UGC-HRDC

ज्ञान-विज्ञान विमुक्तये

KUMAUN UNIVERSITY, NAINITAL

Patron:
Prof. N.K. Joshi
Vice-Chancellor

Course Coordinator
Prof. R. K. Pande
Dean Arts & HoD Geography

Director:
Dr. Divya U. Joshi

Assistant Director:
Dr. Reetesh Sah

17/09/2021 to 30/09/2021

Refresher Course in Geography

Theme:
Research Frontiers in Geography and Disaster Risk Management

- Online Mode as per directions of the UGC
- **Application Fee:** Rs. 1000.00 (online and non-refundable)
- **Seats**: 40 on *first come first serve basis.*
- **Duration:** 02 Week
- Course will be of two week duration spread over a total of 12 working days comprising of 72 contact hours @ six hours per day.
- **Course Timings:** 10.00 am to 05.00 pm
- Classes will commence at 10.00 am continue till 5.00 pm in the evening. There will be a lunch break from 1.00 pm to 1.45 pm besides two tea-breaks of 15 minutes each at 11.15 am and 03.15 pm.
- **Target Group:** All regular faculties of Universities/ Colleges that are included under section 12 (b)/2(f) of the UGC Act. The contract teachers who have been teaching for at least 03 academic sessions may be permitted.
- **Course:** Desktop/ Laptop/ Smart phone with good Internet connectivity (Webcam, Microphone, headphones and Multimedia enabled).
- Full attendance in all the sessions is mandatory for all the participants.
- Number of sessions conducted and number of sessions attended by the participants will be mentioned on the participation certificate.
- **For filling online form click: www.hrdcnainital.ac.in**

Phone: 05942-236410
E-mail: hrdcnainitalcourse@gmail.com
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KUMAUN UNIVERSITY NAINITAL

UGC Human Resource Development Centre

in collaboration with

Department of Geography

Organised

Two Weeks Refresher Course in Geography

Theme: Research Frontiers in Geography and Disaster Risk Management

17th to 30th September, 2021

Prof. Divya U. Joshi
Director, UGC-HRDC

Dr. Reetesh Sah
Deputy Director, UGC-HRDC

Patron
Prof N k Joshi
Vice Chancellor

Prof. R. K. Pande
Dean-Arts,
HoD -Geography
Course Coordinator

Dr. Manisha Tripathi
Course Co-coordinator

UGC–Human Resource Development Centre, Kumaun, University Nainital

R C in Geography

(From 17 September, to 30 September 2021)

FINAL LECTURE SCHEDULE

DATE/DAY	SESSION	TOPIC	RESOURCE PERSON
17 September 2021 Friday	09.45-10.00 am.	Join	
	10.00-11.15 am.	Basic Introduction/ Inaugural Function	
	11.15-11.30 am	Tea	
	11.30-01.00 pm	Role of Geospatial Technologies in Disaster Management	Prof. R K Pande
	01.00-01.45 pm.	LUNCH	
	1.45-03.15 pm	Role of Geospatial Technologies in Disaster Management contd…	Prof. R K Pande
	03.30-04.45 pm.	Interactive	HRDC
18 September 2021 Saturday	10.00-11.15 am.	Climate change with special reference to Rajasthan	Prof. H S Sharma
	11.30-01.00 pm.	Climate Change and Human Perception	Prof. H S Sharma
	01.00-01. 45 pm.	LUNCH	
	01.45-03.15 pm	Tree-ring studies and its application in natural hazards research	Dr. Rajesh Joshi
	03.15-05.00 pm.		Dr. A. Uniyal
19 September 2021 Sunday	Sunday		
20 September 2021 Monday	10.00-11.15 am.	Disaster management and environmental justice	Prof. .B S. Butola
	11.30-01.00 pm.	Research Projects formulation: Key Guidelines Watershed prioritization using geospatial technology	Dr. B R Thakur
	01.00-01. 45 pm.	LUNCH	
	01.45-03.15 pm	Understanding Geomorphological Hazards with special reference to Arunachal Pradesh	Prof. Suresh C. Rai
	03.15-05.00 pm.	Research/Sampling Methodology	Prof. Suresh C. Rai
21 September 2021 Tuesday	10.00-11.15 am.	Mountain Climate and vulnerability analysis : a case study of Indian Himalaya	Prof B W Pandey
	11.30-01.00 pm.	Field Techniques in high altitude region Recent trends in geographical studies: role of geoinformatics	Prof B W Pandey
	01.00-01. 45 pm.	LUNCH	
	01.45-03.15 pm	Community Based Disaster Management	Prof. Pardeep Sahni
	03.15-05.00 pm.	Role of Elected Members and Officials of Urban and Rural Local Bodies in Disaster Management	Prof. Pardeep Sahni
22 September 2021 Wednesday	10.00-11.15 am.	'Mainstreaming Disaster Risk Reduction into Sustainable Development Goals	Mr. Navneet Yadav
	11.30-01.00 pm.	Advantages of a mixed method approach in social science/ qualitative methods in social science research	Prof Sucharita Sen
	01.00-01. 45 pm.	LUNCH	
	01.45-03.15 pm	Recent trends in geographical studies: role of geoinformatics	Prof A R Sidiqui
	03.15-05.00 pm.	Overview of Geospatial Technology for Hydrological Modelling". Models for Hydrological Modelling (HEC_HMS or SWAT	Dr. Arpit Chouksey

23 September 2021 Thursday	10.00-11.15 am.	Building Rural Resilience for Disaster Risk Management	Prof. S K Chattopadhyay
	11.30-01.00 pm.	Nature-based solutions for flood disaster management: Role of Geography	Prof. S K Chattopadhyay
	01.00-01. 45 pm.	LUNCH	
	01.45-03.15 pm	Microteaching	Prof N C Dhaundhiyal
	03.15-05.00 pm.	Microteaching	Prof N C Dhaundhiyal
24 September 2021 Friday	10.00-11.15 am.	Why and How Past Matters for the Future: Resurrecting Paleo Environments	Prof. Milap Chand Sharma
	11.30-01.00 pm.	Climate and Glacial Lake Outburst Assessment: Impact, Consequences and Remedies	Prof. Milap Chand Sharma
	01.00-01. 45 pm.	**LUNCH**	
	01.45-03.15 pm	Microteaching	Prof N C Dhaundhiyal
	03.15-05.00 pm.	Microteaching	Prof N C Dhaundhiyal
25 September 2021 Saturday	10.00-11.15 am.	Research Frontiers of Geography with special reference to Agricultural Geography in India	Prof. M H Qureshi
	11.30-01.00 pm.	Disaster Risk Management : A geographical approach	Prof. M H Qureshi
	01.00-01. 45 pm.	LUNCH	
	01.45-03.15 pm	Microteaching	Prof N C Dhaundhiyal
	03.15-05.00 pm.	Microteaching	Prof N C Dhaundhiyal
26 September 2021 Sunday	**Sunday**		
27 September 2021 Monday	10.00-11.15 am.	Human Impact on River Health: Examples from Tripura and Darjeeling	Prof. Sunil Kumar De
	11.30-01.00 pm.	Human Impact on River Health: Examples from Tripura and Darjeeling…Contd…	Prof. Sunil Kumar De
	01.00-01. 45 pm.	LUNCH	
	01.45-03.15 pm	PPT of Research Proposal Evaluation	Prof P C Tiwari
	03.15-05.00 pm.		
28 September 2021 Tuesday	10.00-11.15 am.	Disaster and sustainability	Dr. Vishwa B.S.Chandel
	11.30-01.00 pm.	Human Induced Hazards and Disasters: The Question of Sustainable Urban Systems	Prof. Anuradha Banerjee
	01.00-01. 45 pm.	LUNCH	
	01.45-03.15 pm	PPT of Research Proposal Evaluation	Prof. P. C Tiwari
	03.15-05.00 pm.		
29 September 2021 Wednesday	10.00-11.15 am.	Climate Change from a Humanitarian lens	Mr. Navneet Yadav
	11.30-01.00 pm.	Mapping as an Investigative Tool for Social Science Research	Prof. Anuradha Banerjee
	01.00-01. 45 pm.	LUNCH	
	01.45-03.15 pm	PPT of Research Proposal Evaluation	Prof. Vinod Kumar Tripathi
	03.15-05.00 pm.		
30 September 2021 Thursday	09.45 am	Webinar : Climate change ,Disasters and Disaster Risk Reduction in Indian Himalayan Region (IHR)	Inaugural Address
	10:00am-11:00 am	Key note Address(1)	Prof. B S Butola
	11:00am-12:.00Hrs	Key note Address(2)	Dr. Subrat Sharma
	12:00Hrs-01:00pm	Guest of Honor Impact of climate change on Glaciers of North West Himalaya	Prof. M N Kaul
	1.00-01. 45 pm.	LUNCH	
	01.45-03.15 pm	Geography and the new research frontiers	Prof Sachidanand Sinha
	03.15-05.00 pm.	**Valedictory Session**	**Valedictory Session**

Galaxy of Eminent Scholars and Resource Persons of Refresher Course- Geography

UGC–Human Resource Development Centre
Kumaun, University Nainital

REFRESHER COURSE (GEOGRAPHY)
(17 September- 30 September 2021)

Introduction

Geography has been developing for a long time as a science that studies the similarities and differences of geosphere phenomena from territoriality and environment perspective in a spatial context. In The relationship between humans and their surroundings has been the object of study since classical geography. Currently, geography science has developed into various other branches of science. Geographers have a long-standing interest in natural hazards, disasters and vulnerability research. Hazards and disaster risk are included in one study theme that researchers and observers widely discussed in geography. Disasters pose threats to social, economic and ecological environment. Millions of people globally are affected by natural and human induced disasters. Nearly 90% people residing in countries exposed to natural hazards are experiencing extreme impoverishment due to the subsequent disaster shocks. Effective mitigation, proactive measure and effective post disaster planning may help in overcoming these challenges. It is essential to analyze the awareness about natural disasters and the management of disasters among the teachers of higher education. The UGC has also decided to introduce it as one of the topics in orientation and refresher courses offered by the UGC-HRDCs for teachers as well. The overall initiative is an effort to spread awareness and step up public preparedness to meet any exigency in times of disaster. Teachers are responsible for disseminating the information of disaster management among the students. Especially, teachers of higher education are expected more to be aware of the details and measures and actions to be taken at the time of any kind of disasters. The specific theme of the course that was intended to contribute toward the broader understanding of geography and disaster management was "*Research frontiers in Geography and Disaster Risk Management"*. This refresher course was organized to inform and update the university/college teachers about the current trends of new research being done to understand and explain various geographical phenomena and to make them aware and alert about disaster management. The theme of the refresher course is pertinent to all of us as well as for our future generations. The aim of this course was to draw attention that the geographers who were not involved in science, felt ready and competent for monitoring of natural hazards and disasters at the local level and such written tracks might serve for future scientific investigations. Disasters are increasing in intensity and number and may even become worse due to climate change, We need professionals educated

in disaster management for preparedness, mitigation, response, and recovery. The course illustrated the opinion of geographers about the possibility to use their knowledge about natural hazards and disasters in the environment where they work, concerning prevention and protection and how much they believe to know about those natural hazards which happen more often in the geographic fields where they live. Besides that, this course has also introduced the contribution to easy ways of understanding disasters which can help a lot to various profiles of geographers who are dealing with it. Adoption of advanced technology to manage disaster is important as it can alert and fasten the process of management in affected areas. The eminent academicians, researchers, administrators, and disaster professionals from the premier Universities , institutions from the country like; Jawaharlal Nehru University, Delhi University, CESS Kerala, Indira Gandhi Open University, Banaras Hindu University, University of Allahabad, Punjab University, North Eastern Hill University, Rajasthan university, University of Jammu and Kashmir, GBPIHED-Sikkim and Ladakh region, Doers-HP, IIRS, Dehradun, Kumaun University were the resource persons for the Refresher Course. Unimaginable contributions were made by experts and professionals from different corners of the country. During the program varied aspects of the natural and man-made disasters, their causes and mitigation and management, disaster preparedness, the economics of disaster were covered. The course witnessed some very eminent scholars of the field coming and deliberating on the theme of this refresher course. So many exciting concepts, models and case studies were discussed which ought to augment the scope of this refresher course.

This 2 weeks refresher course provided excellent opportunities for interaction among the researchers and scholars from different part of the country. It was attended by a total of 43 faculty members from various colleges and universities across India. We saw participants right from Jammu to Kerala, from Rajasthan to West Bengal, including Nagaland, Arunachal Pradesh and also from states of Karnataka, Maharashtra Bihar, Uttar Pradesh, Chatisgarh, Uttarakhand, etc. All the participants spoke very high about the Refresher Course, content and the recourse persons of the Refresher Course organized by the Department of Geography and UGC-HRDC Kumaun University Nainital.

The multi- diastral effects could be traumatic for the nation, thus , environmental changes must also be given equal importance as they rank one of the top reasons for the cause of disaster .

A webinar on the topic of "*Climate change, Disasters and Disaster Risk Reduction in Indian Himalayan Region (IHR)*" was also organized where the pertinent issue of Climate Change & Disaster risk reduction was discussed.

Finally, the refresher course, which deals with the emerging field of new perspectives on geographic thinking, inspired participants to engage critically with the potential and challenges of new geographic frontiers.

Objective of Refresher Course

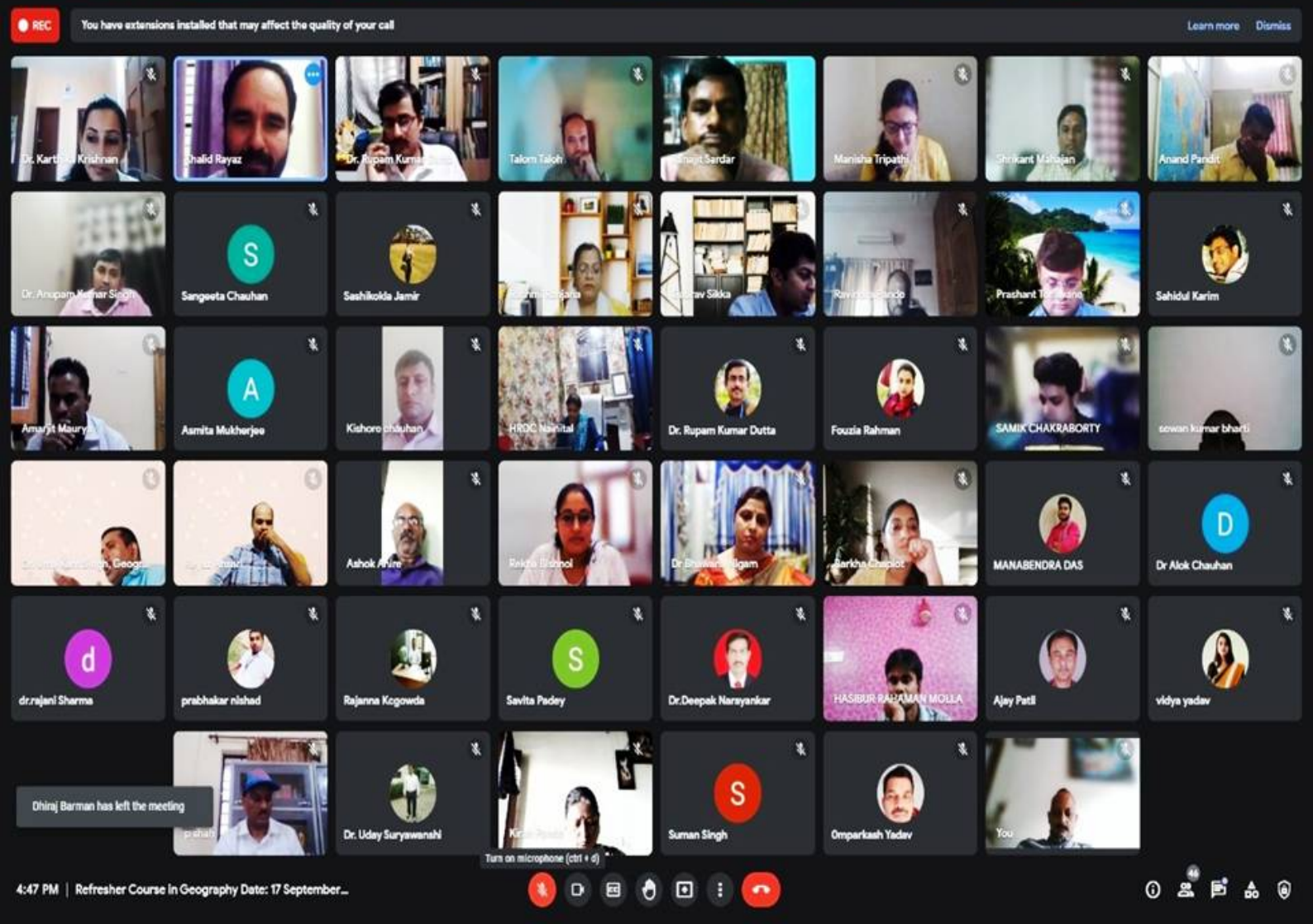
The objective of the refresher course was to explore the opportunities and challenges involved in geographical research and disaster management at global, national and regional level. Major objectives of the course were as follows:

- To disseminate sound knowledge of geography to understand global events and their impact on the rest of the world.
- To develop a high level understanding of the subject matter in all the vital sub-fields of Geography with special reference to disaster risk management.
- To educate young geographers and to empower them to become informed citizens and responsible stewards of planet Earth.
- To explore the opportunities and challenges involved in disaster management at global, national, regional and local level.
- To explain the role and importance of geographers towards the society, at educational institutions which are dealing with prevention and reclaiming of natural hazards and disasters.

The focus of the Refresher Course

- Access new and profound research ideas.
- Interact with eminent international and National speakers.
- Participate in stimulating case discussions.
- Showcase latest research through the presentation.
- Avail opportunities to network and exchange ideas.
- Get inspired towards professional studies.
- Knowledge sharing to enhance geographical research.

REFRESHER COURSE_GEOGRAPHY : PARTICIPANTS



भूविज्ञान विभाग
उच्चानुशील अध्ययन केन्द्र
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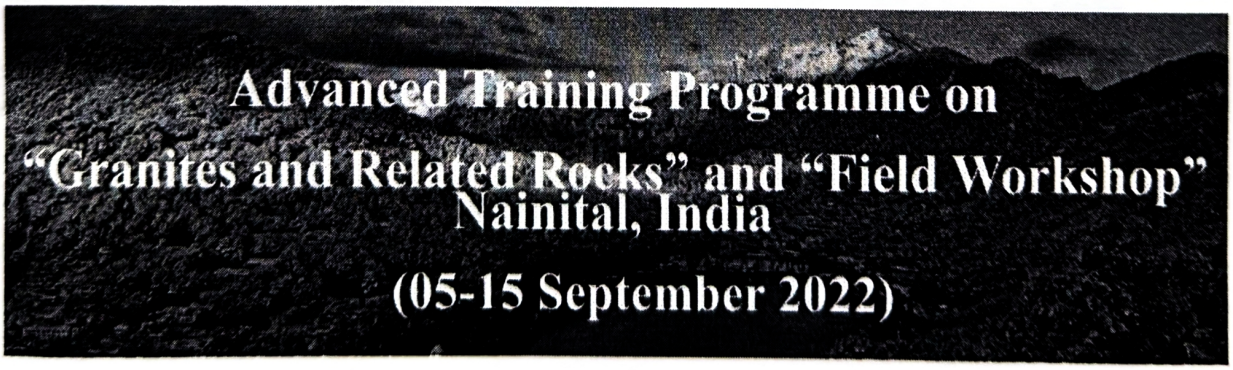
DEPARTMENT OF GEOLOGY
CENTRE OF ADVANCED STUDY
KUMAUN UNIVERSITY, NAINITAL - 263 002
UTTARAKHAND, INDIA

Date :

Activity 1

Title f the event	Advanced training programme on "Granites and related rocks" and "Field workshop"
Duration of the event	5-15 September 2022
Venue	• Department of Geology, Kumaun University Nainital • HRDC, Nainital
Details of organizers	Department of Geology, Kumaun University, Nainital
Type f Activity	For Indian women geoscientists
Details f Expenditure	7.84 lakh (funded by DST)
Total number of beneficiaries	20



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Advanced Training Programme on Granites and Related Rocks and Field Workshop in Kumaun Lesser Himalaya

Article *in* Journal of the Geological Society of India · December 2022

DOI: 10.1007/s12594-022-2250-4

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Jour. Geol. Soc. India (2022) 98:1768-1770
https://doi.org/10.1007/s12594-022-2250-4

NEWS AND NOTES

Advanced Training Programme on Granites and Related Rocks and Field Workshop in Kumaun Lesser Himalaya

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Received: 29 October 2022 / Accepted: 8 November 2022

The Department of Geology, UGC-Centre of Advanced Study, Kumaun University, Nainital, India, convened an advanced training programme on "Granites and Related Rocks", exclusively for Indian women geoscientists from 5th to 11th September, 2022. The programme was funded under the DST-KIRAN (Department of Science and Technology-Knowledge Involvement in Research Advancement through Nurturing) scheme of the Government of India. The course was primarily aimed at preparing a pool of women scientists to undertake advanced research on felsic intrusive rocks using state-of-the-art, field, petrological, geochemical, geophysical, geochronological and mathematical tools.

Eleven well-known researchers from France, the Czech Republic, Italy, South Africa, Switzerland and the United States of America, were the instructors for the course. A total of 20 women Indian scientists, selected from Indian institutes/universities, participated in the training programme. Prof. Santosh Kumar of Kumaun University acted as the Indian course coordinator for the both the Advanced Training Programme and the Field Workshop. Prof. Jean-François Moyen, Jean-Monnet University, France, was the Foreign course coordinator.

The training programme commenced with a formal opening session to welcome the dignitaries, foreign instructors, trainees, students and colleagues. Prof. Santosh Kumar began the session, by emphasizing the significance of the training programme with its aim to advance the knowledge of a pool of Indian women researchers/scientists. Prof. A. B. Melkani, Dean of the Faculty of Science, Kumaun University, inaugurated the programme with his opening remarks. Prof. Jean-François Moyen, Chief Guest of the opening session, inspired the students by recollecting how he began research on the Dharwar craton as a young PhD student, 25 years ago. His point was that he was then at the same career stage as the young researchers are now, and encouraged the participants to make optimal use of training programme. Prof. Neeta Bora Sharma, Director, Centre for Women Studies, Kumaun University, as Guest of Honour, described the importance of women empowerment in science and technology. Dr. Umesh K. Sharma, Scientist-F, DST, New Delhi, Guest of Honour, presented a brief account of DST-KIRAN and other programmes of DST, and encouraged the participants to come up with good research proposals. Prof. Pradeep K. Goswami, Head of Geology Department, closed the opening session by elucidating the teaching and research activities of the department, followed by felicitations and thanks to the foreign instructors.

Prof. Prof. Jean-François Moyen, Chief Guest, addressing the audience during opening session.

In a week-long schedule, a total of twelve course modules, developed specifically for this programme, were taught by the instructors to the participating women scientists. Out of twelve modules, trainees had the option of choosing eight modules. The first module related to digital data collection tools, including StraboTools, and was offered to everyone. Each day, two lectures (theories/principles/software) in the morning session were open to all participants. In the afternoon, three parallel practical/hands-on-training sessions were offered to participants. Because some hands-on-training sessions were offered multiple times, a total of twelve modules were taught.

Module 1: *Data procurement, visualization, and calculation using Microsoft Excel and StraboTools Software:* **Prof. Basil Tikoff** (Department of Geoscience, University of Wisconsin, USA) discussed different types of fabrics in granites, and how those fabrics reflect both strain and melt transport processes. A brief review of three-dimensional flow fields and the resultant fabrics was also presented. In the practical session, Professor Tikoff and **Dr. Sarah Trevino** (University of Wisconsin, USA) demonstrated the use of *StraboSpot* and *StraboTools* (installed on android phone or Mac iPad) to procure, analyze, and visualize the data in the field. The next day, 6th September 2022, a one-day fieldtrip in the granitic terrain of Amritpur region was convened where *StraboSpot* and *StraboTools* were used by the participants, to practice the collection of field data.

Module 2: *Automated geostatistical-based geochemical mapping of igneous complexes using IG-Mapper (ArcGIS):* **Dr. Roberto Visalli** (Department of Biological, Geological and Environmental Sciences, University of Catania, Italy) discussed geostatistical and interpolation

reliability methods that allow mapping an igneous terrain hidden under a sedimentary cover. In a practical session, Dr. Visalli demonstrated a new user-friendly, fast, and effective ArcGIS-based IG-Mapper tool for the automated geochemical mapping of igneous complexes. This tool provides a geospatial representation of petrological parameters through the application of either deterministic (IDW) or stochastic (Kriging) interpolation techniques.

Module 3: *Combined quantitative microstructural and minerochemical analyses from X-ray maps and optical images using Q-XRMA and MFA (Arc-GIS):* **Dr. Roberto Visalli** demonstrated the use of computational methods to obtain, easily and reliably, quantitative mineralogical, compositional, and textural data. These data are obtained by the combined use of two ArcGIS-based tools. 1) Q-XRMA (Quantitative – X-Ray Map Analyzer), which uses statistical processing of X-ray images acquired by Scanning Electron Microscope (SEM), Electron Probe Micro Analyser (EPMA), or micro-XRF, which are able to identify minerals and sub-mineral phases in selected thin-section microdomains, and 2) MFA (Micro-Fabric Analyzer), which uses the statistical processing of high-resolution optical images for the quantitative extrapolation of rock microstructural features, such as grain size parameters and grain shape factors distinct per mineral phase.

Module 4: *Spatial and temporal modelling of cooling magma reservoirs: estimating the temperature and cooling rate of intrusions*: A petrological tool developed by **Dr. Catherine Annen** (Institute of Geophysics, Czech Academy of Sciences, Prague, Czech Republic). The theory covered by this module was presented by Professor Moyen because of Dr. Annen's illness. In a practical session, Microsoft-Excel was used to formulate relevant heat transfer equations using a number of parameters and further to explore and resolve various petrological questions, including: (1) how cooling times change with the thickness of the intrusion and the temperature of the country rock, and (2) the contribution of latent heat of crystallization in enhancing the thermal gradient in country rock.

Module 5: *Modelling volcanic and plutonic processes using rhyolite-MELTS (Microsoft Excel):* **Prof. Guilherme Augusto Rosa Gualda** (Vanderbilt University, Nashville, Tennessee, USA) taught key concepts of thermodynamics to derive several thermodynamic potentials that do not depend only on intensive parameters rather on extensive variables. Prof. Gualda highlighted a number of textural features of granitic rocks that help in inferring the paragenetic sequence, and unravelling the magmatic and post-magmatic processes. In a practical session, Prof. Gualda demonstrated the use of rhyolite-MELTS with examples, and discussed different solidification and eruption scenarios of magmatic systems that yield a better understanding of petrological processes.

Module 6: *Thermodynamically constrained forward modelling of granite chemistries in R-crust*: **Dr. Matthew J. Mayne** (Department of Earth Sciences, Stellenbosch University, South Africa) elaborately discussed the basic principles and theories behind phase equilibria modelling and highlighted the strengths and pitfalls of the assumptions required in order to apply the *RCrust* program to resolve petrological issues. These included the caveats of thermodynamic datasets and activity composition models, oxygen fugacity and iron valence, fluid state and water activity, extent of equilibrium/disequilibrium and the interpretation of results from phase equilibria in order to solve petrological problems. These approaches were applied to metamorphism and melting of pelitic rocks under the condition of differential amounts of water extraction.

Module 7: *A short guide for reducing and interpreting isotope data (Isoplot R):* **Prof. Federico Farina** (Department of Earth Sciences, University of Milano, Italy) gave a detailed account of U–Pb geochronology, presenting the most common techniques and reviewing some of the recent innovations in both high-precision and high-spatial resolution dating methods. Prof. Farina also presented radiogenic isotope (Rb–Sr, Lu–Hf) systematics and explained how these isotopes can be used effectively for tracing the petrogenetic processes. In his extended lecture and practical sessions, he discussed stable isotopes and the main mechanism of isotope fractionation (equilibrium vs. kinetics). Further, he provided an overview of recent methodological advances in *petrochronology* that allows potentially linking time (i.e., ages or duration) with the protracted rock-forming processes.

Module 8: *Classic approaches to whole-rock geochemical modelling of igneous processes using Microsoft Excel*: **Prof. Jean-François Moyen** discussed the basic principles of representing whole rock geochemical data, implications, useful statistical approaches and several other considerations such as visualizing the additional variables on bi-variate plots, coordinate mapping and use of principal component analysis. Prof. Moyen also covered aspects of choosing appropriate diagrams and graphical captions, and how they can be used in combination to depict useful petrogenetic information. A practical session, led by **Prof. Vojtìch Janoušek** (Charles University and Czech Geological Survey, Prague, Czech Republic), reviewed the main petrogenetic processes shaping the compositional variability of magmatic suites – including, *inter-alia,* partial melting, fractional crystallization and magma mixing/contamination. He demonstrated the techniques which are classically employed to numerically model whole-rock data in igneous

Group photograph of Instructors, Participants and Supporting Scientific Staff

Instructors, Participants, and Supporting Scientific Staff during one-day field training using *StraboTools*.

geochemistry: major- and trace-element compositions as well as radiogenic (e.g., Sr–Nd) isotopic ratios.

Module 9: *Geochemical Data Toolkit (GCDkit 6.1), a R-language based tool for handling, recalculating and plotting the geochemical database of igneous rocks*: **Prof. Vojtìch Janoušek** during lectures and practical sessions: (1) reviewed the currently available MS. Windows based software for the interpretation of igneous, whole-rock, geochemical data, (2) introduced the freeware R-language (r-project.org) and the *GCDkit* package (gcdkit.org) that offer not only a broad array of ready-made geochemical tools but also a rich environment to develop customized applications, (3) taught practical skills for installing and using the *GCDkit* software to recalculate/plot geochemical datasets, and (4) gave practical tips and tricks on internal working features of the software.

Module 10: *Evaluating fractional crystallization models and calibrating a geobarometer based on experimental data*: **Prof. Othmar Müntener** (Institute of Earth Science, University of Lausanne, Switzerland) presented the first part of his lecture online discussing *experimental phase relations and granite formation* - what, how, pitfalls, projections and interpretation, different approaches of equilibrium vs fractional crystallization, polybaric fractionation and the importance of volatiles (H_2O). In the second part of the lecture, he compared the natural data of Kohistan magmatic rocks with experimental results, and the timescales of magma transport from lower to upper crust. He further suggested that the evolution of granites through the major process of fractional crystallization (±mixing/assimilation) leaves behind a mafic cumulate at the Moho, an interpretation that is supported by geophysical data.

Module 11: *Finding nano-granitoids and microstructural features under the polarizing microscope:* **Prof. Silvio Ferrero** (University of Cagliari, Sardinia, Italy) gave a detailed account of how nanogranitoids and fluid inclusions in partially melted rocks help us understand how the crust melts and differentiates. He also showed a few unexpected features present in the partially melted rocks, such as primary fluid-melt immiscibility, rare crystallization products of melt droplets, preserved glass in old rocks and metasomatic melt inclusions. In the practical session Prof. Ferrero demonstrated the methods of how to discover and identify the melt and fluid inclusions in partially melted rocks by optical means using a petrographic microscope. Prof. Ferrero provided samples containing nanogranitoids, fluid inclusions and melt-related microstructures and taught the students how to recognize such features in these samples. In some cases, the group worked on metamorphic and igneous samples provided by the participants themselves, in order to acquire hands-on knowledge on the criteria used to recognize these microstructures.

Module 12: *Using field gravity and magnetic data to constrain the depth and shape of plutons - understanding the non-uniqueness of geophysics*: **Dr. Sarah Trevino** (University of Wisconsin, USA) explained the simultaneous use of magnetic and gravity analyses to determine the internal structure of plutons and three-dimensional shape of granitic bodies, in order to constrain emplacement mechanism of plutons. She further elaborated the Anisotropy of Magnetic Susceptibility (AMS) technique and how it differs from paleomagnetic analysis. **Prof. Michael Cheadle** (Department of Geology and Geophysics, University of Wyoming, USA) and Dr. Trevino provided theoretical knowledge on gravity-magnetic systematics and further imparted hands-on-practical training on using gravity and magnetic database/images in order to infer depth and geometry of plutons. Prof. Cheadle also presented a lecture on nucleation growth theory of crystals and quantifying rock textures to constrain formation and crystallization histories of igneous plutons.

Each student participant delivered oral (five-minutes) and poster (displayed throughout the training period) presentations related to their ongoing research problems. The instructors discussed the research issues and methods on a one-to-one basis with the participants and provided scientific suggestions for how the researchers can achieve their objectives using approaches taught in the training programme. In the valedictory session, instructors expressed their views about the programme and thanked the participants for their attentiveness and interaction.

A four-day field workshop (12-15 September 2022) in Kumaun Lesser Himalaya was convened under UGC-CAS-Phase II programme, led by Professor K. K. Agarwal, Professor Santosh Kumar and Professor Pradeep K. Goswami. Researchers from the Geology Department, Kumaun University, who are working on the Himalayan mountains, and some of the overseas scientists also participated in the field workshop. A series of extension lectures were also delivered by these overseas scientists to graduate students and researchers of the Department of Geology, Kumaun University, Nainital.

The training programme and field workshop in Kumaun Lesser Himalaya was successfully convened with the generous and continuous support from DST, New Delhi, UGC-HRDC, UGC-CAS-Phase II Programme to Geology Department, Kumaun University, Nainital, and the supporting scientific staff (Kapil S. Panwar, Shri Nirmit Sah, Dr. Narshimha Chintapally, Dr. Ravi Ranjan). Department of Geology, Kumaun University, Nainital extends deep sense of gratitude and thanks the overseas scientists for their active participation and continuous support.

Department of Geology Centre of Advanced Study, Kumaun University, Nainital

Advanced Training Programme on "Granite and Related Rocks"

5-11 September 2022

Attendance List

S. No.	Name	5	6	7	8	9	10	11
1	Chitra Joshi							
2	Sonal Raypa							
3	Diezenemo Meyase							
4	Priyanka Negi							
5	Valluri Sai Krishna Priya							
6	Anjali Solanki							
7	Rokozono Nagi							
8	Gorania Parita K							
9	Prachiti Prakash Kanaksdande							
10	Dr Kavita Tripathi							
11	Anju Mishra							
12	Duttanjali Rout							
13	Liza Gogoi							
14	Dr. Manjari Pathak							
15	Dr. Manisha Sanguri							
16	Saima Rahman							
17	Dr. Priyanka Singh Rao							
18	Ruby Kumari Prasad							
19	Mitakshi Pathak							
20	Futa Padiyar							

Kumaun University, Nainital

1. **Title of the Report: Financial Literacy**
2. **Department Name:** Department of Commerce
3. **Date of Event:** 16.12.2022, 1pm
4. **Name of the Organisation or Contributor:** TIME Institute, Haldwani
5. **Guest Speaker:** Mr. Ankur Mahajan (IIM Alumni, TIME Institute, Haldwani)

7. Purpose of the Event: Financial literacy is the ability to understand and effectively use various financial skills, including personal financial management, budgeting, and investing. When students are financially literate, they will have the essential foundation for a smart relationship with money. This can help start a lifelong journey of learning about the financial aspects of their lives. Education is the key to a successful financial future.

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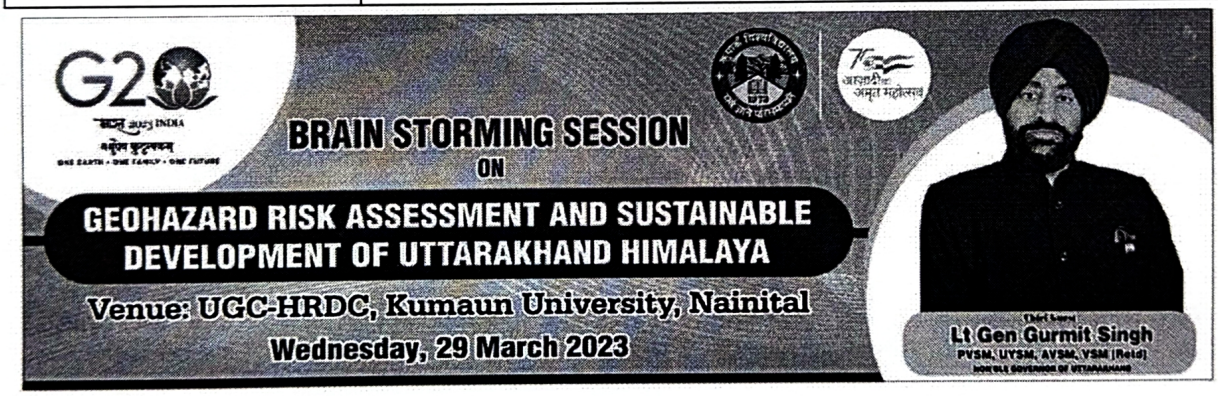
DEPARTMENT OF GEOLOGY
CENTRE OF ADVANCED STUDY
KUMAUN UNIVERSITY, NAINITAL - 263 002
UTTARAKHAND, INDIA

Date :

Activity 2

Title f the event	Geohazard Risk Assessment and Sustainable Development of Uttarakhand Himalaya
Date of the event	March 29, 2023
Venue	UGC-HRDC, Kumaun University Nainital
Details of organizers	Department of Geology Kumaun University Nainital
Type f Activity	Environment (Brain Storming Session)
Details f Expenditure	--
Total number of beneficiaries	154



Head
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Department of Geology
Kumaun University
Nainital - 263002

Proceedings and Recommendations of the brainstorming Session on '*Geohazard Risk Assessment and Sustainable Development of Uttarakhand Himalaya*'

Organized on 29 March, 2023 by CAS Department of Geology, Kumaun University, Nainital, at Devdar Sabhagar, UGC HRDC, Kumaun University, Nainital

Compiled by

Moulishree Joshi and Poonam Jalal

CAS Department of Geology,

Kumaun University,

Nainital-263002 (Uttarakhand)

Organising Committee

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Professor N.K. Joshi, Hon'ble Vice Chancellor, Kumaun University, Nainital

Convener

Professor Pradeep Goswami, Head, Department of Geology, Kumaun University, Nainital

Co Convener

Professor Rajeev Upadhyay, Department of Geology, Kumaun University, Nainital

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Dr. Poonam Jalal, Department of Geology, Kumaun University, Nainital

Dr Chintapally Narshimha, Department of Geology, Kumaun University, Nainital

Background and Agenda

The Himalaya is one of the world's youngest and tectonically active mountain ranges. Continued collision between the Indian and Asian plates build-up enormous stress all across the Himalaya, making it more prone to geohazards such as earthquakes and mass movements. Heavy precipitation in the region further adds to its proneness to Glacial and Landslide Lake Outburst Floods. Despite these unfavourable geological and meteorological conditions, the enchanting beauty of the landscape, locations of famous pilgrimage centers, favourable climatic conditions for the horticulture, and plenty of natural resources etc. of the Himalaya attract the attention of people for leisure, adventure, and spiritual activities, as well as the exploration of natural resources and its environs. An exponential rise in such activities over the past few years has resulted in threatening the developmental projects aimed at enhancing the infrastructure and exploration of natural resources all across the Indian Himalaya, particularly in the Uttarakhand Himalaya. It is however objectively difficult to protect the natural environment if we think for the developmental activities, and these are must for the betterment of the society as well as for the growth of a nation. All the anthropogenic activities interfere with the critical natural balance between different components of the regional landscape. Increased, unplanned, and unscientific developmental activities in the geologically sensitive regions like Uttarakhand Himalaya induce the vulnerability to geohazards that might lead to disasters. It is thus imperative that the developmental activities in the Uttarakhand Himalaya be planned and taken up keeping in view the geoscientific rationale for minimizing the risk of geohazards in the region.

The brainstorming session on " Geohazard Risk Assessment and Sustainable Development of Uttarakhand" was organized to provide a common platform to the geoscientists, technologists, academicians, and planners to discuss crucial aspects of the Uttarakhand Himalaya's geohazard risks, and finally to make the recommendations for the sustainability of the developmental activities and protection of the natural environment.

The specific agenda of the session was to discuss following two basic questions pertaining to the sustainable development of Uttarakhand keeping in view its geohazard proneness:

(i) How we could ensure sustainable development of this region without adding to its disaster vulnerability, or without putting further pressure on its resources?, and

(ii) Can we plan development of this area in such a way that all the developmental activities ultimately reduce the risk from disasters, and ensure the conservation of its natural resources?

Pradeep K Goswami and Santosh Kumar

Key Speakers

Dr Piyoosh Rautela,
Executive Director, USDMA, Dehradun;

Dr. Anand Pandey,
Scientist, National Geophysical Research Institute, Hyderabad

Dr. T. R. Martha
Scientist, National Remote Sensing Center, Hyderabad

Prof. C.C. Pant,
Retd. Dean, Faculty of Science, Kumaun University, Nainital

Prof. S.N. Labh
Retd. Professor, Tribhuvan University, Kathmandu

Dr. B.S. Kotlia,
Rtd.UGC Senior Scientist, Kumaun University, Nainital

Dr. Ashok K. Singh
Retd. Scientist, Department of Science and Technology, New Delhi

Mr. Anand Sharma
Retd. ADG, Indian Meteorological Department, New Delhi

Proceedings

A brainstorming session on *'Geohazard, Risk Assessment and Sustainable Development of Uttarakhand Himalaya'* was organized by the CAS Department of Geology, Kumaun University, Nainital at Devdar Sabhagar, UGC HRDC, Kumaun University, Nainital. The event was inaugurated by the Hon'ble Governor of Uttarakhand and Chancellor, Kumaun University Lieutenant General (Retd.) Gurmit Singh, PVSM,UYSM, AVSM,VSM.

The programme was subdivided into three technical sessions following the inaugural session. In the inaugural session Professor Pradeep Goswami, Head, Department of Geology, Kumaun University apprised the audience about the specific agenda of the programme. Professor N. K. Joshi, Hon'ble Vice Chancellor welcomed the Chief Guest Hon'ble Governor of Uttarakhand and Chancellor, Kumaun University Lieutenant General (Retd.) Gurmit Singh, all the invited key speakers and participants and shared his views on the burning issues of hazard proneness and sustainable development of the state. Hon'ble Governor of Uttarakhand and Chancellor, Kumaun University Lieutenant General (Retd.) Gurmit Singh delivered the inaugural address. He stressed upon the urgent need of maintaining balance between the development, natural resources and environment of the state to cope up with the challenges posed by geohazards. At the end of the inaugural session Professor Pradeep Goswami proposed the vote of thanks.

Technical Session 1

The first talk in the opening session was delivered by Dr Piyush Rautela. Dr. Rautela started the discourse with a broad statement that most disasters are our own creation as we are getting increasingly shortsighted and overlooking the implications of our actions that are increasing our vulnerability to various hazards and, therefore, it is no surprise that disaster induced losses are increasing at an exponential rate.

Citing the examples of 1894 Alaknanda floods, 1880 Sher-ka-Danda landslide and 1803 Garhwal Earthquake, Dr. Rautela deduced that the region had always been prone to various hazards as also resource scarce. He added that the people of the region managed the

available resources optimally and devised ways of warding off the threat posed by hazards to which the region has always been vulnerable.

Dr. Rautela convinced the audience that the people of the region knew not only the basics of hydrology but also the art of groundwater prospecting and urged the scientists to undertake research on the same. He also described the benefits of fragmented land ownership, traditional crop rotation (*Sari*) and mixed cropping (*Baranaja*) as also food processing and preservation practices that ensured food security.

Taking lead from the settlement pattern and *jungle guls* Dr. Rautela deduced that the people of the region had devised ways of not only warding off the threat of landslide and flood but also identifying slopes that are vulnerable to slope instability.

Dr. Rautela stressed upon the tradition of multistoried houses in the region and emphasized that but for the knowledge of earthquake safe construction these would have been razed to ground by Garhwal Earthquake of 1 September 1803 that inflicted losses in places as far as Delhi, Lucknow, Aligarh and Mathura.

Dr. Rautela subsequently talked about 05 basic precepts of the traditional earthquake safe construction practice of the region; (i) site selection, (ii) sound foundation, (iii) simple plan, (iv) safe joints, and (v) load transfer. Highlighting the issue of fast increasing seismic vulnerability of the building stock in the region Dr. Rautela flagged the issues related to (i) breakdown of traditional construction practices, (ii) not so easy and economic unavailability of local building material, (iii) sudden change in building material, (iv) neglect of training of masons in the use of new building material, (v) social status attached to houses built with brick-cement and (vi) lack of routine and proper maintenance of traditional houses.

Highlighting long recurrence interval between major earthquakes Dr. Rautela urged the researchers to unravel the methodology employed by these people to pass on changes made in the buildings so as to compare the losses incurred in next earthquake so as to validate the appropriateness of the innovations.

In the end he impressed upon the importance of studying and researching upon various aspects related to traditional construction practices to innovate on these and making these well suited to present ground realities.

He also highlighted the need of having sound debris disposal and land use policies as also site-specific building codes.

Dr.Rautela ended the discourse emphasising the need of increased funding for practical and innovative research to bring forth locally relevant, economically viable, sustainable and socially acceptable solutions and packaging the finished product with an appeal to the Little Tradition of the masses so as to ensure voluntary compliance of these. According to him this and not present consultant driven approach alone is to make the region and its inhabitants disaster resilient.

The second talk was given by Dr Ashok Singh, onUttarakhand Disaster: A case study of Joshimath crisis.Dr Singh stressed uponthe need of Geospatial data in disaster management and mitigation. He stated that poor management leads to disasterstherefore, scientific dataset must be updated. He emphasized on the need of a centralized geospatial data, rather than a jargon of data from various platforms to increase the accuracy of disaster monitoring and prediction. To elaborate the efforts of the government, he put forward the success stories of the following programmes launched by the government which were carried out using the digital platform.

The MANU Programme (Map the Neighbourhood in Uttarakhand): Efforts for this programme were made by NRDMS Division, DST for disaster management in Uttarakhand. The Programme MANU was initiated in 2013, soon after Kedarnath Tragedy, for damage assessment in Uttarakhand. The focus of this programme was "to map the extent of devastation and damage, analysis of the temporary and permanent damage to the ecosystem and to provide actionable recommendations and follow up actions".

Following six institutes participated in this programme:

1) Kumaun University, Nainital, Uttarakhand

2) HNB Garhwal University, Garhwal, Uttarakhand

3) Kashmir University, Kashmir

4) Delhi University, Delhi

5) Wadia Institute of Himalayan Geology, Dehradun, Uttarakhand

6) Indian Institute of Remote sensing, Dehradun, Uttarakhand

Under this programme, capsule training of two days was provided in two batches, prior to the mapping with the objective to train participants to collect the data on damage to different types of structures through mobile application developed for the MANU programme

and upload the same to Bhuvan geoportal. The training was a practical field and lab exercise,given by the faculty of ISRO (IIRS and NRSC) and SOI. A total of 149 participants participated in this training.The data is available in the Bhuwan Portal.

*NGP 2022:*Dr Sharma briefed the audience about the National Geospatial Policy (NGP). The Ministry of Science and Technology has formulated a National Geospatial Policy (NGP) 2022 with the goal of making India a world leader in geospatial technology sector. It is a citizen-centric policy which seeks to strengthen the geospatial sector to support national development, economic prosperity, and a thriving information economy. The policy is aimed to set up high resolution topographical survey and mapping with a high accuracy digital elevation model (DEM) by 2030. It aims to make India a world leader in global Geospatial space, to develop a coherent national framework in the country,to develop geospatial infrastructure, skill, knowledge, standards, Geospatial businesses, to promote innovation and strengthen the national and sub national arrangements for generation and management of Geospatial information.

*Gati Shakti:*He also talked about Gati Shakti, a programme launched on October 13, 2021 aimed to revolutionize infrastructure in India. It is again a centralized digital platform to bring 16 Ministries including railways and roadways together for integrated planning and coordinated implementation of infrastructure connectivity project. It is one of the four big priorities ofPrimeMinister Narendra Modi government.

Dr Ashok Singh strongly advocated upgrading of Natural Resources Data Management System as and when required.

He put forward the importance of research for the people by the people by giving the example of successful use of the mobile app used during the MANU programme by the local, graduate, and postgraduate people to acquire the data and upload it in the Bhuwan portal. By sharing the success stories of programmes like MANU and NGP, he raised the demand forthe data to be mademore visible and accessible. For this he proposed centralizing the geospatial data and maps.

Technical Session 2

The first talk in the second technical session was given by Prof C.C. Pant, retired Dean, Kumaun University, Nainital. He discussed the historical background of Nainital and the origin of Naini lake. The lake was formed due to the activation of Nainital fault, a rotational fault, along which the Sher ka danda ridge was upthrown leading to the blockade of a stream that led to the formation of the lake.

Prof. Pant discussed the fragile ecosystem of Nainital citing examples of some of the prominent historic landslides of the town such as the Alma landslide of 1867, the landslide of 1880 and many subsequent ones. He pointed out that most of the settlement in Nainital is on loose landslide debris which has stabilized over the years and althoughthe slopes of Nainital have always been fragile,more damage is caused now because of increasing number of people occupying unstable zones.The rocks in Nainital are highly sheared and fractured owing to the tectonically active nature of the terrain.

He discussed the bathymetry study carried out by NIO (National Institute of Oceanography) whichhas revealed the basin structure of the lake.He expressed concern over the alarming rate of sedimentation in the Naini lake. The lake is being rapidly filled with sediment and according to an estimate the lake may be filled with sediment in 350 years.

He warned the audience that the future of Nainital depends upon the stability and well beingof Baliya Nala which is the outlet of the Nainital lake, flowing in southeast direction. Increasing anthropogenicactivity in the recent times has caused immense threat to this life line of Nainital. He strongly advocated building small, smart hill cities in and around Nainital to divert congestionand pressure on the town.

Dr. B. S. Kotlia, retired UGC Senior Scientist delivered the second talk of the session. He talked about the impending disaster that awaits Nainital. He voiced his concern on Nainital becoming the hub of landslides and subsidence orgradual downward settling of ground surface for which not only the administration but the residents are equally to blame.

He shared the data generated during his research in Baliya Nala landslide by using Global Positioning System (GPS)measurements in static mod. Showing a map of active landslide in Nainital, he raised concern that Baliya Nala which is the foundation of Nainital

has been damaged completely over the years. He outlined the main triggers of the old Baliya Nala landslide. The fundamental reason for catastrophe according to him are the steep slopes,the rock type (which plays a dominant rolein mass movement) and the tectonic set up of the area.

GPS study carried out by his team has revealed that the area is sliding at the rate of 10 to 60cm/yr in general, while in certain places even by 1m/yr. In Krishnapur, an area of 5km has registered subsidence upto 52cm and the entire area is criss-crossed with cracks.Dr Kotlia expressed his grave concern for the inhabitants of Krishnapur who have nowhere to go and called it an unfortunate warning signal for Nainital town.

Dr. Kotlia revealed that the area of landslide prone zone has increased by about three-fold in the last five years and the active landslide area has been amplified by several times. In 1998, the DSB college gate experienced a disastrous landslide, followed by ground subsidence around Raj Bhawan area in 2011. Since 2018, the town has again witnessed landslides and cracks in the lower mall road. Subsequently, about 25m of the lower mall road hasslumped into the lake, twice. In 2020, the damaged part of the road was inspected and suggestions were made to the government officials. California Bearing Ratio (CBA) which is a measure of the strength of the subgrade of a road or a paved area and Total moisture Content (TMC) around the site of construction must be measured while restoring the mall road.However, he was unsure if his suggestions were taken into account by the authorities.

Dr. Kotlia shared the satellite data between 2006-2017 to show how rapidly, Nainital is losing its green cover, giving way to settlements. He also talked about the palaeo-shoreline at Sukhataland expressed his grave concern that the lake has already lost 20ft of water.

Dr. Kotlia compared the present disaster response to that of 1880 when a committee was formed under Ramsay within 4 days of the disaster and recommendations were made to (a) line and rivet the ravines,(b) fill deep cracks with hard clay (c), prohibit construction on affected hill sides , (d) plant steep slopes with trees and prohibit grazing, (e) appoint an honest and trustworthy officer as Inspector of buildings and drains. The recommendations were implemented with immediate effect. However, many of these were discontinued with time.

Dr. Kotlia suggested that in order to prevent further damage to the lake ecosystem,water management must be given priority. Roof water from each house should be tapped for water harvesting.Sukhatal, which is a recharge zone for the lake should not be

tampered. Springs and streams around the lake should be mapped and preserved. Steps should be taken for erosion control and forest regeneration. Cementing of roads should be avoided and steps should be taken to saveBaliya nala. Water from Baliya Nala should be pumped into the Nainital lake. Instead of beautifying the exterior, the need of the hour is to strengthen the foundation.

Technical Session 3

The first talk in this session was given by Mr Anand Sharma, retired ADG, IMD. He talked at length about the challenges in predicting extreme weather events in the Himalaya.He talked about weather as a dynamic entity, changing from time to time. However, due to anthropogenic interference, and emission of greenhouse gases, the overall surface temperaturesare increasing at a faster pace leading to added pressure in climate variability.

Mr. Sharma stressed upon the need to differentiate between climate change and climate variability as both are different but often interpreted as similar. He stated that a slight change in temperature cannot be attributed to climate change. Extreme climate events have always occurred due to natural causes such as, tilt of the earth, solar activity, volcanism and other natural phenomenon and he referred tothese as climate variability. However, extreme events which occur due to the increase in anthropogenic pressure may be referred to as climate change, the effect of which is more pronounced now than before.

Mr. Sharma postulated that natural hazards are everlasting. Even when anthropogenic pressure was not a concern in the previous centuries, before the industrial revolution, andwhen the greenhouse gases were at an optimum concentration, naturaldisasters were a common phenomenon. Therefore, to cope with the disasters, the society has to be made resilient. There are two options, disaster mitigation such as lowering of greenhouse gases (Zero carbon economy by 2050) and adaptation.

He raised concern that if not checked, the temperature of the earth will increase by 5 degrees till 2100 which will be catastrophic for the earth and its residents. Dr Sharmadiscussed the ‘Paris Accord’ regarding climate change where the member countries

have agreed upon taking effective measures to prevent global temperaturesfrom escalating beyond 1^0C.

He maintained that evenhazards have a positive side(floods make the soil productive, thunderstorm and lightening help in nitrogen fixation, cyclones help recharge groundwater table in coastal areas like Tamil Nadu, dust storms bring in micronutrients to farmlands in northern India.However, hazards should not be allowed to convert into disasters therefore early warning systems need to be developed.

He talked about the four components of early warning system. First component is comprehensivevulnerability analysis, isolating areas which are highly disaster prone. Second componentis observation , monitoring and prediction which is mainly done by IMD.He further elaborated that there are two types of observations, surface and upperair. While temperature, rainfall and humidityare measured closer to the earth's surface at 4ft, wind speed is measured at 10 feet.While predicting weather for a state, data is required from not only neighbouring states but all over the world. As weather cannot be predicted in isolation therefore high intensity network is required.

Mr. Sharma expressed concern over the lack of high density upper air networks specially in a disaster prone state like Uttarakhandwhich has only one upper air network till nowand that is inDehradun.

He stressed upon the need for valley specific, mesoscale models, (10km-100km) inthe Himalayan region which has a diverse topography made of hills, valleys and ridgesin order to record local variability. Upper air network needs to be improvised and high-density network of RADAR must beestablished specially in the Himalayan terrain.

Mr. Sharma postulated that although RADAR network has been established, its density needs to be improved.Mesoscale networks,covering small areas to record local events, need to be strengthened.According to him, the most important aspect istimely dissemination of information for which 24X 7 weather channels are required such as in U.S or Europe.

He urged each individual to include weather information in day-to-day planning.He also explained how to see the weather phenomenon on hourly and daily basis from the Indian Meteorological Department site.Also, he emphasized on the need of hourly weather forecast for the farmers.

Mr. Anand stressed upon the need for improving the availability, quality and use of weather and climate information and developing valley specific meso-scale models. Development of multihazard EWS (Early warning System) and fail-safe communication system such as community radio, development of comprehensive vulnerability/ risk maps and state of art telecommunication system that promote sharing of data are priority he said.

Dr AK Panday from NGRI, Hyderabad delivered the second talk of the session. He talked about landslide localization in regional landscape and shallow subsurface site response giving reference to Joshimath subsidence.He statedthat NGRI is associated with several research works in Uttarakhand for the past four years in the areas of earthquakes, floods, and landslides. The evolution of a landscape is a function of dynamic and competitive interaction of geodynamic processes and climate driven erosion.Landslide and mass wasting are among the most efficient processes modifying a landscape. However, the global trend shows that the landslides are majorly driven by precipitation. Giving examples of landslides from Spiti valley, Dhauli Ganga and Gaula river, he stated that majority of landslides in the Himalayan region occur during the monsoon months.

The localization of primary erosion by landslide and remobilization of eroded regolith-debris can be modelled with reasonable precision in the bed rock landscape like Himalayas. However, predictive characterization of subsidence and slow mass movement in an otherwise stabilized hill slope is challenging. It requires site specific shallow subsurface characterization and analysis of the geomorphic and local geological mass for slope stability assessment. Since most habitation in the Himalayas is confined to either old landslide material or fluvial depositional landform due to availability of stable gentle slopes near water source suitable for farming. Imbalance insustainability would produce ephemeral landform modification which have hazard potential for inhabitants. Site specific analysis using multiparametric study was carried out in Joshimathfor decoding its subsidence using Remote Sensing, Physical mapping, integrated subsurface mapping.

Discussing the situation in Kedarnath in 2013, he detailed about the conventional mapping which was done under MANU programme. He emphasized upon the use of quantification mapping over conventional mapping. Heshared theonsite field pictures of Joshimath hazard survey carried out in January 2023. GPR, MASW and EVRI survey revealed large fractures up to 30 to 40 meters in depth running all along the length affecting

the roads, houses, and the hilly farms of the residence. He assured thatsubsidence-affected familieshave been evacuated to safety.

He also pointed out that Joshimath town is sitting on river born loose material and not on glacial moraine as believed. Th bulk of fissureswhich developed overthe loose material,dehydrated the strata, causing subsidence of the area. There are many pockets of loose material over hard rock of varying thickness.

Dr Pandey recommended the use of multiscale data analysis to identify locations vulnerableto slope hazard. The habitation and important infrastructural centres should be mapped for shallow subsurface characterization using multiparametric studies with specific objectives.

Multiparametric data input can bring in a comprehensive understanding of the region which is required for meaningful decision making. As the study is expensive, and required specialised expertise, Dr Pandey emphasised on prioritizing the area of investigation.

Dr T.R. Martha from National Remote Sensing Centre (NRSC) delivered third lecture of the session. He talked about the use of satellite data and geospatial models.His talk focused around the landslides, their nature and disaster created by them in different mountainous regions.

He shared that NRSC has created a nationwide landslide inventory and prepared a district wise ranking of landslide disaster. 12.6% of India's landmass is vulnerable to landslides. India ranks 1st among all nations in the world in terms of the number of fatal landslides. Approximately 10,305 people have died in India in the last two decades due to landslides.On many occasions, minor landslides give way to major, valley blocking landslides.

He discussed how the earth surface temperature is rising resulting in retreat of glaciers in the Himalayan region. A study carried out in Kerela by NRSC has revealed that the rainfall pattern has deviated from the normal. He displayeda statewise landslide inventory created by NRSC which shows around 80,000 landslides in India.Uttarakhand is ranked number 1 and 2 in district wise ranking of landslide disasters.

He compared the pattern of landslide in the Northeast and Northwest India. While landslides in the northeast are of much smaller dimension, landslides in Uttarakhand, Jammu and Kashmir, Ladakh and Himachal cover a much larger area.

Dr Martha discussed the case study of Chamoli rock and glacier avalanche of 7th February 2021carried out by NRSC. An unstable landslide dam formed near the crash zone in Raunthi gad. Challenge was to identify the source of the disaster. Geotechnical cause was identified using high resolution multitemporal satellite data. Satellite images showed the event in near real time.

Damage assessment of Tapovan Project was also carried out using remote sensing data. Landslide dammed lake in Rishi Ganga was monitored using Remote sensing data. Similar study was also carried out in Baliya Nala, Nainital between 2004-2019. NRSC has prepared landslide susceptibility map and rainfall based early warning system.

Prof S.N. Labh delivered the last talk of the session. He talked about risk Assessment and sustainable development with reference to Joshimath, its present status and future challenges. He talked at length about how geohazards like volcanism, earthquakes and landslides affect human societies.

He pointed out that increasing anthropogenic pressure is creating imbalance in landuse practiceswhich in turn has led to an increase in the occurrence of geohazards.Showing the global data, he raised theissue of Asia being highly prone to hazards, particularly, the developing countries, which are on the topmost hierarchy of geohazards.

Coming to the disaster in Josimath, he emphasized the significance of the town in tourism sector of Uttarakhand and it beingan ancient heritagesite of the Hindus. He further elaborated that the earlier studies suggest Joshimath to be laid on a loose material, with low bearing capacity, continuously fetched by the river system as landslide material. Excessive construction activities and landerosion have adversely affected the people of Joshimath.

He recommended a strict replanned township with a constrained population that can be sustained in such geological conditions, updated drainage system and proper disposal network for municipal wasteshould be considered to reconstruct Joshimath for its sustainability in future.

He raised concern aboutthe impact of climate change and reduced land availability on traditional agricultural practices. People of the hills have stopped using traditional crop management practices. Lack of maintenance of traditional agricultural practices due to migration in search of better opportunities and reduced economic viability is exposing more and more land to mass wasting and erosion.

He pointed out how people have begun to look down upon traditional style of houses, with roofs being replaced by concrete slabs and houses being built close to the roads and rivers, thereby inviting disasters.

Prof Labh believed that the Himalayan topography presents ample opportunities for cultivating a variety of plants. The terrain is particularly suitable for growing rare herbs and plants that require very specific conditions to grow. The altitude ranges from a few metres to almost 7000 metres above sea level. Even the rarest of herbs and plants of medicinal value can grow naturally inthe region. Herbs like *yarsagambu* are being cultivated in the wild at altitudes of 4000 m and above. In the lower reaches,farms are best suited to grow medicinal herbs and plants native to lower altitudes.

He stressed on having interdisciplinary studies providing degree/diploma/PhD in Disaster Science as a part of the university curriculum. He suggested that State governments should provide fellowships among intra -Himalayan state level students in disaster studies.

Dr Labh advocated the implementation of aquaculture (one house, one farm) policy. Aquaculture is a method used to produce food and other commercial products. He also promoted habitat restoration and replenishment of wild stocks and rebuilding populations of threatened and endangered species.

He discussed the present scenario of Joshimath in detail and made some suggestions. He suggested that there should be a complete shutdown of developmental activities and hydroelectric projects in the region. He urged the authorities to reconsider the town's planning to accommodate the new variables and the changing geographical factors.The city has a poor drainage and sewer management as more and more waste is seeping into the soil, loosening it from within. Hence, drainage planning is one of the biggest factors that needs to be studied.

Recommendations

Based on discussions, ideas, information, experiences and data produced during the brain storming session by the experts, several suggestions were floated. After careful screening of ideas, information and data, the experts expressed their unanimity in making the following recommendations for addressing sustainability issues in the fragile terrain of Uttarakhand. The experts were of the opinion that though the recommendations are specific, the policy formulation and implementation must take into account the ground realities and involve all stakeholders to ensure meaningful implementation.

The Suggestions/Recommendations may be categorized into:

1. Preventive measures and
2. Curative measures

Preventive Measures

- **Risk Assessment**

  The exercise must begin with identification of all possible reasons that are responsible, directly, or indirectly, for increased vulnerabilityof the entire Himalayan terrain, to disasters. Efforts must also be made to determine the impact of human activity on facilitating disasters. All possible factors must be brought on record to address the gap that exists in extant literature. It has been observed that during the last few years, the intensity of rainfall has increased leading to increased frequency of cloudburst. Consequently, the frequency of landslides has also increased in the region affecting the vulnerable areas. Thus, it is recommended to carry out large scale landslide hazard zonation and mapping of the vulnerable areas.

- **Developing Communication Network**

  The significance of communication in managing disasters cannot be underestimated. Communication is the lifeline of disaster management. Efficient and effective communication network is an essential prerequisite in planning for managing disasters. A good communication network can sensitize the locals on the nitty gritties of disaster management and keep them informed and updated on the ways and means

to managing pre and post disaster scenarios. The locals in disaster prone areas should always be in a state of preparedness to minimize or eliminate the possibilities of loss to life and property.

- **Ground Realities in Policy Formulation**

  A brilliant policy on paper that cannot be implemented is useless. Therefore, it is imperative that policy makers considerthe local conditions and formulate policies and programs that are workable and can be implemented. There must be a good balance of economic, physical, and social viability. Very often, policies and programs fail because only cost of implementation is considered while choosing the best policy alternative. Sustainability issues related with the physical environment and the social environment are often ignored. Therefore, it is suggested that there must be an integrated approach all through the process of policy formulation to implementation.If necessary, more stakeholders like academic and research institutionsmay be involved.

- **Traditional Practices in Sustainable Development**

  Our ancestors have lived in complete harmony with nature since generations. The ancient practices, the ways of living have been documented by many experts, historians, sociologists etc. Moreover, the ancient practices are still followed in many remote areas where villagers are confidently dependent on their traditional practices in managing their social life and their relationship with nature.

  Research and documentation of traditional practices and their improvisation and packaging the output can make a huge difference in the way sustainability issues are managed. Our social and religious practices are woven around the theme of conservation of natural resources. Various traditional practices are attached to the conservation of water, forests, and the entire ecosystem. There is a need to research and document these traditional practices while looking for socially acceptable solution. According to some experts, going back to our roots is the only way forward towards sustainable development.

- **Integrated Approach to Sustainable Development**

  Sustainability issues can never be addressed by one agency, department, institute or even one ministry. It requires a coordinated and integrated approach. Information, data, expertise and inputs from across departments and ministries can present

decision makers with a more holistic picture. The interrelatedness and interdependency of the government departments necessitates the integration of data from different sources to generatecentralized geospatial data to make the disaster monitoring and prediction easier and more accurate.

- **Research for Development**

  Research should not be merely an academic exercise. Research can only be meaningful if it can facilitate growth and development. Research projects/grants must contribute directly, or indirectly to society and further the cause of development. Research is NOT a domain reserved exclusively for the academic. There are a huge number of knowledgeable individuals amongst us who may not be associated with teaching or research. So many of them are endowed with tacit knowledge that must be made explicit. Academics/ Researchers can help in identifying, documenting, enriching, and disseminating such knowledge for growth and development. Experts during the session recommendedthat state governmentshould develop R&D programs in consultation with the specialized institutionsand experts to provide proper technical guidance to handle such disasters.

  A Himalayan research laboratory should be established as Centre of Excellence and regular courses up to Master's level to address the Himalayan issue must be established. Geoscientists and environmentalists should contribute to risk management policies related to social and technical issues associated with geohazards as well as disaster mitigation. Interdisciplinary courses concerning livelihood like Himalayan tourism, leadership management, workshops and seminars, addressing issues related to Himalayan ecosystem, disaster mitigation should be encouraged.

- **Use of technology in active disaster areas**

  Reactivation of any geological fault or thrust is a natural phenomenon and cannot be controlled by us. It is a natural process and will continue to damage weak zones of any area. Therefore, the only solution is to treat such disasters prone areas usingengineering technology. Vertical retention walls on the affected sites is not a long term solution as these walls may get washed away. Robust strengthening measures such as those employed at dam sites such as nailing, knitting, and anchoring are required. High angled steep slopes should be stabilized with geo nets, nailing, and

anchoring and grouting. Small or unscientifically constructed fortification in the form of protection walls in Baliya nala is of little use. At the base of the landslides, piles (long cylinders of concrete) should be pushed into the hard rock or placed in drill holes. Retaining walls can be constructed by adding metal or concrete beams horizontally between the piles.

CBA and TMS must be measured before treatment of any landslide or subsided patches. Only strong semi vertical walls in the form of steps should be erected in unstable , landslide prone regions like Baliya nala high tech Engineering (as in dam sites) as has been done in Varunawat, Uttarkashi to stop erosion.Construction, quarrying and excavation activities should be completely prohibited on affected hillslopes. Steep slopes should be planted with trees or soil binding shrubs such as *Rambaans*. Grass cutting and grazing should be strictly prohibited on such hill slopes.

- **Use of multiparametric data**

Use of multiscale data analysis to identify vulnerable and disaster-prone areas. The habitation and important infrastructural centres should be mapped for shallow subsurface characterization using multiparametric studies with specific objectives. Multiparametric data input can bring in a comprehensive understanding of the region which is required for meaningful decision making. As the study is expensive, and required specialised expertise, the area of investigation should be prioritized.

- **Appropriate Water Management**

Cementing of roads prevents rainwater from percolating underground thereby hampering the subsurface recharge. Therefore, it is suggested that authorities restrict the use of concrete, especially in the catchment areas. Sukhatal is one of the most important recharge zones/catchment areas of Nainital lake. If it is tampered in the name of beautification, the lake will be adversely impacted. Therefore, the authorities should ensure that this recharge zone is not disturbed. However, the situation is already alarming. Indiscriminate construction has limited the lake's catchment and construction activity continues unchecked.

Streams/springs/ thrust zones/ weak zones around the lake should be mapped and no construction should be allowed on the weak, shattered rocks and landslide

debris. Further, the ancient springs, *naulas* and *dharas* should be remapped and brought back to their former glory.

Water from roof tops should be tapped for water management.Water harvesting must be encouraged. Reduction in surface runoff will also help prevent erosion.

A very interesting suggestion from an expert was to tap Harinagar spring water at the meandering point of old Balia landslide and lift this water to Nainital lake. It will not only save Balia nala from undercutting, but fragile rocks of Harinagar will also be saved from water charged debris. Moreover, Naini lake would get additional water.

- **Effective use of Weather monitoring and forecasting technologies**

  Efforts must be made to improving the availability, quality and use of weather and climate information.The experts were of the opinion that large scale weather models fail to monitor small scale activity such as a cloud burst which is a local phenomenon. As a result, timely interception and warning does not happen.

  It is suggested that valley specific meso- scale models be developed. Meso-scale and valley specific models using RADAR network can register small scale yet high damage phenomenon. Such forecasting and warning systems can reduce damage significantly.

  Development of multihazard EWS (early warning system) and fail safe communication system like the community radio will definitely help the cause. There should be a 24X7 weather channel or use of scrollers in news channels which give uninterrupted weather updates. Also, people should be motivated to incorporate weather updates in their day to day lives.

  High density upper air network should be established in disaster-prone regions. Currently there is only one station in Uttarakhand which is in Dehradun. More such stations need to be established to closely monitorthe smallest change in the weather pattern even in a remote area.

- **Proper Drainage**

  Disaster vulnerability and risk assessment exercises are essential in settlements/villages/towns located on or near palaeo-landslides. Two such towns - Nainital and Joshimath, which have settlements over or near palaeo-landslides, along

steep slopes and near watercourses have been adversely affected and suffered maximum damage. It has been observed thatin such regions the agriculture is practiced after modifying the palaeo-lanslides. Such sites are typically located at the base of steep slopes. In such geomorphological settings, the rainwater that flowsdown the hill slope on reaching the terrace, percolates and removes the fine material (sand, silt and clay), leading to the sinking and subsidence of these areas. Consequently, under this scenario, the infrastructure and settlement built on such locations gets severely damaged. A proper drainage system needs to be created/developed/maintained is all such identified areas.

Curative Measures

- **Developing an effective response mechanism:**

  There is an urgent need to create/develop and maintain a Natural Disaster Rapid Response Mechanism to facilitate rescue, relief, and rehabilitation. Search and rescue operations should put into use the best available technology. The response team must be thoroughly trained and geared to carry on rescue and relief operations. All required equipment must be made available to these teams. Experts may be identified and engaged in such operations. It is also very important to develop terrain specific guidelines to handle disasters in affectedareas.

- **Sustainable agricultural practices:**

  Agriculture in the hilly areas of the Himalayan state of Uttarakhand is of subsistence type, characterised by fragmented land holdings, usually in the form of terraces cut out of the slopes. The fragmented holdings make it extremely difficult to use technology. The problem has been aggravated due to climatic changes and outmigration of the male population to town and cities within the state and in neighbouring states. Women are burdened with the additional responsibility of cultivating crops. Moreover, agricultural land is shrinking.

  It may become increasingly challenging to grow crops using traditional methods. Therefore, alternative techniques should be investigated such as ‘One house, one farm’ scheme, aquaculture and aquaponics.

- **Developing Resilience**

  Mock exercises and drills should be made a regular feature in highly sensitive areas to ensure preparedness for sudden and extreme events/disasters. Evacuation methods, shelter developments and rehabilitation plans must be in place so that post disaster management is efficient and effective. The affected people must be provided all possible assistance to ensure quick rehabilitation without any bureaucratic hurdles. Permissions and clearances from concerned government agencies for post disaster work must be in place before disaster strikes. A comprehensive disaster management strategy must incorporate post disaster / rehabilitation plans. Investing in disaster risk reduction for resilience. Enhancing disaster preparedness for effective response.

  Community participation for post disaster work must be promoted through effective dissemination of information. Community involvement can help affected people in a big way.

- **Managing physical carrying capacity of hill stations**

  Hill stations like Nainital are witnessing an extreme abuse of physical carrying capacity due to uncontrolled mass tourism. Vehicular traffic has increased manifold in recent years. Scarcity of parking spaces is compelling people to park vehicles indiscriminately on roads and lanes surrounding the lake. Moreover, the movement of such traffic is causing irreparable damage to the local ecology due to the weight and vibrations generated.

  Nainital, being a tourist destination is reeling under immense anthropogenic pressure. It is suggested that small satellite townships should be developed around the main town. A limit should be imposed on the number of tourists as per the demography of Nainital. Rather than creating more pressure on Nainital for parking, a multi parking must be made away from Nainital in the nearby plain areas as Haldwani, Kaladhungi and a proper system be created for tourists to visit Nainital. Appropriate tourism policies should be developed for such destinations. Mass tourism must be discouraged through demarketing strategies.

Brain Storming Session
on
Geohazard Risk Assessment and Sustainability Development of Uttarakhand Himalaya

Organized by:- Department of Geology, Kumaun University, Nainital

S.No.	Name	Designation & Department	Signature.
1.	Dr. Manisha Sanguri	Guest faculty, Geology Dept	Manisha
2.	Nirmit Shah	" " , Geology	
3.	Dr. Moulishree Joshi	Woman Scientist-A	
4.	Dr. Poonam Tolal	Woman Scientist-A	Poonam
5.	Arti arya	Department of Hindi D.S.B. Nainital (शोधार्थी)	
6.	Shivani (Research Scholar)	M. B. P. G College Haldwani	Shivani
7.	Purnima	D.S.B Campus History Dep. Research Scholar	
8-	Inder Prasad	D.S.B. campus Nainital Research Scholar	
9-	Ravi Kumar	Research Scholar Pol. Sc. Dept.	
10-	Prakash singh	~~Research~~ Research scholar (ECO)	
11→	Pradeep Pathak	Department of Geology (MSc I)	Pradeep.
12-	Preeti Sagar	Department of History (scholer)	Preeti Sagar
13	Nirmala	Department of Sanskrit	
14.	Jayshri Joshi	Department of Sanskrit research scholar शोधार्थी (द्वितीय) Research Scholar	Joshi
15.	Rakshita Kandpal	Department of Education M.B.P.G. College, Haldwani Resea	RKandpal
16.	DEEPAK BISHT	Department of Geology, KU, Nainital. Designation - JRF	Bisht
17.	Pankaj Bhatt	Department of Commerce	
18.	Siddhant Khulbe	Department of Economi	Siddhant

19.	Divya Rawat	Bsc. III, Geology	Divya
20.	Abhishek Kohli	Research Scholar Dept. of Geology, KU, Nhl.	Abhishek
21.	DEEWAKAR BAWARI	Research Scholar, Dept. of Geology, KU., NH.	Deewakar
22.	Bimal Kishor Tamang	Research Scholar Dept. of Geography, KU	Bimal
23.	Ambika Tiruwa	Research Scholar, Dept. of Zoology, KU., NHL	Ambika T.
24.	Chetan Chaudhary	Research scholar, Dept. of Geology, CAS, KU, NHL	Chetan
25)	Deeksha Bohra	Research Scholar (Dept of Geology)	
26)	Dr. Santosh Joshi	SRF (Geology)	
27	Mohit Singh Rautela	Research Scholar (Pol. Science)	Mohit
28.	Manmohan Kukreti	Research scholar (Geology)	
29.	Dr. Harish Bisht	"	
30	Mohd. Rehan	" (Comp Scienc)	
31	Abhay. J. Joshi	Research fellow (Dept. of Geology)	
32.	Mr. Lalit Prasad	Research Scholar (computer science)	
33.	Leelawati Nitwal	Research Scholar (Chemistry)	
34.	Manisha Palni	Research Scholar (Chemistry)	
35.	Chandralok Kumar	Research Scholar Pol. Sci.	
36.	SATYENDRA TIWARI	Research Scholar (Pol Science)	
37	Puneet Pandey	RS (Pol Sci)	
38	Deep Joshi	Research Scholar (History)	
39	Pijush		
40	Dheeraj Bhatt	Research (Geology)	
41	Prabhupada pradhan	Msc. 1st sem (Geology)	
42	Janki Goswami	Research Scholars Dept of Biotechnology	

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43.	Nisha	Department of Economics (Research Scholar)	Nisha
44	Shokeen Malik	Research Scholar Department of Sociology	
45	Khushboo Dasauni	Research Scholar Department of Biotechnology Bhimtal	
46.	Chetan Rajput	Research Scholar Department of Political Science	
47-	Sneha Arya	Research Scholar	
48.	भास्कर काण्डपाल	संस्कृत विभाग (शोधछात्र)	
49.	Subiya Naaz	commerce department (Research Scholar	Subiya Naaz
50	Hemlata	History department (Research Scholar)	
51	Kritika Bisht	Home Science (Research Scholar)	
52	Divya Kohli	Home Science (Research Scholar)	
53	Neha Dubey	Home Science (Research Scholar)	
54	Mamta Arya	Sociology (Research Scholar	
55	Neha Bisht	"	
56	Sweta Buddhowala	"	
57	Abhijeet Singh	"	
58	Kamlesh Pandey	"	
59	Monika Rawat	Dept of Economics	
60	Rashmi Bhatt	"	
	Sonam Kutwal	"	

61	Arun Singh	Department of Economics	Arun
62.	Deepti Parihar	Department of chemistry (Research Scholar)	
63	Sram	"	Sram
64	Namrata Khati	"	Nkhati
65	Divya Mahar	Chemistry Department	Divya
(66)	Nitish Semwal	"	Nitish
(67)	Arvind Kumar	"	Arv
(68)	Rakshita		Rak
(69)	Nazish	"	
	~~Nazish~~	"	Naz
(70)	Deepa	forestry Department	
(71)	Kavita Mamgai	pharmacy	Kavita
(72)	Lalita Paloniya	pharmacy	Lalita
(73)	Intakheb Alam	Chemistry	
(74)	Shahid Husain	Physics	Shahid
(75)	Kavita Joshi	forestry dept	Kavitajoshi
(76)	Arif Ansari	"	Arif
(77)	Nirmala	"	
(78)	Geeta Sharma	"	
(79)	SALHOUVI RUTSA	Geology department	Salhouvi
(80)	KOPEZO KAPFO	"	Kopezo
(81)	RAHUL	"	Rahul
(82)	Naresh Joshi	Zoology (Research Scholar)	
(83)	Deepa Kholia	Chemistry	Kholia
(84)	Garima Chand	"	Garima
(85)	Rahul Anand	Biotechnology	Anand
(86)	Amrita Kumari	"	Amrita

Brainstorming Session (2nd session)

87	Ayushi Budhlakoti	Geology	Ayushi
89	Chingte Toubing	Geology	Chingte
87	Deepshikha Tewari	Geology	Deep
90	Neha Chandora	Geology	Neha
91	Gaurav Dev	Geology	Gaurav
92	Mohit Giri	Geology	Mohit
93	Amit Joshi	Geology	Amit
94	Divyansh Singh	Geology	Divyansh
95	Subham Joshi	Geology	Subham
96	Puma Khati	Geology	Puma
97	Ravi Kumar	History	Ravi
98	Deepak Kumar	History	Deepak
99	Sachin arya	History	Sachin
100	Mala	History	Mala
101	Kokush K. Tripathi	Biotechnology	
102	Yogesh tripathi	forest	
103	Elozi Ahiicho	Geology	elozi
104	Kikasangla Jamir	Geology	
105	Ankita Agnihotri	Geology	Ankita
106	Prakhar Bhardwaj	Geology	
107	Adyajit Ram	Geology	Adyajit
108	Dev Baliyan	Geology	Dev
109	Rahul - Morariya	"	Rahul
110	Hem Chandra Bhatt	Computer Science (Guest faculty & Research scholar)	Hem

(111) Dr. Sunil Dhali	PRS-NSNT, Department of chemistry D.S.B. Campus KU, Nainital.	Sunil
(112) Bhagwati	Hindi Department, D.S.B. campus Nainital, Research Scholar	Bhagwati
(113) Lalit Mohan	Hindi Department. D.S.B. Campus Nainital, Reserch Scholar.	Lalit
(114) Shivani Sharma	Hindi Department, D.S.B Campus Nainital, Research Scholar	Shivani
(115) Karuna Singh	Research Schdar, Geology department, D.S.B. campus, Nainital	Karuna
(116) Asma Adhikari	Research scholar, Commerce dept. D.S.B. campus, Nainital	Asma
(117) Poonam Goswami	Research scholar, Department of History, D.S.B. campus. Nainital.	
(118) Shreya Tukaria	Masters Department of Chemistry D.S.B Campus, Nainital	Shreya
(119) Kishor Kumar	Research scholar, Department of History D.S.B. Campus, Nainital	
(120) Shirshity Gangwar	Hindi Department D.S.B Campus Nainital Research Scholar	
(121) Radhika Devi	Research Scholar, Dept. of Pol. Sc. DSB campus, Nainital	Radhika
(122) Meenakshi	Research scholar, Department of Political scien DSB campus, Nainital	Meenakshi
(123) Avinash Jatav	Research Scholar, Dept. of Political Science, D.S.B. Campus Nainital	
(124) Sweta Chandela	Student, Dept of Computer science, D.S.B Campus, Nainit	Sweta
(125) Sheetal rani	Student, Bachaler of arts, D.S.B. Campus Nainital	Sheetal
(126) Meenakshi Mahara		

(127) Avantika Arya — Student, Bachelor of Science D.S.B Campus Ntl — Avantika

(128) Sangeeta Koranga — Student, Bachelor of Science D.S.B Campus Ntl — Sangeeta Koranga

(129) Neha Arya — Student Bachelor of Arts D.S.B Campus NTL — Neha Arya

(130) Khushi Bisht — Student, Bachelor of Physical Education Short Science (B.P.E.S) D.S.B Campus NTL — KBisht

(131) SALONI ARYA — Student, Bachelor of Arts D.S.B Campus NTL — Saloni Arya

(132) Priyanshu Pokhariya — B.A, D.S.B Campus Ntl — J Singh

(133) Sarita Arya — Student, Bachelor of Arts D.S.B Campus NTL — Sarita

(134) Aarti Bisht — Student, Bachelor of Arts D.S.B. Campus NTL — Aarti

(135) Meena Bhatt — Student, Bachelor of Science, D.S.B Campus Ntl — Meena

(136) Tanuja Bargali — Student, Bachelor of Science, D.S.B. Campus, NTL — Tanuja

(137) Soniya Pandey — Student, Bachelor of Arts D.S.B. CAMPUS. NAINITAL — Soniya

(138) ROSHNI BISHT — STUDENT, BACHELOR OF ARTS D.S.B. CAMPUS NAINITAL — Roshni

(139) Bhawana Adhikari	Student of Bachelor of Arts D.S.B Campus, Nainital	Bhawana
(140) Ritu Mahara	Student of Bachelor of Arts D.S.B. Campus Nainital	Ritu
(141) Prachi Adhikari	B.Sc. DSB Campus Ntl	Prachi
(142) Megha Mehra	Student of Bachelor of Arts DSB. Campus, Nainital.	Megha
(143) Shreya Bisht	Student of Bachelor of Science DSB. Campus, Nainital	Shreya
(144) Priyanshi Bisht	Student of Bachelor of Science D.S.B Campus, Nainital	Priyanshi
(145) Tanuja Talal	Student of Bachelor of Science D.S.B Campus NAINITAL	Tanuja
(146) Riya Kanwal	Student of Bachelor of Science D.S.B Campus, Nainital	Riya
(147) Himanshi Arya.	Student of Bachelor of art's D.S.B. Campus nainital	Himanshi
(148) Shivangee Arya	B.Sc, D.S.B Campus Nainital	Shivangee
(149) Archana Verma	Student of Bachelor of Arts D.S.B Campus, Nainital	Archana
(150) Taniya	B.Sc, D.S.B Campus Nainital	Taniya
(151) Rakshi Singh	Student of Bachelor of Arts D.S.B Campus, Nainital	Rakshi Singh
(152) Kavishma Arya	Student of Bachelor of Arts D.S.B Campus. Nainital	Kavishma
(153) Shailja Tiwari	Student of Bachelor of Arts D.S.B Campus Nainital	Shailja
(154) Megha Bhandari	Student of Bachelor of Commerce D.S.B Campus Nainital	Megha