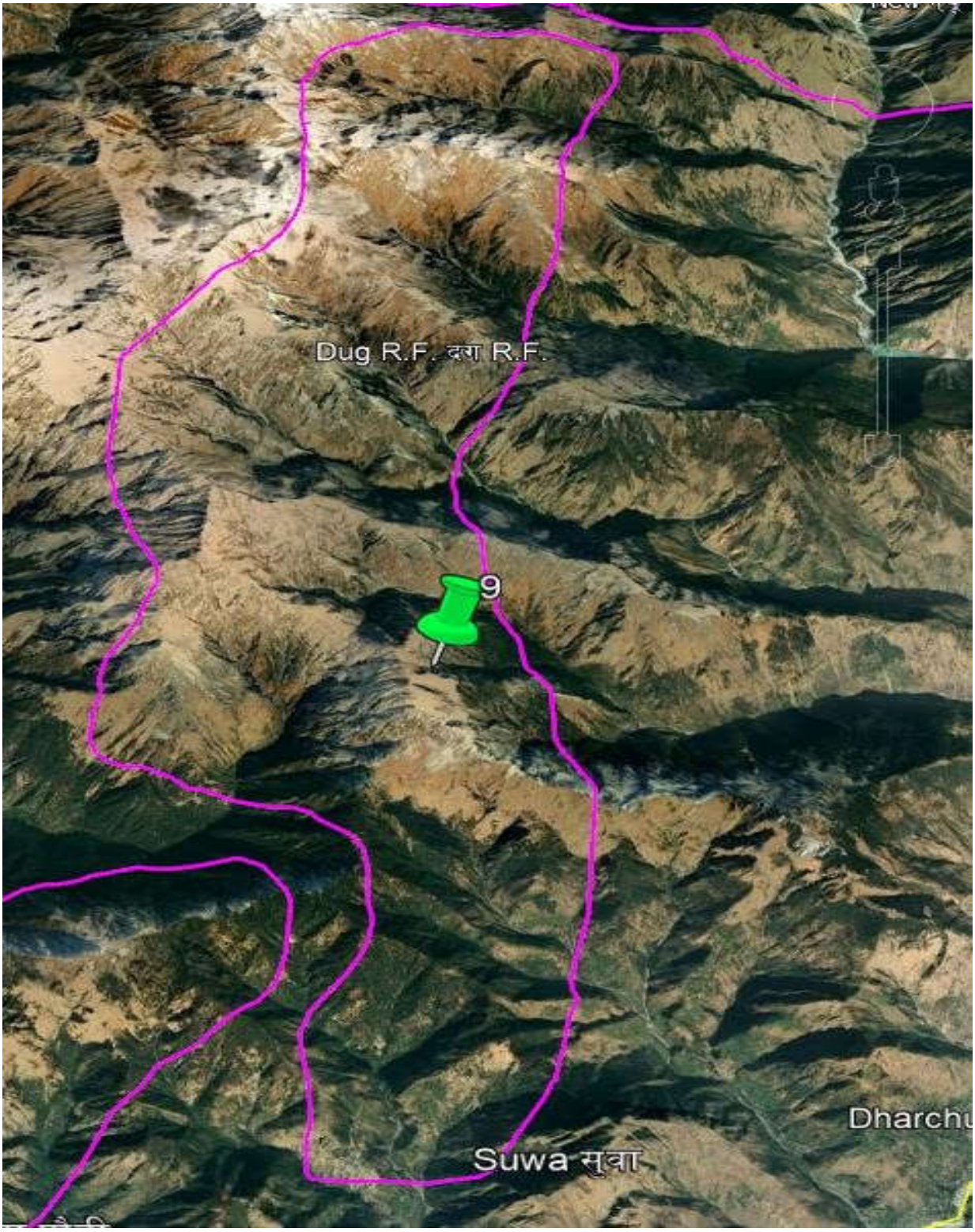
6. Namik–Khaliya–Potingbio-corridor



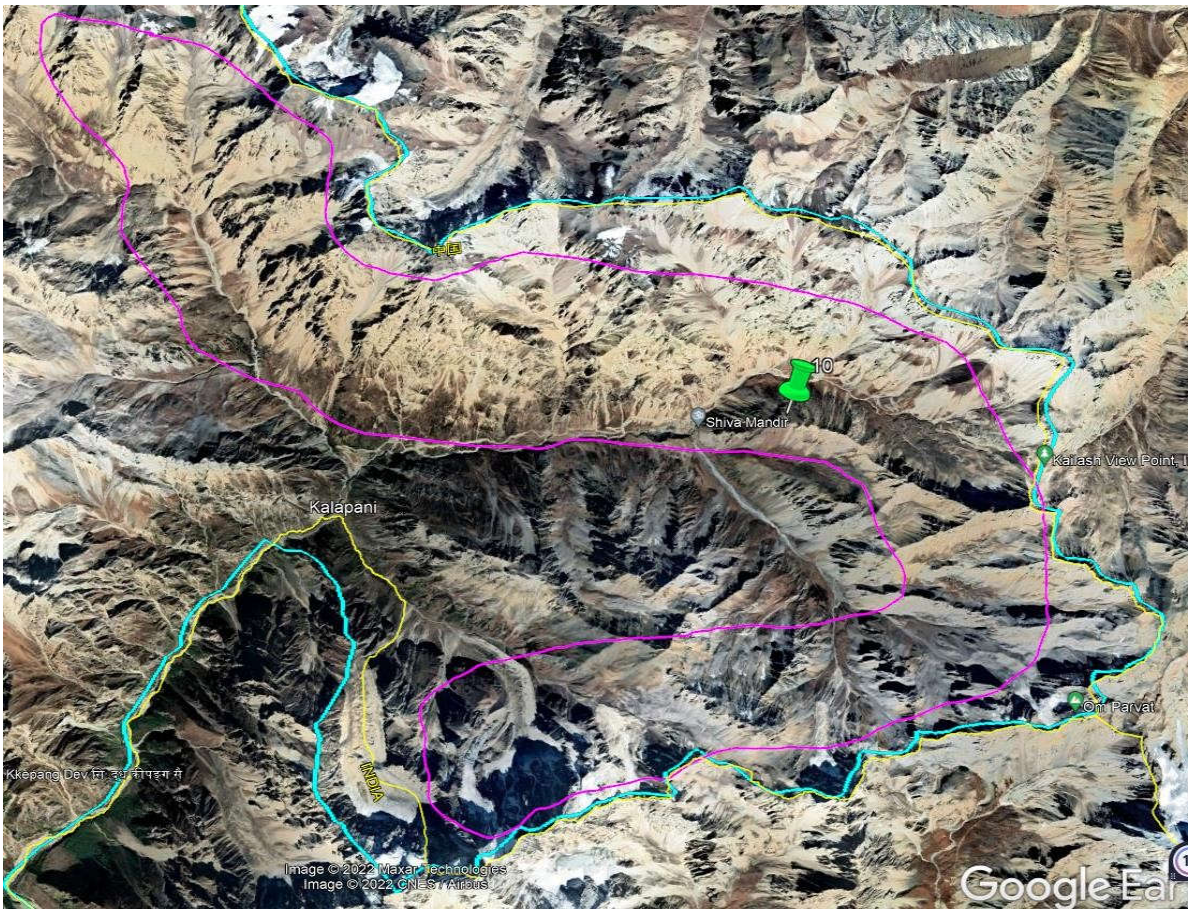
7. Rajramba-Buidhura–Dhunkhanbio-corridor



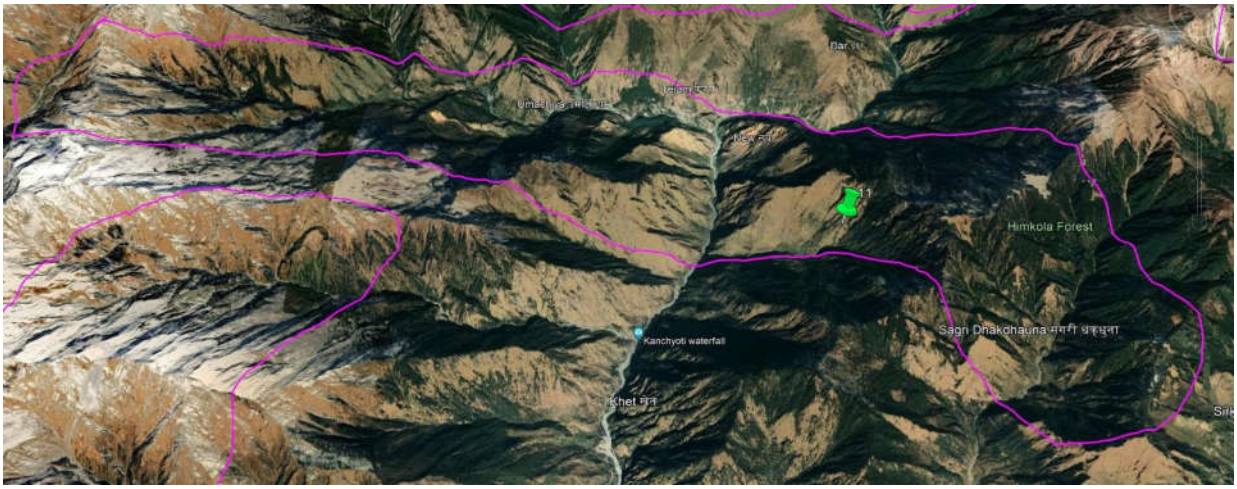
8. BurphuDhura–Barjikang –Ralambio-corridor



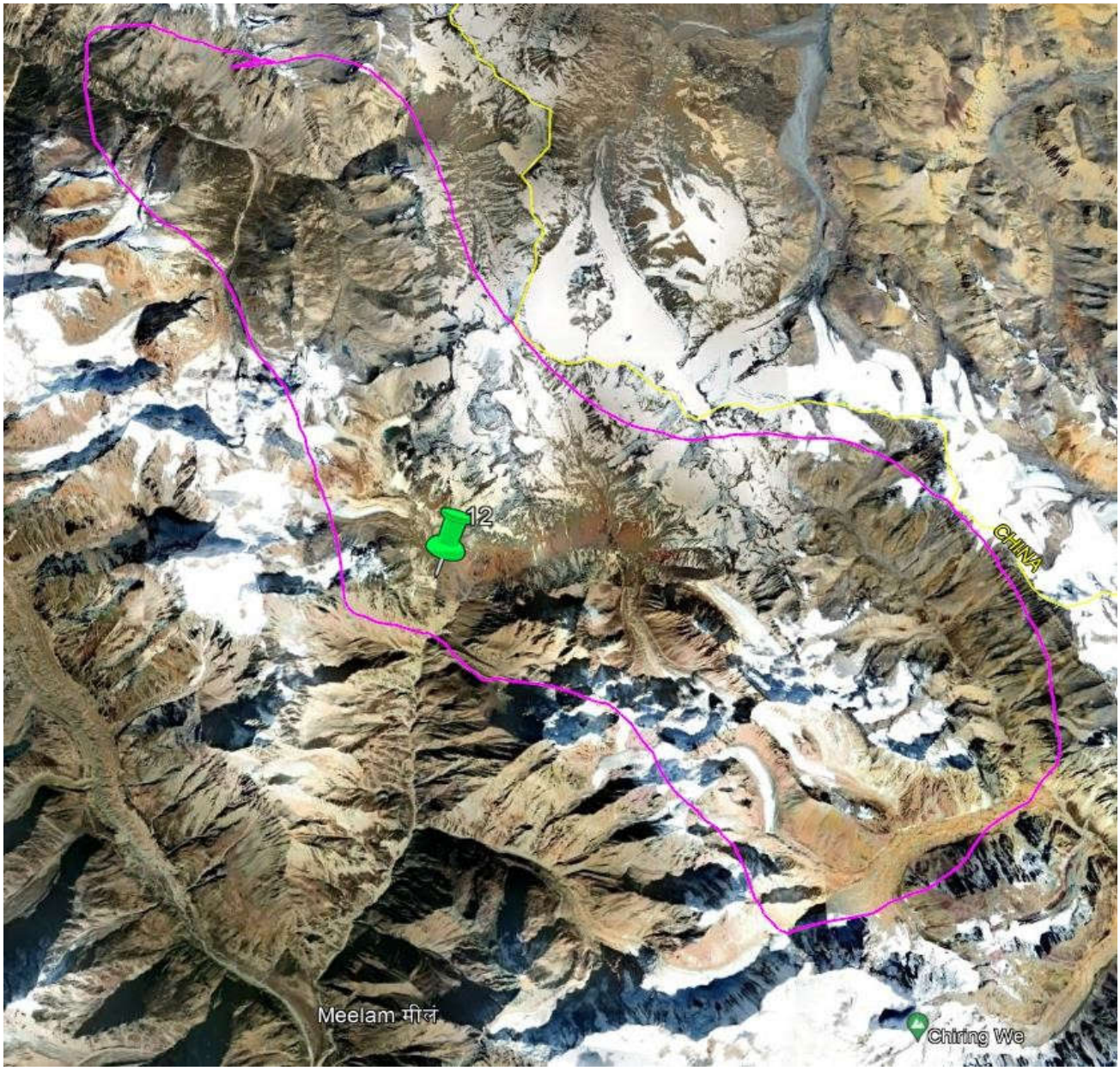
9. Chhiplakedar –Najuri–BalchiDhurabio-corridor



10. Kalapani–UpperKuttibio-corridor



11. Karangdang-Nasamartibio-corridor



12. Dung–Untadhura –Girthibio-corridor