



Conference Report

First International Conference On Climate Induced Natural Disasters & Mitigation OCT. 30-31, 2023 at Karakoram International University Gilgit Baltistan

Prepared by: Dr. Karamat Ali and Dr. Asad Ullah



Forward: Climate induced disasters are extreme weather events and natural phenomena that have been intensified by the effects of climate change. Natural hazards are posing a substantial risk to sustainable development around the globe. With the onset of climate change, the frequency and intensity of natural hazards are rising, specifically in the mountainous terrains with significant impacts on the communities and infrastructure. The region of Gilgit-Baltistan is endowed with many natural resources including minerals, rangelands/forests, glaciers, wetlands, rivers and wildlife in a mountainous setting that is unique on Earth. These natural resources are nestled in the area which is one of the ecologically most fragile in the world. The climate-induced natural disasters negatively affect all these natural resources and threaten the ecosystem, particularly threatening the sustainable livelihood and survival of the inhabitants of these rugged mountains.

The International Conference on Climate-Induced Natural Disasters and Mitigation, held from 30th to 31st October, 2023 at Karakoram International University, Gilgit, Pakistan, brought together experts, researchers, and policymakers to address the pressing challenges posed by climate change-induced natural disasters and explore effective mitigation strategies. This conference provided a platform for research scientists, academicians, policy makers and government officials to share their knowledge and experiences that will lead to a better preparedness on part of the government and the public in facing natural calamities and climate-change related dynamics.

The International Conference on Climate-Induced Natural Disasters and Mitigation (ICCINDM), jointly organized by Karakoram International University Gilgit and National Centre of Excellence in Geology, University of Peshawar and sponsored by the UNDP-GLOF-II project, Aga Khan Agency for Habitat and CPEC collaborative research grant (CPEC-CRG-130). As an important international academic event marking a new level of international exchange, cooperation and unity among science and technology researchers, ICCINDM has attracted a large number of international and national science and technology elites of the discipline to Gilgit.

We are deeply grateful to all the authors who submitted papers and to the organizations and individuals who contributed to the conference in different ways. It is their active participation and dedication that enabled more people to share the achievements and knowledge of the field and make the ICCINDM a remarkable success. We look forward for the continued support of our sponsors, partners, mentors and peers. The 2nd Conference of the series has been scheduled in Sep, 2024 In Sha Allah.

(Prof. Dr. Attaullah Shah-Conference Chair)

Objectives: The main objective of the conference was to bring together leading experts, researchers, scholars, industry professionals, and policymakers worldwide to foster discussions, share innovative ideas, and collaborate on critical issues related to conference themes. This multidisciplinary conference covered a wide range of topics, including but not limited to geohazards, hydro-meteorological hazards, glacial lake outburst floods, disaster preparedness, response and recovery, the role of technology in disaster risk management, disaster policies and practices, and disaster education. The theme focused on identifying innovative approaches and solutions for mitigation and adaptation in the face of a changing climate and its impact on natural disasters.

In addition to sharing the contemporary knowledge and better practices on selected themes, the conference also aimed at bringing relevant stakeholders together to carry forward the conference declaration towards implementation through their respective departments. For example, in one of the sessions dedicated for hydrometeorological hazards, the participants deliberated on issues and solutions pertinent to climate induced natural disasters in the context of mountainous regions of Pakistan.

Keynote Speakers:

The conference featured distinguished keynote speakers who participated in the conference included:

Prof. Dr. Peng CUI: Vice Director of Institute of Mountain Hazards and Environment (IMHE), CAS and chair of the IMHE academic council. His keynote speech title was “A Physical-Based Platform for Flash Torrent and Debris Flow Forecasting” Flash torrents and debris flows are typical hazards that threaten human lives and cause great loss in mountainous areas. This study introduces a platform for process simulation and risk forecast of mountain disasters (e.g., flash torrent and debris flow) based on the full process of disaster formation-movement-deposition.

Prof. Dr. Christopher Lehmann, Swiss Agency for Development and Cooperation, Switzerland, he presented his talk on Event Analysis 2022 Floods in Swat Valley, Pakistan.

Prof. Li Tao: He is Professor at Northwest University and Project Coordinator, Institute of BRI, Research Centre of Western China Region, Northwest University China. He presented his keynote speech on “Risk Perception Prevention and Management of Mountain Hazards for Cultural Landscape Heritage under the Climate Change”.

(3) **Dr. Muhammad Shafique** is working as an Associate Professor at the National Center of Excellence in Geology, University of Peshawar. He is also the Lab Director of the GIS and Space Applications in Geosciences (GSAG) laboratory established with the affiliation of the National Center of GIS and Space Applications (NCGSA).

(4) **Prof. Dr. Bishal Sitaula**, a distinguished academic at the Norwegian University of Life Sciences, boasts over 33 years of global expertise in environment and development, higher education, and conflict peace and development. He presented his virtually speech on the topic titled “Building Human Agency And Resiliency In A Rapidly Changing Climate With Disasters”.

(5) **Prof. Dr. Chen Fahu** is a geographer, geologist and climatologist who has served as Director of the Institute of Tibet Plateau Research of the Chinese Academy of Sciences since 2018. He presented his virtually speech on the topic titled “Using The Global Navigation Satellite System and Precipitation Data to Establish the Propagation Characteristics of Meteorological and Hydrological Drought in Yunnan, China”

(6) **Prof. Dr. Atta-ur-Rahman** is serving as a Chairman Department of Geography and Geomatics (GIS and Remote Sensing), University of Peshawar, Pakistan and President, Pakistan Geographical Association (PGA). He presented his virtually speech on the topic titled “Transboundary Hydrology, Climate Change and Its Impact on Recurrences of Floods in the Hindu Kush Region”

(7) **Dr. Ghulam Rasul**, Director General, Pakistan Meteorological Department (PMD) Dr. Rasul is Director General of the Pakistan Meteorological Department and Permanent Representative of Pakistan with WMO. He presented his virtually speech on the topic titled “Partial Approaches to Address the Indus Basin Issues not be Productive in the Accelerated Pace of Climate Change”.

Speeches of Partner Institutes/Organizations

Mr. Basit Abdul, provincial Project Coordinator GLOF-II at UNDP, Pakistan. He presented GLOF II project activities in Gilgit-Baltistan, Pakistan. GLOF-II builds on the measures piloted by GLOF-I and aims to empower communities to identify and manage risks associated with GLOFs and related impacts of climate change, strengthen public services to lower the risk of disasters related to GLOF, and improve community preparedness and disaster response. The project will also support the development of sustainable options for livelihoods in project areas, with a particular focus on the participation of women in ensuring food security and livelihoods.

Mrs. Nusrat Nasab, Chief Executive Officer at the Aga Khan Agency for Habitat Pakistan. Her speech was on Role of Aga Khan Agency for Habitat in Sustainable and Resilient Development in Pakistan. Natural Hazards are posing substantial risk to sustainable development across the globe. Pakistan is among the top 10 climate vulnerable countries suffering from impacts of climate change

and its induced disasters, amplified due to weak community resilience and emergency preparedness, and a combination of geographic, socioeconomic, and environmental factors. Sustainable and resilient development in a country like Pakistan is crucial to address the challenges posed by climate change, while promoting socio-economic growth and well-being. This requires a multi-faceted approach combining Disaster Adaptation, Mitigation & Resilience, covering rehabilitation of degraded land, habitat loss, offsetting carbon emissions, and conserve biodiversity.

Participants Presentations on their research findings:

A diverse range of research findings were presented by participants related to climate induced natural disasters and mitigation such as the Science Behind Climate-Induced Natural Disasters, Global Trends and Projections in Climate-Induced Disasters, Impact Assessment: Social, Economic, and Environmental Consequences, Case Studies on Recent Climate-Induced Natural Disasters, Building Resilience: Community-Led Disaster Preparedness, Policy Responses to Climate-Induced Disasters, Infrastructure Development for Climate Resilience, Community Engagement and Education for Resilience and Future Perspectives: Climate Change Adaptation Strategies. These presentations covered various aspects of climate-induced natural disasters, providing a well-rounded view for conference participants. The conference on climate-induced natural disasters provided a comprehensive exploration of the challenges posed by changing climatic conditions and innovative strategies for mitigation and adaptation. The presentations, delivered by esteemed experts and researchers, delved into various facets of climate-induced disasters, offering valuable insights and actionable recommendations. (The detailed Conference Program and Abstract Book is attached as Annex-A)

Recommendations

Around 200 participants attended the conference, 50 research papers were presented by scientists and researchers from China, Switzerland, Nepal and Pakistan. Key recommendations emerged from this conference are as follows:

- i. Considering the nature and magnitude of the multi-hazards in the region and their increased frequency due to climate change, it is strongly proposed to develop a strategy based on contributions and consultation from Multi-disciplinary (earth scientists, engineers, social scientists) and Multi-stakeholder (government, academia, industry, communities) for the assessments and sustainable management of disasters.
- ii. Consultation and coordination is crucial: Gilgit Baltistan is a natural Geosciences laboratory and most affected/prone to climate change, KIU can provide a platform to coordinate and facilitate the national and international researchers.

- iii. GBDMA can provide a platform to coordinate and facilitate the national and international organizations. Enhance the coordination among the government, academia, communities, industry and private sector for DRR
- iv. Data repository and sharing Centre: Collections and archive of hazards, disasters and climate data (old and new) repository Centre is proposed to be established at the KIU.
- v. Technical Wing to monitor / assess and recommend expert opinions to mitigate threats etc.
- vi. Provision of earth moving/ snow clearing machinery for Gilgit Baltistan
- vii. Human Resources are GBDMA and at DDMA level
- viii. Conducting MHVRA across GB to identify the hazards, their vulnerability, and Risks to incorporate DRR into development planning
- ix. Devolution of DRR at community Level through Community Based Disaster Risk Management (CBDRM) across GB.
- x. Strengthening DRR at community level; Translation of the scientific knowledge in easy and local languages, Inclusion of DRR in the academic syllabus at the school and college level, Increased engagement of electronic/social/print media for DRR and Community empowerment and training for DRR
- xi. Facilitation and openness for international collaborations; facilitation for the international collaborations and facilitation for the international researchers

These recommendations collectively aim to strengthen the global response to natural disasters, fostering a proactive and collaborative approach to reduce climate induced disaster risks, enhance preparedness, and build resilient communities. These recommendations also provide a to guide policymakers, practitioners, and communities in developing proactive, comprehensive, and inclusive approaches to mitigate the impact of natural disasters and build resilience in the face of evolving challenges.



ICCINDM 2023

International Conference on CLIMATE INDUCED NATURAL DISASTERS AND MITIGATION

October 30-31, 2023

PROGRAM & ABSTRACTS

Organized by:

Karakoram International University Gilgit, Pakistan

Co-organized by:

UNDP GLOF II Project, Gilgit, Pakistan

National Center of Excellence in Geology, University of Peshawar,
Pakistan

Aga Khan Agency for Habitat, Gilgit, Pakistan

KIU ▪ Gilgit ▪ Pakistan

October 30 - 31, 2023

ICCINDM 2023

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Patron-in-Chief: Engr. Prof. Dr. Attaullah Shah
Editor-in-Chief: Dr. Asad Ullah
Managing Editor: Dr. Karamat Ali
Scientific Editors: Dr. Farida Begum, Dr. Samina Mumtaz
Dr. Sher Sultan, Dr. Masroor Alam

Welcome message from the Conference Chair

INTERNATIONAL CONFERENCE ON CLIMATE-INDUCED NATURAL DISASTERS AND MITIGATION (ICCINDM, 2023)



On behalf of the Karakoram International University (KIU) and our valuable partners (National Centre of Excellence in Geology (NCEG), University of Peshawar, United Nations Development Program, Pakistan- GLOF II project, Aga Khan Agency for Habitat, Pakistan and Higher Education Commission of Pakistan), I take this opportunity to welcome the conference delegates who have honored the International Conference on Climate-Induced Natural Disasters and Mitigation being convened at the Karakoram International University Gilgit, Pakistan. We greatly value and welcome your contributions and the knowledge you share about the emerging issue of the climate-induced natural disasters that poses serious challenges not only to Pakistan but also to the community of nations across the globe.

The region of Gilgit-Baltistan is endowed with many natural resources including minerals, rangelands/forests, glaciers, wetlands, rivers and wildlife in a mountainous setting that is unique on Earth. These natural resources are nestled in the area which is one of the ecologically most fragile in the world. The climate-induced natural disasters negatively affect all these natural resources and threatens the ecosystem, particularly threatening the sustainable livelihood and survival of the inhabitants of these rugged mountains.

We expect that this conference will provide a platform for research scientists, academicians, policy makers and government officials to share their knowledge and experiences that will lead to a better preparedness on part of the government and the public in facing natural calamities and climate-change related dynamics.

The organizing team has worked very hard for arranging ICCINDM and I feel confident that the participants can expect a conference with a high scientific quality. The interdisciplinary nature of the conference and participation by scholars from around the globe is expected to nurture an active interaction leading to an enriched academic endeavour for the guest participants and the KIU family. I take this opportunity to congratulate the organizing committee to materialize this conference despite all challenges posed by our remote location. I am equally indebted to the partner organizations for their organizational, logistic, technical and financial support.

Looking forward to receive you all at ICCINDM 2023.

(Engr. Prof. Dr. Attaullah Shah)

Conference Chair/ Vice Chancellor, Karakoram International University

Preface

The International Conference on Climate-Induced Natural Disasters and Mitigation (ICCINDM), jointly organized by Karakoram International University Gilgit and National Centre of Excellence in Geology, University of Peshawar and sponsored by the UNDP-GLOF-II project, AKAH and CPEC collaborative research grant (CPEC-CRG-130), will be held at Karakoram International University Gilgit, Pakistan on October 30 - 31, 2023. The purpose of the conference is to promote knowledge on climate-induced natural disasters that revolve around understanding hydrometeorological and geohazards, disaster mitigation, preparedness, response and recovery, role of technology in disaster risk management, and disaster policy and practices. In addition to sharing the contemporary knowledge and better practices on selected themes, the conference also aims at bringing relevant stakeholders together to carry forward the conference declaration towards implementation through their respective departments. For example, in one of the sessions dedicated for hydrometeorological hazards, the participants may deliberate on issues and solutions pertinent to climate induced natural disasters in the context of mountainous region of Pakistan.

As an important international academic event marking a new level of international exchange, cooperation and unity among science and technology researchers, ICCINDM has attracted a large number of international and national science and technology elites of the discipline to Gilgit. Let us work together, promoting each other, dedicating and innovating to achieve greater development and success in the field.

We are deeply grateful to all the authors who submitted papers and to the organizations and individuals who contributed to the conference in different ways. It is their active participation and dedication that allows more people to share the achievements and knowledge of the field and make the ICCINDM a remarkable success.

Editorial Committee of ICCINDM

Organizing Committee of ICCINDM

KIU, Gilgit, Pakistan

October, 2023

Keynote and Invited Speakers



Prof. Dr. Peng CUI is now the vice director of Institute of Mountain Hazards and Environment (IMHE), CAS and chair of the IMHE academic council. He worked in IMHE since 1985 and got his doctoral degree from Beijing Forest University in 1990. He studied in the Geography Department of Illinois University in 1994-1995 and in the King's College London in 1995-1997, and then he returned IHME with the support of the CAS "Hundred Talents Project". He was granted by the NSFC for Distinguished Young Scholars in 2000 and elected as the CAS Academician in 2013. Prof. Peng CUI has been engaged geo-hazards for decades and obtained acknowledged achievements in debris-flow mechanism and risk management technology. He has published more than 300 papers and got 19 patents of disaster mitigation technology and authored 4 monographs plus one atlas. He won the second-class award of the national science and technology progress (2009) and 5 first class awards at the provincial level (2003, 2006, 2010, 2012, 2013). He also founded the Journal of Mountain Science in 2004 and made it an influential international journal in the field as the chief editor. For his systemic achievements, he won "The Distinguished Researcher Award" of WASWAC in 2010.



Prof. Dr. Juzhi Hou is a Research Professor at the Institute of Tibetan Plateau Research (ITP), Chinese Academy of Sciences (CAS), focusing on past climate changes and biogeochemistry. He received Ph.D. degrees at Institute of Geology and Geophysics, CAS in 2003 and Brown University in 2008. Dr. Hou joins ITP in 2009 as a research professor, and he has been awarded Excellent Youth Scientists Project by National Science Foundation of China in 2020. He has authored more than 100 scientific publications in peer-reviewed journals.



Prof. Dr. Kejie Chen is currently an Associate Professor at the Department of Earth and Space Sciences of Southern University of Science and Technology (SUSTech), China. Dr. Chen received a doctorate degree in precise GNSS data processing and its application in 2016 from GFZ German Research Center for Geosciences and the University of Potsdam. Before joining SUSTech, he was a postdoc at California Institute of Technology. His main research interests focus on understanding and mitigation of natural hazards using geodetic tools. He has

authored more than 40 scientific papers and headed natural science fund project.



Dr. Muhammad Shafique is working as an Associate Professor at the National Center of Excellence in Geology, University of Peshawar. He is also the Lab Director of the GIS and Space Applications in Geosciences (GSAG) laboratory established with the affiliation of the National Center of GIS and Space Applications (NCGSA). He holds MSc and Ph.D. in GIS and Remote sensing for Geohazards assessment from the Faculty of Geoinformation and Earth Observation, University of Twente, the Netherlands. He has 20 years of experience in applications of GIS and remote sensing for geohazard hazard assessment, natural resources exploration, and management. He is leading the geospatial research group at his institute and the principal investigator of many research projects from national and international donors with a total financial worth of 200 million PKR. From his research, he has published more than 45 publications in reputed international journals and presented his research in dozens of conferences around the globe. His current research focus is on the multi-hazard risk assessment along the CPEC route in northern Pakistan.



Prof. Dr. Bishal Sitaula, a distinguished academic at the Norwegian University of Life Sciences, boasts over 33 years of global expertise in environment and development, higher education, and conflict peace and development. He's led extensive programs across Asia, Africa, and the Western Balkans, published 265 scientific articles, and supervised numerous students' research. Prof. Sitaula's recent focus lies in Global Change education, mindfulness training, and inner transformation. He's played a vital role in establishing regional programs and organizations. He's also a published author and a visiting scholar at prestigious American universities. Prof. Sitaula is dedicated to sharing wisdom and personal transformation on a global scale



Prof. Dr. Chen Fahu is a geographer, geologist and climatologist who has served as Director of the Institute of Tibet Plateau Research of the Chinese Academy of Sciences since 2018. He formerly served as professor and Vice President of Lanzhou University, and Dean of the university's College of Earth and Environment Sciences. He is an academican of the Chinese Academy of Sciences and The World Academy of Sciences.



Prof. Dr. Atta-ur-Rahman is serving as a Chairman Department of Geography and Geomatics (GIS and Remote Sensing), University of Peshawar, Pakistan and President, Pakistan Geographical Association (PGA). He is holding degrees of Bachelor of Sciences in Bio-Geo-Chemistry, Master of Science in "Geography" with distinction, Master of Science in "Urban & Regional Planning" with Gold Medal, MPhil in "Applied Geomorphology", Post-Graduate Dip in GIS & Remote Sensing, PhD in "Environmental Geography" and Post Doc in "Flood Risk Modelling" from Kyoto University, Japan. He is regularly publishing in prestigious journals with a good share of publications in impact factor. He has over 170 publications, with a majority of publications in the field of climate change, hydro-meteorological, Agricultural Geography and Disaster Risk Management. He has supervised and produced 40 MS/MPhil and 12 PhDs.



Dr. Ghulam Rasul, Director General, Pakistan Meteorological Department (PMD) Dr. Rasul is Director General of the Pakistan Meteorological Department and Permanent Representative of Pakistan with WMO. He holds a Doctor of Philosophy (Ph.D.) in Meteorology degree from the Institute of Atmospheric Physics of the Chinese Academy of Sciences. He has been editor of Pakistan Journal of Meteorology and member of its Editorial Board; reviewer of International Peer Reviewed Journals; and expert reviewer of IPCC 5th Global Climate Change Assessment Report. Dr. Rasul has been Co-Chair of Drought Working Group-GEOSS Asian Water Cycle Initiative, and the WG-2 on Climate Change and Climate Variability, UIB Network.



Mr. Basit Abdul, provincial Project Coordinator GLOF-II at UNDP, Pakistan. He demonstrated history of working in the non-profit organization management industry. Skilled in Corporate Social Responsibility, Business Planning, Rural Development, Gender Mainstreaming, and Natural Resource Management. Strong program and project management professional with a Certificate Course in Pro Poor Market Development focused in Agri Business from The University of Queensland.



Mrs. Nusrat Nasab has been working in the field of Development and Disaster Risk Reduction for over two decades. Currently she is the Chief Executive Officer at the Aga Khan Agency for Habitat Pakistan. Prior to this role, she was on an international assignment and serving as Head of Emergency Management at the Aga Khan Agency for Habitat (AKAH). Prior to this assignment, she served as the Chief Executive Officer of Focus Humanitarian Assistance, Pakistan and worked on senior management positions within other institutions of the Aga Khan Development Network (AKDN). She also serves voluntarily as member Director on various boards of governance on reputed institutes. Her academic background is with a Master's degree from University of East Anglia, Norwich UK in Development Economics and another degree in Economics from Pakistan. She has authored and co-authored several papers including the chapter on "Disaster Risk Reduction and Building Resilience in the Hindu Kush Himalaya" in the book "The Hindu Kush Himalaya Assessment" published in early 2019 by Springer.

About Conference

Organized by: Karakoram International University Gilgit, Pakistan
Co-organized by: UNDP GLOF II Project, Gilgit, Pakistan
National Center of Excellency in Geology, University of Peshawar, Pakistan
Aga Khan Agency for Habitat, Gilgit, Pakistan

Conference Committees

Conference core committee

Chair: Prof. Dr. Attaullah Shah, Vice Chancellor, KIU

Prof. Dr. Muhammad Idrees, Vice Chancellor University of Peshawar

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- Dr. Muhammad Shafique, University of Peshawar
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- Dr. Sajjad Haider
- Major (R) Altaf, Director Security
- Mr. Abideen Ali Zia

Program

General Timetable

Monday, Oct. 30, 2023	
08:00 -09:00	Registration at the Conference Secretariat adjacent to Musharraf Hall
09:00-10:15	Opening Ceremony at Musharraf Hall, KIU/ Take Photos
10:15-10:35	<i>Tea Break</i>
10:35-12:25	Plenary Lectures
12:25-13:25	<i>Lunch & Prayer Break</i>
13:25-15:35	Technical Sessions (01)
15:35- 16:00	<i>Tea Break</i>
16:00-17:30	Technical Sessions (02)
17:30-18:00	Feedback meeting of Chairs & Co-Chairs

Tuesday, Oct. 31, 2023	
09:30-11:00	Technical Session (01)
11:00-11:30	<i>Tea Break</i>
11:30-13:00	Parallel Technical Session (02) Musharraf Hall
11:30-13:00	Parallel Technical Session (03) Senate Hall
11:30-13:00	Parallel Technical Session (03) Conference Hall
13:00-14:00	<i>Lunch & Prayer Break</i>
13:00-14:00	<i>Closing Ceremony</i>

Opening Ceremony

9:00-10:15, Monday, Oct. 30, 2023

Location: Musharraf hall

Monday, Oct. 30, 2023	
9:00	Guests to be seated
9:00- 9:05	Recitation from Holy Quran
9:05- 9:10	Welcome to Guests
9:10-9:40	Presentations by partners (NCEG, GLOF II, AKAH) Dr. Muhammad Shafique: Multi-Hazards Vulnerability and Risk Assessment in Hunza-Pakistan, the Challenges and Way Forward Mr. Abdul Basit: Scaling-Up of Glacial Lake Outburst Flood Risk Reduction in Northern Pakistan Mrs. Nusrat Nasab: Natural Hazards and Sustainable development
9:40-9:50	Address by Engr. Prof. Dr. Atta Ullah Shah (Conference Chair/ Vice Chancellor) Karakoram International University Gilgit, Pakistan
9:50-10:10	Address by Chief Guest (Speaker GB Assembly Mr. M.Nazeer Advocate
10:10-10:15	Vote of thanks by Coordinator GLOF II
10:15-10:35	Tea break



Day 1

Plenary Lectures

10:35- 12:25, Monday, Oct. 30, 2023

Venue: Musharraf hall

Monday, Oct. 30, 2023	
10:35-10:50	Peng Cui: A Physical-Based Platform for Flash Torrent and Debris Flow Forecasting
10:50-11:10	Chen Fahu: Climate-environmental changes
11:10-11:25	Juzhi Hou: Outburst Of Precipitation-Fed Lake on the Tibetan Plateau in the Context of Global Changes
11:25-11:40	Kejie Chen: Using the Global Navigation Satellite System and Precipitation Data to Establish the Propagation Characteristics of Meteorological and Hydrological Drought in Yunnan, China
11:40-11:55	Ghulam Rasul: Partial Approaches to Address the Indus Basin Issues will not be Productive in the Accelerated Pace of Climate Change
11:55-12:10	Atta-ur-Rahman: Transboundary Hydrology, Climate Change and its Impact on Recurrences of Floods in the Hindu Kush Region
12:10-12:25	Bishal Sitaula: Building Human Agency and Resiliency in a Rapidly Changing Climate with Disasters

Technical session

Venue: Musharraf hall

Timing	Topic	Presenter	Chairs
13:25-13:35	CLIMATE-SECURITY NEXUS: A PARADIGM SHIFT FROM REACTIVE DISASTER APPROACH TO PROACTIVE RISK REDUCTION APPROACH TOWARDS CLIMATE-INDUCED NATURAL DISASTERS AND MITIGATION IN PAKISTAN	Fazal Elahi Bilall	Dr. Ghulam Rasul (Chair) Dr. Noshin Ilyas (Co-Chair)
13:35-13:45	SAFE HOMES: CLIMATE CHANGE-INDUCED DISASTERS AND HOUSEHOLD RESILIENCE IN GILGIT BALTISTANS	Uzma Hanif	
13:45-13:55	DISASTER MANAGEMENT & SECURITY: ROLE OF TECHNOLOGY IN RISK AVERSION STRATEGIES	Sumeera Imran	
14:55-14:05	DISASTER MANAGEMENT AND RISK ANALYSIS LEARNING THROUGH REAL THINGS AND TEXT-CUM-PICTORIAL MATERIALS	Khizar Hayat Bhatti	



14:05-14:15	ASSESSMENT AND RISK MAPPING OF GLACIAL LAKE OUT FLOOD PRONE AREAS FROM GORASHI CLUSTER OF LAKES USING GEO-INFORMATICS TOOLS	Naveed Mustafa	
14:15-14:25	SAR BASED FLOOD MAPPING AND IMPACT ASSESSMENT UNDER COUPLED MODEL INTERCOMPARISON PROJECT PHASE 6 SCENARIOS IN TRANSBOUNDARY CHENAB RIVER, PAKISTAN	Muhammad Farqoor Iqbal	
14:25-14:35	CLIMATE-INDUCED NATURAL DISASTERS LEADING TO NUTRITIONAL CRISES IN MOUNTAINOUS COMMUNITIES	Imtiaz Hussain	
14:35-14:45	DISASTER EDUCATION: PREPARING CHILDREN FOR DISASTER MANAGEMENT	Muhammad Mansoor Zakir	
14:45-14:55	ADAPTATION PLANNING FOR FLOOD RISK REDUCTION IN URBAN AREAS OF PAKISTAN	Hassam Bin Waseem	
14:55-15:05	EVALUATING LANDSAT DATA FOR GLACIAL ANALYSIS IN KARAKORAM, NORTH PAKISTAN	Salik Javed	
15:05-15:15	COMPARATIVE ANALYSIS ON SHISHPER AND KHURDOPIN GLACIER SURGING DYNAMICS AND GLOF HAZARD IN HUNZA RIVER BASIN, PAKISTAN	Deedar Karim	
15:15-15:25	CLIMATIC FEEDBACKS OF SOIL MICROBIAL COMMUNITY	Noshin Ilyas	
15:25-15:35	Tea Break		

15:35-16:00	CLIMATE CHANGE: A COMPARATIVE ANALYSIS ON THE EFFECT OF NATURAL DISASTERS ON THE DEVELOPED AND DEVELOPING COUNTRIES	Sahar Malik	Dr. Atta-ur- Rahman (Chair) Dr. Farida Begum (Co-Chair)
16:00-16:10	A REGIONAL WEB GIS PORTAL WITH DYNAMIC APPLICATIONS LIKE HAZARD ASSESSMENT AND NATURAL RESOURCE MANAGEMENT FOR DIFFERENT STAKEHOLDERS	Ahmed Saleem	
16:10-16:20	GEOSPATIAL TECHNOLOGY FOR THE OPINATION OF THRESHOLD RANGES AND MAPPING FLOOD EXTENT FROM SENTINEL-1 AND SENTINEL-2: A CASE STUDY OF PAKISTAN FLOODS 2022	Syeda Saleha Fatima Ali	
16:20-16:30	MULTI-HAZARDS VULNERABILITY AND RISK ASSESSMENT IN HUNZA-PAKISTAN, THE CHALLENGES AND WAY FORWARD	Muhammad Shafique ¹	
16:30-16:40	QUICK HAZARD ASSESSMENT: AN EFFICIENT TOOL IN DESIGNING MITIGATION MEASURES FOR HAZARD SPOTS IN CHITRAL AND GILGIT-BALTISTAN, PAKISTAN	Mian Sohail Akram	



16:40-16:50	EVALUATING LANDSAT DATA FOR GLACIAL ANALYSIS IN KARAKORAM, NORTH PAKISTAN	SalikJaved	
16:50-17:00	UTILIZATION OF WEB GIS IN FORESTRY DRIVE FOR DISASTER RISK REDUCTION AND MITIGATION	Muhammad Hashir Ilyas	
17:00-17:10	RESIDENT PERCEPTION OF IMPACT OF CLIMATE CHANGE ON RURAL LIVELIHOOD AND FOOD SECURITY: EMPIRICAL EVIDENCE FROM GILGIT-BALTISTAN	Faqeer Muhammad	
17:10-17:30	Feedback Meeting Of Chairs And Co-Chairs		

Day 2

Tuesday, Oct, 31, 2023

Venue: Musharraf Hall

Timing	TOPIC	Presenter	Chairs
9:30- 9:40	INTEGRATED ASSESSMENT OF SUSTAINABLE DEVELOPMENT GOALS (SDGS) AND CLIMATE CHANGE MITIGATION: A CASE STUDY OF SOUTH PUNJAB, PAKISTAN	Maria Javaid	Dr. Khizar Hayat Bhatti (Chair) Dr. Raja Irfan Sabir (Co-Chair)
9:40-9:50	MACHINE LEARNING BASED EARTHQUAKE FORECASTING: A CASE STUDY OF THE JUNE 26,2020 HOTAN, CHINA EARTHQUAKE USING TEC AND ATMOSPHERIC PARAMETERS	Amna Hameed	
9:50-10:00	MITIGATING SEISMIC HAZARDS BY EMPLOYING COULOMB FAILURE STRESS IN CENTRAL HIMALAYAN, PAKISTAN	Faiza Baloch	
10:00-10:10	HARNESSING NATURE-BASED SOLUTIONS TO MITIGATE URBAN HEATWAVES	Aimen Feroz	
10:10-10:20	PARAMETRIC ANALYSIS OF FACTORS AFFECTING SLOPE STABILITY: A CASE STUDY OF HUMARI LANDSLIDE, PAKISTAN	Abdullah	
10:20-10:30	ADOPTION OF ENVIRONMENTAL INNOVATIVE TECHNOLOGIES IN THE HOTEL INDUSTRY: DEVELOPMENT OF PRO-ENVIRONMENTAL BEHAVIOR	Huma Adeel and Raja Irfan Sabir	
10:30-10:40	ANALYSIS OF TEMPORAL AND SPATIAL VARIATIONS OF DROUGHT OVER PAKISTAN BY INVESTIGATING THE APPLICABILITY OF PRECIPITATION-BASED DROUGHT INDEX	Qurratulain Safdar	
10:40-10:50	INTEGRATED APPROACH TO INVESTIGATING SLOPE INSTABILITY AT LOHAR GALI LANDSLIDE, MUZAFFARABAD, PAKISTANS	Mazhar Ali	
10:50-11:00	EVAPOTRANSPIRATION RETRIEVAL USING S-SEBI MODEL WITH LANDSAT 8 DATA OVER SEMI-ARID REGION OF DISTRICT PESHAWAR, PAKISTAN	Iqbal	



11:00-11:10	TEMPORAL ASSESSMENT AND CHARACTERISATION OF HYDRO-METROLOGICAL DROUGHT IN THE SOUTHWEST OF PAKISTAN	Muhammad Ali	
11:10-11:30	Tea break		
TECHNICAL SESSION MUSHARRAF HALL			
11:30-11:40	SLOPE-BASED SEISMIC SITE CONDITION ANALYSIS OF NORTHERN PAKISTAN	Tanveer Ahmed	Dr. Muhammad Shafique (Chair) Dr. Muhammad Zafar (Co-Chair)
11:40-11:50	THE STUDY OF THE MODIFICATION IN AEROSOL LOADING OVER KARACHI USING REMOTE SENSING	Adnan Ghafoor Tabsum	
11:50-12:00	PERCEPTIONS ON PEACEFUL USES OF NUCLEAR ENERGY AND ITS ROLE IN ACHIEVING SDGS: A CASE STUDY OF PAKISTAN	Muhammadi	
12:00-12:10	A COMPARATIVE STUDY OF PREHISTORIC, HISTORICAL, AND POTENTIAL LANDSLIDE DAM SITES: A CASE STUDY FROM MAYOON TO ATTABAD ALONG CPEC IN HUNZA DISTRICT	M.Z. Iqbal	
12:10-11:20	THE INFLUENCE OF MITIGATION STRATEGIES ON THE COMMUNITY: EVIDENCE FROM THE SELECTED VILLAGES OF THE GILGIT-BALTISTAN	Jamal Hussain	
12:20-12:30	CROSS VALIDATION OF GLACIAL LAKE OUTBURST FLOOD (GLOF) AND HAZARD MAP OF PASSU VILLAGE THROUGH MODELING USING RAMMS ON UAV-BASED DIGITAL ELEVATION MODELS (DEM)	Zulfiqar Ahmad	
12:30-12:40	UNLOCKING THE BARRIERS IN THE ADOPTION OF BIG DATA IN THE HEALTHCARE SUPPLY CHAIN	Hamza Farooqui	
12:40-12:50	AN APPLICATION FOR AUTOMATIC LAND USE AND LAND COVER CLASSIFICATION USING A CLOUD-BASED PLATFORM: A CASE STUDY OF GILGIT-BALTISTAN WITH GOOGLE EARTH ENGINE	Sher Karim	
12:50-13:00	DEBRIS FLOWS HAZARD, VULNERABILITY, AND RISK ASSESSMENT IN HINDUKUSH MOUNTAIN RANGES, NORTHERN PAKISTAN, BY UTILIZING REMOTE SENSING AND FIELD DATA	Nisar Ali Shah	
PARALLEL TECHNICAL SESSION CONFERENCE HALL			
11:30-11:40	GLACIAL LAKE OUTBURST FLOODS: IMPACT ON THE ENVIRONMENT AND SOCIOECONOMIC CONDITIONS OF HUNZA	Irfan Karim	
11:40-11:50	SNOW COVER FREQUENCY (SCF) TREND ANALYSIS OF GILGIT-BALTISTAN FOR THE PERIOD 2000-2021 USING MODIS DATASET	Amna Ali	
11:50-12:00	CLIMATE CHANGE: A CASE STUDY OF NON- TRADITIONAL SECURITY THREATS FOR PAKISTAN	Muhammad Ismail	
12:00-12:10	EXPLORING PERCEPTIONS OF HEAD TEACHERS, TEACHERS, AND STUDENTS REGARDING CLIMATE CHANGE EDUCATION IN THE MIDDLE SCHOOLS OF DISTRICT GHIZER, GB	Mubarak Hussain	
12:10-11:20			



	SPATIOTEMPORAL MODELING AND MAPPING OF SOIL EROSION, SEDIMENT DELIVERY, AND RETENTION SERVICES IN THE TERRESTRIAL ECOSYSTEM OF PAKISTAN	Arshad Ali Shedayi	Dr. Abdul Razzaq (Chair) Dr. Muhammad Ali (Co-Chair)
12:20-12:30	SELECTION OF BEST SITES FOR CONSTRUCTION OF HOMES FOR THE FLOOD VULNERABLE PEOPLE	Zahid Hussain	
12:30-12:40	COMPARATIVE ANALYSIS OF TWO SPACE-BRONE DATASETS TO MAP THE SURFACE TEMPERATURE OF MOUNTAINOUS TERRAIN; A CASE STUDY OF KARAKURAM RANGE	Azra Batool	
12:40-12:50	MACHINE LEARNING ALGORITHMS FOR EXTRACTION OF GLACIAL LAKES USING GROUND RANGE DETECTED (GRD) DATA: A CASE STUDY FROM HUNZA RIVER BASIN, PAKISTAN	Hajraa	
12:50-13:00	DISASTER GOVERNANCE AND VULNERABILITY: THE CASE OF SHISHPER AND BADSWAT GLACIER LAKE OUTBURST FLOODS, GILGIT-BALTISTAN, PAKISTAN	Zarina Baig	
PARALLEL TECHNICAL SESSION SENATE HALL			
11:30-11:40	GRAPH THEORY AND COMBINATORICS BASED MATHEMATICAL MODELING OF CLIMATE CHANGE AND DISASTER RISK MANAGEMENT	Asad Ullah	Dr. Sher Wali Khan (Chair) Dr. Shaukat Ali (Co-Chair)
11:40-11:50	CLIMATE CHANGE AND THE IMPACT OF NATURAL HAZARDS ON WATER INFRASTRUCTURES AND THE COPING CAPACITY OF MOUNTAIN COMMUNITIES IN GILGIT-BALTISTAN	Karamat Ali	
11:50-12:00	SHAPING ECO-AGRICULTURAL PRODUCTIVITY WITH HETEROGENEOUS TECHNOLOGICAL INNOVATION IN N-11 ECONOMIES: EXAMINING THE MODERATING ROLES OF ENVIRONMENTAL QUALITY AND GREEN ENERGY	Muhammad Tariq	
12:00-12:10	PREVAILING CLIMATIC TRENDS PERSPECTIVE IN KARAKORAM MOUNTAIN RANGE, UPPER INDUS BASIN, PAKISTAN	Shaukat	
12:10-11:20	VARIABILITY OF SOIL PROPERTIES IN DIFFERENT FLASH FLOOD-RISK ZONES IN GILGIT RIVER BASIN, NORTHERN PAKISTAN	Farida Begum	
12:20-12:30	CLIMATE-INDUCED HAZARDS, AND IMPACT ASSESSMENT IN SHIGAR AND KHAPLU VALLEY, BALTISTAN, PAKISTAN	Iqtidar Hussain	
12:30-13:00	<i>Feedback meeting of chairs and co-chairs</i>		
13:00-14:00	<i>Closing ceremony</i>		





ICCINDM 2023

INTERNATIONAL CONFERENCE ON CLIMATE INDUCED NATURAL DISASTERS AND MITIGATION

ABSTRACTS

Organized by: Karakoram International University Gilgit, Pakistan

Co-organized by: UNDP GLOF II Project, Gilgit, Pakistan

National Center of Excellency in Geology, University of Peshawar,
Pakistan

Aga Khan Agency for Habitat, Gilgit, Pakistan

KIU ▪ Gilgit ▪ Pakistan

October 30 - 31, 2023



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1. A PHYSICAL-BASED PLATFORM FOR FLASH TORRENT AND DEBRIS FLOW FORECASTING

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KEYWORDS: System platform, flash torrent, debris flow, physical process, forecasting and early warning.

ABSTRACT

Flash torrents and debris flows are typical hazards that threaten human lives and cause great loss in mountainous areas. This study introduces a platform for process simulation and risk forecast of mountain disasters (e.g., flash torrent and debris flow) based on the full process of disaster formation-movement-deposition. The geographic information is managed by basic distributed units, while the meteorological data are directly accessed by Web Graphics Library (WebGL). Comparing with the traditional forecasting methods (rainfall thresholds), this platform has two main advantages: 1) it is a multipurpose approach that can either forecast hazards occurrence in a large region or simulates the affected area of a small catchment; 2) it is a complete physical-based method consists the physical simulation of hazards formation and movements processes. A supercomputer platform based on efficient multiple parallel computing greatly facilitates computational efficiency and increases the leading time of disaster early warning. The platform is currently under trial operation in the mountainous regions of China. In Liangshan Prefecture, Sichuan Province, a typical demonstration plot, the real events of debris-flows and flash floods were captured by this system and delivered the early warning information to the local residents. The accuracy is more than 79% in 2022, significantly supporting local disaster prevention.

2. TRANSBOUNDARY HYDROLOGY, CLIMATE CHANGE AND ITS IMPACT ON RECURRENCES OF FLOODS IN THE HINDU KUSH REGION

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KEYWORDS: Climate Change, Transboundary Hydrology, Intense Rainfall, Flood

ABSTRACT

This study analyses the transboundary hydrology, climate change and its impact on recurrences of floods in the Kabul-Swat floodplain, Hindu Kush region. In action 3rd, the Sendai Framework for disaster risk reduction has insisted to strengthen regional exchange on disaster risk information for better understanding of complex transboundary risks, cascading and compound disasters. It was found from the analysis that globally there is a rising trend of hydro-meteorological events both in terms of frequency and intensity and the same is attributed to changing climate scenario. The Kabul-Swat floodplain is no exception to it. During past decade (2011-2022), Pakistan has been declared amongst the top ten climate affected countries. The analysis revealed that the recurrences of flash floods, riverine floods, drought, long wet spells, intense rainfalls, heavy snowfall, late and early rainy seasons and rising trend in temperature have been identified as the major flood contributing factors and clear manifestations of climate change impacts. It was found that in the study region, the drought event (1997-2005) has paralyzed the agriculture sector and put tremendous pressure on the regional economy. It was followed by century worst flood of 2010, 2013 and 2022, and caused billions of US\$ damages to critical infrastructure, agriculture and other sectors. The analysis revealed that in Afghanistan investments have been made on building new dams over the Kabul River and it has posed serious implications on the downstream communities of Afghanistan and Pakistan. In a changing climate scenario, the Indus Water Treaty is at stake, while Kabul River Treaty has yet to mature. In the study region, hydro-meteorological disasters are expanding the canvas and thereby calls for effective mechanism of forecasting, early warning, response, adaptation and mitigation to minimize the flood impacts.

3. USING THE GLOBAL NAVIGATION SATELLITE SYSTEM AND PRECIPITATION DATA TO ESTABLISH THE PROPAGATION CHARACTERISTICS OF METEOROLOGICAL AND HYDROLOGICAL DROUGHT IN YUNNAN, CHINA

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KEYWORDS: Drought, Resource Management, Precipitation data, Geodetic data

ABSTRACT

Analyzing the spatiotemporal characteristics and evolution of meteorological and hydrological droughts can reproduce the process of drought propagation, which helps reduce the impact of droughts and improve water resources management. While emerging studies have attempted to build drought severity index based on the cutting-edge space geodetic observations, few have focused the propagation characteristics of meteorological to hydrological drought using geodetic data. In this paper, using global navigation satellite systems (GNSS) observations together with precipitation data, we systematically investigated drought propagation in the Yunnan province, Southwest China. We first identified seven meteorological and seven hydrological droughts in Yunnan from January 2011 to May 2021, and the meteorological drought was mainly concentrated in northern Yunnan lasting for 1–11 months. By contrast, hydrological droughts were more severe and larger than meteorological droughts, lasting for 2–16 months. The drought propagation time was 2–7 months, short in the southwest but long in the northeast. Water vapor, precipitation, and water storage demonstrated a spatiotemporal pattern of uneven distribution, with the red river fault (RRF) as the boundary, and their phase difference also presented notable regional differences, indicating that the RRF not only influences spatial variation of water resources but also affects drought propagation.

4. OUTBURST OF PRECIPITATION-FED LAKE ON THE TIBETAN PLATEAU IN THE CONTEXT OF GLOBAL CHANGES

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KEYWORDS: Global Changes, Precipitation, Catastrophic, Flash floods

ABSTRACT:

In the context of the current global changes, the Tibetan Plateau (TP) experiences increasing frequency and intensity of natural hazards, because of accelerating warming in high elevation regions. Recently, some new types of natural hazards, including catastrophic collapse of glacier in the western TP, blockage of Yarlung Tsangpo River by glacier avalanches and associated landslides, outburst of precipitation-fed lake, have been emerging in past decades, which have caused severe ecological, environmental, and societal problems. Outburst of precipitation-fed lakes were rarely reported on the Tibetan Plateau. Water from a precipitation-fed, closed basin lake in the Hoh Xil, Lake Zonag, suddenly breached the eastern shoreline in September 2011, resulted in rapid shrinkage in lake area and catastrophic flash floods, threatening the Qinghai-Tibet Railway, Highway, and communication cables. This presentation will show the processes of outburst of Lake Zonag and propose future studies from a paleolimnological perspective.

5. EVENT ANALYSIS 2022 FLOODS IN SWAT VALLEY, PAKISTAN

Christoph Lehmann

Swiss Agency for Development and Cooperation, Switzerland

KEYWORDS: Floods, Monsoon, Disasters, Risk, Damages, Capacity Building

ABSTRACT

Pakistan experienced heavy rains and extended floods during the monsoon season 2022, which caused great damage, especially in Swat Valley, in the Khyber Pakhtunkhwa province of Pakistan. Drawing lessons from the devastating floods in 2022 is important for building back better and reducing disaster risk in Swat Valley. Therefore, Switzerland proposed to the Islamic Republic of Pakistan to undertake a Flood Event Analysis and invited the National and Provincial Disaster Management Authorities (NDMA, PDMA) and the National Centre of Excellence in Geology of the University of Peshawar to collaborate in the study. The study is based on the integrated risk management (IRM) concept. It includes on-site field observations supported by spatial data analysis, including debris flow calculations, flood plain as well as risk map modelling based on satellite and UAV-based aerial survey (drone) images.

Massive floods occurred already in 2010 and had a great morphological influence on the 2022 floods. The 2022 event was too big to be brought under control by humans. A succession of different processes caused damage throughout the valley. After the event, the potential risk of damage has increased in many places in comparison to before 2022, especially on river stretches with extreme deposits and bank erosion. Due to the fact that, as a result of riverbed aggradation, a higher frequency of flooding are to be feared, damage will occur more frequently and, in some cases, more intensively. The event clearly showed the spatial conflict between humans and nature, and it looks like this effect will intensify in the future, also because of the increasing population in the Swat Valley causing more pressure to settle in high-risk areas. To reduce damages in the future, proposals like capacity building and exchange of knowledge on different levels, multiple hazard risk mapping and continuation of restoration of critical community infrastructure are made for future works in the area.

6. PARTIAL APPROACHES TO ADDRESS THE INDUS BASIN ISSUES WNOT BE PRODUCTIVE IN THE ACCELERATED PACE OF CLIMATE CHANGE

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KEYWORDS: Global temperature, Glacial lakes, flash floods, Climate Change Adaptation

ABSTRACT

Global average temperatures have already been touching the rise of 1.5 °C above the pre-industrial era, the emissions of CO₂ and other greenhouse gases are the ever highest resulting into the intensification of the hydrological cycle producing extreme events around the globe. Monsoon was low-lying air mass and did not reach the high elevations of Gilgit-Baltistan (GB) and Chitral. Due to the intensification of monsoon winds as a result of the land and sea temperature difference, the heavy downpour during summer has become a common feature and last year was full of devastation. Summer monsoon rainfall being warmer accelerates the melting process and generates more than expected volumes of discharge through glacier channels. Glacierized GB and Indus Delta are the most vulnerable hot spots of Pakistan due to climate change representing the head water and discharge pathway to sea resounding upstream and downstream connections of Indus Basin. GB representing the Upper Indus Basin (UIB) hosts 7259 glaciers spanning over an area of 11780km² and holding more than 2066km³ water (PMD 2014) which sustain the Indus flows due to melting in summer. Due to global warming, the melting process has accelerated enhancing the tendency of formation of glacial lakes and thawing of permafrost triggering the Glacial Lake Outburst Floods, snow avalanches, landslides and rockfalls. In case of 1.5 °C increase in temperature 1/3 HKH glacier ice will deplete and with business-as-usual emission scenarios 2/3 glacier mass will melt away by the end of 21st century (Himap 2019). The year 2022 happened to be the most disastrous producing 48 GLOF events against the annual average of 1 or 2 and 163 flash floods resulting in land degradation, damage to infrastructure and loss of lives and livelihood. Central Indus Basin (CIB) receives heavy monsoon downpour and generates the riverine floods inflicting heavy losses to food production. While Lower Indus Basin (LIB) is impacted by reduced environmental flows, sea level rise, storm surges, sea water intrusion, coastal erosion and increasing salinity. Global Sea level rise has been doubled since 1993 and 10mm increase recorded over the last 3 years (WMO 2022). After 2022 floods in Pakistan, a large number of projects has been launched in LIB ignoring the UIB linkage which may lead to a partial success to address the climate change issues of the Indus Basin in entirety. There is a dire need to enhance the understanding of the Government officials on upstream-downstream connections, moving climate finance toward north and preparing communities to climate change adaptation through DRR, climate resilient development and nature-based solutions.

7. CLIMATE CHANGE AND THE IMPACT OF NATURAL HAZARDS ON WATER INFRASTRUCTURES AND THE COPING CAPACITY OF MOUNTAIN COMMUNITIES IN GILGIT-BALTISTAN

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KEYWORDS: WASEP, Natural hazards, Vulnerability, Disruptions, Community –managed

ABSTRACT

This paper examines the performance of community-managed water systems under the Water and Sanitation Extension Programme (WASEP) in Gilgit-Baltistan. It looks at the role of engineering in the delivery of water services in the context of risks posed by natural hazards in mountainous regions such as Gilgit-Baltistan, and the ability of communities to respond to the often-inevitable disruptions to water services. It assesses how the standard operation procedures (SOPs) that inform the design, engineering and construction of water infrastructure under WASEP help minimise disruptions from natural hazards and if perceived changes to the wider pattern of natural hazards in Gilgit-Baltistan are related to climate change and specifically changes in temperature, precipitation and river flow. Finally, it examines the coping capacity of communities in relation to the severity of natural hazards and vulnerability proxies of communities, and the role of external support to undertake repairs and sustain water services.

8. BUILDING HUMAN AGENCY AND RESILIENCY IN A RAPIDLY CHANGING CLIMATE WITH DISASTERS

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KEYWORDS: Climate Change, Resiliency, Human, Disasters, transformations, mitigation

ABSTRACT:

In a world marked by rapidly changing climate patterns and an increasing frequency of disasters, the need to cultivate human agency and resiliency is more pressing than ever. This abstract explores the multifaceted challenges posed by climate change and its associated disasters, highlighting the essential role of human agency and resiliency in addressing these issues. Drawing from various disciplines and real-world experiences, this abstract delves into the key concepts of agency and resiliency, shedding light on their significance in the face of climate-related upheavals. Through the lens of both individual and collective agency, the abstract discusses the strategies and practices that empower individuals and communities to adapt, mitigate, and recover from the impacts of climate change. Moreover, it emphasizes the crucial interplay between internal and external transformations for sustainability and climate action. In light of a rapidly changing climate, this abstract serves as a foundational guide for understanding the importance of building human agency and resiliency, offering a path toward a more adaptive and sustainable future.

9. DEBRIS FLOWS HAZARD, VULNERABILITY, AND RISK ASSESSMENT IN HINDUKUSH MOUNTAIN RANGES, NORTHERN PAKISTAN, BY UTILIZING REMOTE SENSING AND FIELD DATA

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KEYWORDS: Debris flows; remote-sensing; hazard; vulnerability; risk

ABSTRACT

Debris flows are one of the most common and destructive natural hazards in steep terrains, causing significant environmental and economic losses and casualties. The debris flows activities are strongly influenced by climate change, geology, topography, hydrology, steep slope, and the linkage of sediment source areas, channel networks, and human activities. Debris flows hazard, vulnerability and risk assessments are essential for mitigation, land use, and development planning. However, they are, often missing in developing countries. Debris flows have adversely impacted the local communities, infrastructure and socio-economic settings in northern Pakistan. In this study, a methodology is designed and implemented for debris flow hazard, vulnerability and risk assessment, using freely available remote-sensing and field-based data for one of the most prone areas for debris flows in the Hindukush Mountain ranges of northern Pakistan. Very high-resolution satellite images, their spectral characteristics, and field data are used to compute the parameters for debris flow hazard assessment at the basin level. A morphometric analysis was performed to evaluate the drainage characteristics of the study area. All the parameters are combined in a raster layer by assigning weights, based on previous literature, expert opinion, and conditions of the study area. To create a set of indicators for the element at risk, substantial field data and remote sensing data are combined. The typological information about building footprints, roads, people, and land cover is included in the element at-risk data. Finally, a spatial multi-criteria evaluation technique is utilized to assess the vulnerability of elements at risk data in the alluvial fans, where the local communities are settled. Furthermore, a risk matrix connecting debris flow hazard and vulnerability is used to classify debris flow risk types. All the analyses are performed in the ArcGIS environment and the developed maps are classified into five categories: very low, low, moderate, high, and very high. The risk index maps shall help to highlight the debris flow risk hotspots and risk reduction strategies.

10. GRAPH THEORY AND COMBINATORICS BASED MATHEMATICAL MODELING OF CLIMATE CHANGE AND DISASTER RISK MANAGEMENT

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KEYWORDS: Climate change, Disaster risk management, Mathematical modeling, Graph theory, Combinatorics

ABSTRACT

Climate change is a global challenge that has far-reaching implications for disaster risk management. As extreme weather events become more frequent and severe, there is a growing need for comprehensive and efficient strategies to mitigate their impacts. Mathematical modeling techniques, such as graph theory and combinatorics, have emerged as powerful tools for analyzing and addressing the complex interplay between climate change and disaster risk management. This research presents an innovative approach to modeling climate-induced disasters and optimizing disaster risk management strategies by leveraging graph theory and combinatorics. We demonstrate how mathematical structures, such as graphs and combinatorial algorithms, can be applied to represent, analyze, and optimize disaster risk management systems.

We construct climate networks to model the relationships between various climate variables, such as temperature, precipitation, and extreme weather events. By representing these variables as nodes and their interactions as edges, we create a comprehensive framework to analyze climate patterns and their impacts on disaster risk. Using graph theory, we assess the vulnerability of regions and communities to climate-induced disasters. Vulnerability metrics, such as node centrality and connectivity, help identify areas at the highest risk and in need of targeted disaster risk management measures. Furthermore, combinatorial algorithms are employed to optimize disaster risk management strategies. By considering various mitigation and adaptation measures, we determine the most effective combinations to reduce disaster risk and enhance community resilience. Finally, we develop decision support systems that integrate real-time climate data and modeling results to aid policymakers, emergency responders, and disaster management agencies in making informed decisions and allocating resources efficiently.

By combining the precision of mathematical modeling with the flexibility of graph theory and combinatorics, this research contributes to a more systematic and data-driven approach to climate change adaptation and disaster risk management. The results provide valuable insights for policymakers and stakeholders, ultimately leading to more resilient communities and a more sustainable response to the challenges posed by climate change. In a nut shell, this study emphasizes the potential for interdisciplinary collaboration between mathematicians, climatologists, and disaster management experts, paving the way for innovative solutions to one of the most pressing issues of our time.

11. DISASTER GOVERNANCE AND VULNERABILITY: THE CASE OF SHISHPER AND BADSWAT GLACIER LAKE OUTBURST FLOODS, GILGIT-BALTISTAN, PAKISTAN

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KEYWORDS: Shishper glacier, Badswat glacier, Governance, Vulnerability, Resilience

ABSTRACT

Insufficient risk governance can leave societies unprepared for known or new hazards, increase vulnerability, hamper response efforts, and thus increase the likelihood that the hazard turns into a disaster. In mountainous regions, challenges are being posed to the infrastructure, livelihood, and lives of the communities living downstream by the ice-dammed glacial lakes which have the probability of numerous outburst events. This study undertook two case studies, scrutinizing mainly their socio-economic conditions, i.e. the community of Hassanabad living downstream the Shishper glacier and the community of Badswat living downstream the Badswat glacier which are the settlements downstream the highly fragile and surging glaciers. It focuses on the vulnerability assessment of two highly vulnerable communities of Gilgit-Baltistan. The study also scrutinized the target of achieving a comparative analysis of the vulnerability assessment of both the communities based on their adaptive capacity, resilience, land topography with a little sneak peek into their carbon footprint (Estimation based on the anthropogenic activities rather than the mathematical calculations of CO₂ equivalents). A pure qualitative method approach was employed to conduct this study with a semi-structured questionnaire based on both close ended and open ended questions. This survey questionnaire tool was utilized for survey method by getting circulated for the key informant interviews (KIIs) and Focus Group discussions (FGDs) of key representatives from the concerned authorities (Line department) and village organizations in both the study areas. The results obtained likely developed a better picture of vulnerability assessment with a scrutinized conclusion of comparatively the more vulnerable case study which is Badswat Valley from both the case studies. Having less to no resilience, very low adaptive capacity, fragile landscape with highly impactful GLOF events making the valley prone while with a greater use of fuel wood also showing likely greater carbon footprint but not more than that found in Hassanabad valley, Hunza, the community of Badswat is the highly vulnerable to the impacts of climate change in general and to frequent GLOF events in particular. Hence, the study paves way for the future researchers to develop a better picture of the greatly susceptible communities while giving them food for thought to build their research on the research gap of formulating solutions, and mitigation measures along with the recommendation for government and non-profit organizations, stakeholders, civil authorities and local organizations to strengthen the communities on the continuum of policy to implementation level.

12. INTEGRATED ASSESSMENT OF SUSTAINABLE DEVELOPMENT GOALS (SDGS) AND CLIMATE CHANGE MITIGATION: A CASE STUDY OF SOUTH PUNJAB, PAKISTAN

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KEYWORDS: Climate Change Mitigation; Sustainable Development Goals; climate-resilient

ABSTRACT

This research examines the integrated assessment of Sustainable Development Goals (SDGs) and climate change mitigation within the context of South Punjab, Pakistan. Recent global events, such as the Mission Innovation agreement and the European Commission's green strategy, have emphasized the urgency of accelerating low-carbon technological innovations. Additionally, the study insight the influence of climate disaster in Pakistan the mighty flood of 2022 which strikes and damaged one third of the country's landscape and left thousands of dead behind. The Government of Pakistan and international organizations took serious concerns over the natural hazard after UN chief calls the flood as 'climate catastrophe'. The present study highlighted the need for rapid climate action plan to mitigate the loss of natural hazards. Despite these efforts, progress toward achieving climate goals has been insufficient. This study seeks to understand the complex interplay between SDGs and climate change mitigation in South Punjab, a region vulnerable to climate change impacts. Through a mixed methods approach encompassing surveys, interviews, focus group discussions, and case studies, the research aims to assess the current status of SDG progress, identify barriers hindering integration, explore community engagement, and draw lessons from successful initiatives. The study's interdisciplinary and evolutionary methodology encourages active collaboration among experts from various disciplines. The findings of this research will contribute to a deeper understanding of how sustainable development and climate change mitigation can be effectively integrated at the local level. By shedding light on the challenges, opportunities, and policy implications, this study aims to inform future strategies and promote climate-resilient and sustainable development outcomes in South Punjab and beyond. Ultimately, this research strives to accelerate the transition to a low-carbon, climate-resilient future, aligning with global efforts to combat climate change and achieve the SDGs.

13.MACHINE LEARNING BASED EARTHQUAKE FORECASTING: A CASE STUDY OF THE JUNE 26,2020 HOTAN, CHINA EARTHQUAKE USING TEC AND ATMOSPHERIC PARAMETERS

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KEYWORDS: Ionosphere, NARX, Wavelet Transformation, Anomalies, Earthquake

ABSTRACT

Machine learning insights into atmospheric and Ionospheric anomalies, presents a promising avenue for earthquake early warning systems. In this study, we have detected anomalies associated with the earthquake that struck Hotan, China, on June 26, 2020, at a depth of 10.0 km (latitude 35.595°N, longitude 82.416°E). In order to study possible pre- and post-seismic perturbations different methodologies are applied including statistical, wavelet transformation and machine learning (ML)-based neural network, the Nonlinear Autoregressive Network with Exogenous Inputs (NARX) using Levenberg–Marquardt optimization algorithm. We have analyzed surface (Land Surface Temperature (LST)), atmospheric (Air Temperature (AT), Relative Humidity (RH), Air Pressure (AP), and Outgoing Longwave Radiation (OLR)) and Ionospheric precursors (Total Electron Content (TEC)). The analysis reveals significant enhancement in TEC and unusual variations in atmospheric parameters 5-10 days before the main seismic event, also 25% anomalies were observed relative to normal day distribution through NARX. No geomagnetic disturbances ($Dst \leq -40$ nt, $Kp \leq 3$) were observed within the 10 days preceding and following the earthquake. These findings highlight the potential of significance of ML techniques to detect anomalies as earthquake precursors for improved earthquake early warning systems.

14. MITIGATING SEISMIC HAZARDS BY EMPLOYING COULOMB FAILURE STRESS IN CENTRAL HIMALAYAN, PAKISTAN

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KEYWORDS: Seismic Hazards, Faults, central Himalaya, Eurasian Plate

ABSTRACT

We present the current status of CFS and seismically vulnerable regions by employing static earthquake-triggering techniques in the central Himalayan, Pakistan. The study region spanned 1200 kilometers in the central Himalayas, Northern Pakistan. It has major active faults such as MBT, MCT, MMT, MKT etc. This region has been the locus of numerous devastating earthquakes, including the M7.6, 2005 Kashmir earthquake. So far, very few studies have been conducted to determine the earthquake/fault interaction and hazard assessment in this region. To do so, we investigated the historical/instrumental earthquake catalogues and compiled an earthquake sequence with a magnitude ≥ 6.0 . The final earthquake sequence is comprised of twelve earthquakes, spanning from 1905 to 2005. By employing the static earthquake triggering theory on the final earthquake sequence, we have calculated co-seismic stress changes caused by particular earthquakes as well as the impact of earthquakes on the impending earthquakes by incorporating the time-dependent visco-elastic relaxation. To verify the robustness of numerical results, various values for the coefficient of friction (0.2, 0.4 and 0.6) and various values of viscosities (1.0×10^{19} and 1.0×10^{20} Pa. s) were chosen for both the lower crust and the upper mantle. Further, the areas in high CFS zones, vulnerable to seismic hazards, are identified. Our results revealed that out of twelve earthquakes, one earthquake is triggered by the previous earthquake. It is the aftershocks of the 2005 Kashmir earthquake with Mw6.4, which occurred in the high CFS lobe developed by the mainshock of the 2005 Kashmir earthquake. Moreover, our results also revealed that the inter-earthquake triggering is less in this region. It further deduces that the major source of strain accumulation in central Himalayan Pakistan is the tectonic loading (3.0 cm/yr Indian plate movement w.r.t Eurasian plate). These results are in good consistent with the earlier studies. The present results could be improved by incorporating the tectonic loading together with static earthquake triggering. The identified vulnerable regions to seismicity need attention to mitigate future seismic disasters. We can effectively allocate resources and create focused disaster preparedness plans in this regard. The results of this research are also useful for implementing rigorous building codes and infrastructural improvements, which can enhance Pakistani communities' resilience

15. PARAMETRIC ANALYSIS OF FACTORS AFFECTING SLOPE STABILITY: A CASE STUDY OF HUMARI LANDSLIDE, PAKISTAN

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KEYWORDS: Humari, Landslides, Hunza Nagar, Limit Equilibrium

ABSTRACT

The Humari landslide is a major hazard in Hunza Nagar District, Pakistan, with a height of 1100m, width of 1300m, and length of 2300m. This study investigated the geotechnical properties and slope stability of the landslide using Finite Difference (FD) and Limit Equilibrium (LE) methods. Soil samples were collected from different locations and analyzed in the laboratory. The results showed that the soil is silty/clayey sand with gravel, with an average moisture content of 0.8%, specific gravity of 2.66, liquid limit of 22.1, plasticity index of 2-5, angle of internal friction of 35°, and cohesion of 5Kpa. A Ground Penetrating Radar (GPR) survey was conducted to investigate the subsurface strata. The results showed distinct reflections with notable amplitudes, indicative of different materials including silty-clayey soil, sand, and varying thicknesses of boulder-sized rock fragments. Hyperbolic reflections in the top sections of the profiles suggested the presence of a fracture or lineament beneath it, representing major cracks and cavities. Major cracks were observed in some profiles across the slope depth ranging from 0-10 m below ground surface. These cracks, extending throughout the slope and leading to substantial disturbances in the reflector layers at the crest, facilitate deep strata weathering/erosion by allowing water to infiltrate. The whole profiles were considered as single layers due to the absence of bedrock encountered across all profiles, which is located at considerable depth, as the entirety of the studied area consists predominantly of glaciofluvial deposits. The factor of safety (FOS) for the Humari landslide was calculated using FLAC/Slope and GeoStudio-SLOPE/W software's based on FD and LE methods respectively. The FOS in dry condition is 1.37 and 1.39 for FLAC/Slope and SLOPE/W, respectively, while in wet condition, it is 1.29 and 1.31. A comprehensive parametric analysis was also carried out using numerical modeling to determine the effect of slope angle, angle of internal friction, cohesion, and pore water pressure on FOS. The results showed that all these parameters have a strong relationship with FOS, which increases with an increase in angle of internal friction and cohesion, while it decreases with slope angle and pore water pressure. Hazard and risk assessment was carried out using a qualitative method and field observations. The whole hazard was divided into three classes: high, moderate, and low. Based on the observations, it is concluded that the Humari landslide is an active landslide that is stable at present condition but not safe, and may be triggered by any natural phenomena like an earthquake or intense rainfall in the future. The study found that the landslide is stable at present condition but not safe, and may be triggered by any natural phenomena like an earthquake or intense rainfall in the future.

16. ADOPTION OF ENVIRONMENTAL INNOVATIVE TECHNOLOGIES IN THE HOTEL INDUSTRY: DEVELOPMENT OF PRO-ENVIRONMENTAL BEHAVIOR

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KEYWORDS: Tourism, Sustainability, Environmental Technologies, Destinations Marketing

ABSTRACT

The role of environmental innovative technologies on customer experience has already been proven. This study aims to investigate the role of environmental innovative technologies on customers experiences of destinations/hotels with a mediating role of sustainable intelligence. The study theorize that environmental innovative technologies enhance customers 'experience and attitude towards hotels/destinations. Behavioral approach/theory is utilized as a main theoretical farmwork to address the research problem. The data was collected from tourists/visitors at top destinations/hotels in Pakistan with usable sample size of 222 respondents. Surveys results reveal that innovative technologies in context of Environment Responsibility and Economic Responsibility have significant influence on Pro-Environmental Behavior with full mediating role of Sustainable Intelligence. These findings have important effects when implementing innovative technologies in tourism industry to 1) improve customer satisfaction, experience and attitude towards the hotels and destinations; 2) provide guidelines in tourism development policy and marketing; 3) help governments agencies to effectively use pro-environmental technologies to change consumer attitude specifically after Covid-19 pandemic. Cost saving and safety issues of tourists/hotel industry can be address by implementing environmental innovation technologies.

17.SHAPING ECO-AGRICULTURAL PRODUCTIVITY WITH HETEROGENEOUS TECHNOLOGICAL INNOVATION IN N-11 ECONOMIES: EXAMINING THE MODERATING ROLES OF ENVIRONMENTAL QUALITY AND GREEN ENERGY

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KEYWORDS: Agricultural productivity, Environmental quality, Technological innovation, Green energy consumption, Moderation analyses

ABSTRACT

Agriculture sector is the backbone of most Next Eleven (N-11) economies. However, in the past few years, agricultural productivity in these economies is being challenged by poor environmental quality. This study probes how technological innovation, arable land, GDP per capita and labor force along with moderating roles of green energy consumption and environmental quality affect the agricultural productivity in N-11 economies. Current study applied a set of second-generation panel data estimation techniques such as mean group (MG), augmented mean group (AMG), common correlated effects mean group (CCEMG) and pooled mean group (PMG) using balanced panel data set spanning from 2000-2021. The study findings revealed that technological innovation, green energy consumption, GDP per capita and arable land contribute positively to the agricultural productivity while poor environmental quality along with the growth in labor force have a negative impact on it. Similarly, green energy consumption moderates the positive relationship between technological innovation and agricultural productivity while poor environmental quality has an inverse moderating effect on it and the outcome was consistent across all estimators. Finally, to examine the direction of causality among the study variables, DumitrescuHurlin heterogeneous panel causality test was applied and the results showed two-way causal links between green energy consumption, technological innovation, environmental quality, arable land and agricultural productivity for the sample countries. The findings of the study have exceptional policy implications; for instance, due to poor environmental quality, agricultural productivity in N-11 countries is declining overtime, which demands these economies to design their policies that enhance cleaner energy sources and techno-logical innovation in the long run to achieve the global objective of sustainable development.

18. AN APPLICATION FOR AUTOMATIC LAND USE AND LAND COVER CLASSIFICATION USING A CLOUD-BASED PLATFORM: A CASE STUDY OF GILGIT-BALTISTAN WITH GOOGLE EARTH ENGINE

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KEYWORDS: Cloud-Based Platform, Google Earth Engine, Mapping

ABSTRACT

Land use and land cover (LULC) mapping is a fundamental task in remote sensing and geographic information systems (GIS). Accurate LULC maps are essential for various applications, including but not limited to urban planning, natural resource management, and environmental monitoring. Cloud computing offers powerful tools for processing and analyzing remote sensing data, making it an ideal platform for LULC mapping. Now a days, there are several cloud-based platforms providing open-source satellite datasets and free computing cost that include Google Earth Engine (GEE) and MS Planetary Computer.

In this work, we developed an automatic application to classify LULC using Sentinel-I dataset in GEE platform. Our application is implemented for Gilgit-Baltistan region and shows very promising results. This application has high potential to replicate to other areas of applications like Hazard mapping and air pollution mapping using cloud-based platforms. This application demonstrates to leverage all the benefits of cloud-based platforms to minimize manual resources which are time consuming and costly.

19. ANALYSIS OF TEMPORAL AND SPATIAL VARIATIONS OF DROUGHT OVER PAKISTAN BY INVESTIGATING THE APPLICABILITY OF PRECIPITATION-BASED DROUGHT INDEX

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KEYWORDS: Hydro-metrological hazards, Drought, Rainfall variability, Spatiotemporal analysis, Standardized Precipitation Index

ABSTRACT

Drought is a persistent, natural, local or regional phenomenon. It provides an impression of water scarcity owing to inadequate precipitation over an extended period. Drought is different from other natural hazards because of slow onset process with unpredictable ending. It develops gradually and impacts may endure for years after termination of the event. Pakistan has wide latitudinal extent and rainfall variability. The northern part of the Pakistan receives more rains as compared to the southern and south west region of the country that has the lowest precipitation, where frequent meteorological drought occurs. According to Pakistan Meteorological Department Pakistan is undergoing an increase in the frequency and severity of drought due to oscillated pattern of rains caused by climate change. This study focuses on the estimation of regional drought frequency and spatial extent in Pakistan. In current research meteorological drought index such as standardized precipitation index (SPI) has been used for drought analysis and assessment. The standardized precipitation index (SPI) permits for monitoring the frequency, duration, intensity and spatial extent of droughts at different time scales. It is used to do a retrospective analysis of the spatial extent of droughts in Pakistan from 1981. The analysis is made using long term homogenous monthly rainfall data of 40 years to compute SPI values. The negative and positive SPI values show the probability occurrence of dry or wet events in the study area. Parallel to this, drought prone areas with seasonal variation were also identified using Kriging spatial interpolation techniques in GIS environment. The study revealed that there is temporal variation in droughts occurrences both in time series and SPI values that has significant economic, social, and environmental impacts on the studied area. This paper properly concluded the results and suggested a strategic plan to minimize the impacts of drought in Pakistan.

20. CLIMATE-SECURITY NEXUS: A PARADIGM SHIFT FROM REACTIVE DISASTER APPROACH TO PROACTIVE RISK REDUCTION APPROACH TOWARDS CLIMATE-INDUCED NATURAL DISASTERS AND MITIGATION IN PAKISTAN

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KEYWORDS: Climate-induced disasters, Mitigation, Proactive approach, Risk reduction

ABSTRACT

This study's objective is to examine the severity and egregiousness of climate-induced natural disasters, which pose a significant threat and necessitate a holistic and proactive approach to mitigate their impacts effectively in Pakistan, which is currently lacking. Climate change is a complex and multifaceted phenomenon that has become a critical subject and captured universal attention because of its profound impact on all facets of society and the environment. Pakistan is ranked 14th out of 17 nations with a very high flood risk. Devastating floods and droughts, debris flows and GLOFs etc., have killed hundreds of people, uprooted thousands more, destroyed livelihoods, and devastated infrastructure. Primarily, study will examine the multifaceted challenges posed by climate-induced disasters, i.e., hurricanes, floods, droughts, irregular weather pattern etc., underlines the significance of proactive mitigation strategies on natural disasters. Secondary, Pakistan urgently needs a paradigm shift from a reactive disaster approach to a proactive risk reduction approach that incorporates all natural disaster hazards. Tertiary, study will highlight the various elements addressing climate-induced natural disasters through a concentrated focus on sustainable disaster risk reduction, community engagement and capacity building, policy and governance, science-based risk assessment, ecosystem-based approaches, global cooperation, innovative financing mechanisms, etc. Lastly, this study will scrutinize the collaboration between the government, NGOs, global institutions, societies, and all stakeholders in building resilience to climate-induced disasters. The study employs a qualitative method within the theoretical framework of Securitization theory of Copenhagen School. The research will offer several recommendations for boosting the resilience of vulnerable populations in Pakistan and integrating disaster risk reduction into the broader framework of sustainable development in the face of climate change challenges, giving policymakers, practitioners, and researchers involved in adaptation and mitigation strategies for climate change valuable insights to ensure a safer and more resilient future for all.

21.SAFE HOMES: CLIMATE CHANGE-INDUCED DISASTERS AND HOUSEHOLD RESILIENCE IN GILGIT BALTISTANS

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KEYWORDS: Climate Change, Safe Homes, Climate Induced Hazards

ABSTRACT

Gilgit Baltistan is a high mountain region, the land of "union" located in the northmost of Pakistan. The geographical positioning of Gilgit Baltistan makes it vulnerable to climate-related hazards i.e., flash floods, glacial lake outbursts floods, rock sliding, spatio-temporal changes in snowfall patterns, and increase in intensity and frequency of avalanches. Around the year, the people of Gilgit Baltistan face loss of life, livestock, and property imposed by recurrent climate change events. Homes are the basic unit of human survival, custodians of safe life by providing shelter, security, and comfort for individuals and families. Homes are essential for physical and mental health, social well-being, and economic stability. Not only do humans focus on safe housing, but animals and birds also build their homes in safe places to protect themselves and their offspring from predators and the elements like harsh weather. From ancient civilizations to modern times, people have developed innovative techniques and technologies to construct homes that protect them from environmental and social hazards. Safe homes also indicate the resilience to climate change. Loss of homes in Gilgit Baltistan due to recurrent climate change events shows the inadequacy of climate change resilience in response to climate change. Surveys showed that 33% of homes were not considered safe from climate change. Choice of house location, sustainable purchasing power, and awareness regarding climate change play a crucial role in building homes at safer locations. Therefore, these factors' data of 999 observations are collected using stratified random sampling from 29 different rural and urban locations of Gilgit Baltistan. The result of logit models reveals that homeowners living in urban localities, with higher purchasing power, acknowledging early warning systems, having small house sizes and higher education tend to have higher odds of climate change resilient homes. The study suggests the stakeholders should improve climate change-related education, and early warning systems, and diversify livelihood strategies to strengthen the people of Gilgit Baltistan to build climate change resilient homes.

(The study is part of the ICIMOD-funded Project: Institutional Strategies to Adapt Socio-Economic Impacts of Climate Change in Karakoram Region of Pakistan and China, the data for the study have been collected in 2018, 2019, and then in 2023 to update the information).

22.A REGIONAL WEB GIS PORTAL WITH DYNAMIC APPLICATIONS LIKE HAZARD ASSESSMENT AND NATURAL RESOURCE MANAGEMENT FOR DIFFERENT STAKEHOLDERS

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KEYWORDS: Natural Hazards, GIS-Based Hazard, Risk Assessment, Regional Web GIS Portal

ABSTRACT

In the context of Gilgit-Baltistan, where natural hazard events are frequent, there is a dire need to collaborate among all stakeholders including government and non-government organizations to take immediate actions regarding mitigation and proactive actions to avoid or minimize effects of natural disasters. The development of a regional web GIS portal has emerged as a transformative tool, facilitating comprehensive data visualization, analysis, and decision-making for diverse stakeholders. This paper introduces a dynamic web GIS portal designed to cater to the unique needs of various stakeholders, with a particular focus on hazard assessment and natural resource management.

The regional web GIS portal serves as a centralized platform for accessing, analyzing, and sharing geospatial data pertinent to a specific region. Through its user-friendly interface, stakeholders ranging from government agencies and environmental organizations to researchers and the general public can seamlessly interact with geographical information. One of the primary applications of this portal is hazard assessment, which enables stakeholders to evaluate and mitigate risks associated with natural disasters such as floods, and more. The portal integrates real-time data feeds, historical records, drone data, and advanced modeling tools to provide timely and accurate hazard assessments, thereby supporting informed decision-making and disaster preparedness.

Additionally, the web GIS portal empowers stakeholders to engage in effective natural resource management. By offering access to up-to-date data on land use, vegetation cover, water resources, and biodiversity, it assists in sustainable planning and conservation efforts. Through interactive mapping and analysis features, users can assess the impact of land-use changes, monitor environmental trends, and make informed choices that balance economic development with ecological preservation. Key features of the portal include dynamic mapping, data querying, spatial analysis tools, and collaboration capabilities, ensuring that stakeholders can tailor their interactions to their specific needs. Moreover, the platform is scalable, allowing for the integration of additional applications and datasets to address evolving challenges and opportunities. This paper presents a case study of the portal's development and deployment in a real-world context, showcasing its potential to enhance decision support and foster collaboration among diverse stakeholders.

23. GEOSPATIAL TECHNOLOGY FOR THE OPINATION OF THRESHOLD RANGES AND MAPPING FLOOD EXTENT FROM SENTINEL-1 AND SENTINEL-2: A CASE STUDY OF PAKISTAN FLOODS 2022

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KEYWORDS: Natural disasters, Flood; Synthetic Aperture Radar (SAR), Sentinel-1; Polarization

ABSTRACT

Natural disasters such as floods are among the deadliest and most devastating in the world, posing grave dangers to people and property alike. Rapid delineation of flood's spatial extent is essential for monitoring flood dynamics and implementing appropriate emergency actions. To protect susceptible areas from flooding, Synthetic Aperture Radar (SAR) offers an all-weather capability. In flood relief and inundation modelling, SAR's adequate spatial-temporal resolution boosts its ability to image the extent and damage caused by flooding. For this investigation, the European Space Agency's Sentinel-1 (SAR) and Sentinel-2 (OLI) satellite imageries are used. The utility of different polarization modes, including VV and VH transmission and reception, respectively is analyzed before and after the floodwaters have receded, respectively. Water bodies were mapped from intensity values of sentinel-2 bands using water indices (NDWI). Both VV and VH polarizations are suitable for mapping floodwater since the backscatter of floodwater is the same in both polarizations. From close range to far range, -13 to -23 dB, and -7 to -21 dB can be used as optimum ranges for the classification of floodwater in VV and VH polarizations while 16.6% increase in flood extent area was observed. Satellite datasets of pre and post flood events from Sentinel-1 and Sentina-2 imagery can be efficiently used to gain high classification accuracy for flooded areas. To make flood disaster maps in a short period of time, these optimum threshold ranges can be the image in near-real-time, when significant work was spent on determining the thresholds. These flood disaster maps will aid the disaster management agencies and policy makers for better decision support system.

24.HARNESSING NATURE-BASED SOLUTIONS TO MITIGATE URBAN HEATWAVES

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KEYWORDS: Nature-based solutions, heatwave, urban resilience, climate change mitigation

ABSTRACT

Heatwaves present significant hazards to the social, economic, and environmental systems. Exploring efficient and sustainable mitigation measures is immediately needed as the frequency and severity of heatwaves increase because of climate change. Nature-based Solutions (NbS) have emerged as a promising approach to combat heatwaves by leveraging the inherent resilience of natural systems. This study attempts to explore the potential of NbS as a means in urban heatwave mitigation. It highlights the diverse range of NbS interventions utilizing cooling properties of nature to reduce the effects of extreme heat events by encompassing various elements, including urban green spaces, green roofs, vertical gardens and urban forests. NbS-based urban green infrastructure improves and provides several advantages, including lowering temperatures, minimizing the impacts of urban heat islands, improving air quality, and fostering human well-being. Mechanisms like evaporative cooling, shading, and solar radiation absorption create livable and resilient urban environments. This study emphasizes NbS as a viable strategy for mitigating heatwaves, highlighting the prerequisites that are required for adapting NbS in local communities, and integrating nature into urban environments to protect communities from extreme heat. Embracing NbS fosters sustainable, livable cities, prioritizing well-being amid a changing climate.

25. INTEGRATED APPROACH TO INVESTIGATING SLOPE INSTABILITY AT LOHAR GALI LANDSLIDE, MUZAFFARABAD, PAKISTANS

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KEYWORDS: Landslide, Instability, Hazard, Geophysical

ABSTRACT

The LoharGali landslide is a major hazard that blocks the main transportation route to Muzaffarabad, Pakistan. This study investigates the factors contributing to slope instability at LoharGali using an integrated approach involving geologic, geophysical, geotechnical, and rainfall data. The landslide is located on a steep slope composed of fractured and weathered rock and soil. The slope is further destabilized by monsoonal rainfall, seismic activity, and base cutting by the Jhelum River. Geologically, the LoharGali landslide lies on the western limb of Hazara Kashmir Syntaxis in the Precambrian Hazara Formation, comprised of slate, phyllites, unmetamorphosed shale, some limestones, and graphite. In the landslide area, slates are completely weathered into very thick and extremely loose soil cover. A correlation has been developed between the total failed area of the landslide and the yearly rainfall data for the period of 2002 to 2021 showing a continuous increase in the failed area of the landslide from 2002 to 2021 and a positive correlation with rainfall for a few successive years from 2002 to 2009, in 2012, and from 2016 to 2020. The 2D Electrical Resistivity Tomography has demarcated the potential slip surface where clear contrast in the resistivity values is present. The material properties show the soil composition as silty clayey gravels with sands (GC-GM), silty sands with gravels (SM-GM), and silty clayey sands with gravels (SC-SM). The soil samples of the study area are granular, cohesionless, non-plastic to extremely low plastic in nature. Based on the geotechnical, geophysical, and topographic investigation, slope stability analysis was performed in the FLAC Slope 8.0 software, and the factor of safety for the landslide is calculated which is 1.01, representing that the slope is on the verge of failure and small changes in the intrinsic or extrinsic factors may lead to slope failure. The study concludes that the fragile and extremely fractured rock unit, height and over steepness of the slope, low shear strength of the material, monsoonal climatic pattern and heavy rainfalls, seismically active region, physical and chemical weathering and base cutting by the Jhelum River coupled with the massive loading of the houses create suitable condition for slope instability.

26. EVAPOTRANSPIRATION RETRIEVAL USING S-SEBI MODEL WITH LANDSAT 8 DATA OVER SEMI-ARID REGION OF DISTRICT PESHAWAR, PAKISTAN

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KEYWORDS: Evapotranspiration, Landsat OLI/TIRS, S-SEBI, Water cycle, energy balance

ABSTRACT

Evapotranspiration (ET) is an important component of the water cycle and energy balance. Because of high evapotranspiration demands, soil moisture depletes faster, which quickly translates into crop water stress. ET is especially sensitive to changes in climate and land use due to its explicit connection with many land surface processes. Spatio-temporal variation in ET influences the patterns of water availability and impacts the ecosystem due to which it is very crucial to quantify ET in arid regions. In Pakistan, there are very low footprints of meteorological station data. For this purpose, the Remote sensing techniques are proven cost and time-effective. In this research work, the S-SEBI (Simplified Surface Energy Balance Index) model was employed using Landsat 8 OLI/TIRS satellite imagery to map the ET over the southwestern semi-arid district of Khyber Pakhtunkhwa Peshawar, Pakistan for the time-period of 2013-2018. The obtained results were then validated with pan evaporation measurements of ET at the ground station provided by the National Agromet Center Islamabad. The modeled results show a very good correlation with ground-based station data in terms of the Pearson correlation coefficient $r = 0.74$ with a very slight deviation in terms of RMSD (Root Mean Squared Difference) exhibiting a value of 0.03. This study shows that the S-SEBI model is effective in calculating spatiotemporal ET over diverse regions with limited ground-based weather data.

27. TEMPORAL ASSESSMENT AND CHARACTERISATION OF HYDRO-METROLOGICAL DROUGHT IN THE SOUTHWEST OF PAKISTAN

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KEYWORDS: TRMM, SPI, Mann Kendal, Tend Analysis, Sen's slope

ABSTRACT

The most complicated and least recognized of all natural disasters, drought is a recurrent hydro-metrological phenomenon in Pakistan, particularly in the southwest region (Baluchistan Province). Understanding and quantifying drought is essential for effective and sustainable management of water resources, especially under arid conditions. This study aims to temporally assess and characterize drought conditions in the study region using Standard Precipitation Index (SPI) and Mann Kendal Test (MKT) on Tropical Rainfall Measuring Mission (TRMM) and rain gauge data from seven regions of the study area acquired between 1998–2019. The region had faced several droughts, including the most severe drought in different parts of the study region from 1998 to 2002, driven by low and irregular rainfall. Results from this study shows that extreme to severe drought was observed in Barkhan, Zhob, Lasbella, and Panjgur during the years 2000–2002, 2004, and 2018 with SPI values of -1.83 to -2.54. The moderate dry conditions were observed in Barkhan, Zhob, Lasbella, Jacobabad, Nokundi, and Quetta in 2000, 2002, and 2004 with SPI values of -1.09 to -1.48. The Quetta region had faced two extreme droughts (with SPI values of -2.08 and -2.16) during the years 2000–2002 and 2004 (monsoon and pre-monsoon seasons, respectively). The Pangjur region had faced severe drought during 2003 and 2005 (SPI of -1.62) in pre-monsoon season. Similarly, the MKT displayed negative trend (extreme drought conditions) in most of the regions, particularly Barkhan, Jacobababd, Nokundi, Lasbella, Quetta, and Zhob. Results from this study revealed frequent drought events in the region with an expected increasing trend in the future. The agricultural crops and fruits productivity has been negatively impacted by the growing intensity of these droughts in the study region. Planning water resources and irrigation water management systems may benefit from the findings of this study.

28. CLIMATIC FEEDBACKS OF SOIL MICROBIAL COMMUNITY

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KEYWORDS: Ecosystem, Soil, Climate Change, Microbial Communities

ABSTRACT

Determining the impact of climate change on the world's ecosystems is one of the greatest challenges of 21st century. Different abiotic stresses are the most pervasive global change drivers with the predictions of getting worst over time. Soil microbial communities are key indicators of soil health and regulate many critical ecosystem services, including stress resistance, nutrient re-cycling, biodegradation of contaminant, and the sequestration of carbon dioxide from the atmosphere. We conducted experimental research about the effect of different abiotic stresses (water stress, salinity, pollution) on the survival and activity of soil microbial communities so as to understand the response of soil ecosystems. This study helped us to determine the effect of environmental factors on the diversity and activity of soil microbial communities. Isolation and identification of the functional microbes by culture-dependent method coupled with catabolic profiling assayed to provide information regarding the functional capacity of microbial communities experiencing abiotic stress; finally, the selected microbial strains were inoculated to stress exposed wheat under glass house conditions for investigating their stress amelioration potential. These strains were tested as inoculants alone and in combination with various soil amendments like bioorganic fertilizer, compost, and biochar, and their application significantly improved morphological, physiological, and biochemical growth, nutrient uptake, antioxidant enzymes, and osmolytes, and can act as bio-fertilizer particularly under stress. These recent advances in sustainable soil fertilization technology can help improve community structure, ecosystem functioning and agricultural production under global change.

29. DISASTER MANAGEMENT & SECURITY: ROLE OF TECHNOLOGY IN RISK AVERSION STRATEGIES

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KEYWORDS: Modern technology, society, Natural Disasters, Risk management

ABSTRACT

As a methodological tool, science has helped mankind to develop technologies in overcoming the challenges of existence and natural or physical insecurity. Multiplicity of challenges has compounded human existence from antiquity to the present. Mankind has endeavored since times immemorial to enhance his physical capacity versus natural disasters and provide for his physical and social well-being. From climate change to health to economic crises, a range of issues have transformed the way security has traditionally been understood and dealt with in the modern world. Technological advancement has equipped mankind better to mitigate the challenges of natural disasters and environmental insecurity. The paper aims to examine the relationship between disaster management and security, focusing on the role of technology in risk aversion strategies. It focuses in particular on: a) the conceptual understanding of disaster management and b) and role of technology in disaster control and risk aversion strategies. The article undertakes exploratory research to review the type of new technologies available for utilization relying on assistance from advanced states such as the US and China. In conducting empirical research on types of disasters within the context of the northern areas of Pakistan and the technological options available for planning mitigation strategies, the paper seeks to fill-in the gap in knowledge while emphasizing the ethical and moral interrelationship between technology and society.

30. LACIAL LAKE OUTBURST FLOODS: IMPACT ON THE ENVIRONMENT AND SOCIOECONOMIC CONDITIONS OF HUNZA

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KEYWORDS: GLOF, Households, Stakeholders, Disaster, Socio-economic.

ABSTRACT

This study is based on Glacial Lake Outburst Flood (GLOF) occurrences in Hassanabad, Pakistan, over the last five years. The study examines the impact of GLOF on households and understands indigenous knowledge along with community-based risk mitigation techniques to reduce the intensity of GLOF-related damages. The asset pentagon of sustainable livelihood framework of the Department for International Development (DFID) provided the fundamental concepts for carrying out this research. In addition, this study tapped upon the approaches currently used by stakeholders to mitigate GLOF-induced hazards and the lessons for perceived cataclysm. To achieve this, primary data sources, i.e., Focus Group Discussions (FDGs); the questionnaire-based Key Informant Interviews from the households; stakeholders, and representatives from NGOs were utilized, and the gathered data was analyzed using SPSS. The data division was such that quantitative information was converted into percentages and frequencies. At the same time, the primary qualitative data was used to assess community resilience, disaster risk reduction, and GLOF management. According to 74.1 percent of the total respondents, there is a significant loss of cultivable land due to GLOF. Drinking water facilities and irrigation channels are disrupted, which causes 50.3 percent of households to fetch water from outside. This scarcity has limited the agricultural yield by several folds in the past three years. The local communities have been sustained by shifting from natural to social and human capital. Although the indigenous knowledge of the community suggests certain religious rituals to manage disasters like GLOF, the frequency and intensity of such catastrophes remain the subject of research across the region. The current socio-economic and environmental study is a reference for future research work.

31.SLOPE-BASED SEISMIC SITE CONDITION ANALYSIS OF NORTHERN PAKISTAN

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KEYWORDS: Earthquake potential index, GIS, Remote sensing, Lineaments

ABSTRACT

Many building codes classify sites based on the travel-time averaged shear-wave velocity to a depth of 30 meters (V_{s30}) below the Earth's surface. Recent ground-motion prediction equations (GMPEs) also use V_{s30} to estimate site classification, and the distribution of V_{s30} in a region or country has been mapped. Recently, a different approach for assessing global seismic site conditions, or V_{s30} , from the SRTM DEMs (digital elevation models) has been put forth. The basic idea behind the method is that correlations between V_{s30} measurements and topographic gradient can be used to use the topographic slope as a trustworthy substitute for V_{s30} in the absence of geologically and geotechnical-based site-condition maps. Here, we obtain V_{s30} data and a site condition map using DEM data with a 30-meter resolution based on the National Earthquake Hazard Reduction Programme (NEHRP) classification scheme. The site condition map can be effectively used by civil engineers, city planners, and for infrastructure planning and management.

32.SNOW COVER FREQUENCY (SCF) TREND ANALYSIS OF GILGIT-BALTISTAN FOR THE PERIOD 2000-2021 USING MODIS DATASET

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KEYWORDS: Snow cover, Indus River, Snowmelt, Landsat

ABSTRACT

Monitoring snow cover in the Gilgit-Baltistan region and the adjacent low-lying areas along the Indus River is crucial for managing water resources, especially in snowmelt-dominated basins. This study spans the years 2001 to 2021 and utilizes MODIS daily data from Terra and Aqua satellites, both offering a spatial resolution of 500 meters. Ground truth validation involved cross-referencing the MODIS daily snow cover product with a snow map derived from Landsat Enhanced Thematic Mapper Plus (ETM+) data. The primary objective is to analyze surface cover frequency trends at the pixel level, focusing on distinguishing snow-covered and snow-free conditions. Our study shows that over the past two decades, monthly average Snow Cover frequency (SCF) trends have generally remained stable, with exceptions in November and December of 2007, 2010, and 2016 when noticeable declines occurred. These variations also include intra-year fluctuations. The study divides the region into four altitude zones, ranging from up to 2000 meters, 4000 meters, 6000 meters, to 8583 meters. The significant 27% difference in snow cover fraction between the lowest and highest elevations is primarily attributed to variations in altitude-related climate and topography. Terrain slope characteristics exhibit distinct patterns throughout the year. Winter months (January to March) predominantly feature downhill slopes due to snow and ice accumulation, while April transitions to uphill terrain as snow melts. From May to July, the landscape continues to ascend in elevation during the spring-to-early-summer transition. August briefly displays flat or gentle terrain, likely due to completed snowmelt. September and December resemble the terrain observed in March. These slope dynamics reflect the seasonal and environmental influences on the landscape.

33. THE STUDY OF THE MODIFICATION IN AEROSOL LOADING OVER KARACHI USING REMOTE SENSING

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KEYWORDS: AOD, AE, Aerosols, RH, ARF, SSA, VSD, ASY, RI

ABSTRACT

Aerosol optical properties has been analyzed through the ground base aerosol robotic network over the mega city Karachi during the long time period 2006 to 2021. The major inspiration of this study was to find out aerosols impact on climate changes. Listed parameters (AOD & AE) and inversion products (VSD, SSA, RI, ARF and ASY) were analyzed to find out results. The aerosol optical depth (AOD) is strongly dependent on wavelength; for shorter wavelengths AOD values are higher than at longer wavelengths. The seasonal AOD and AE calculated was 0.4166 ± 0.0648 and 0.7812 ± 0.1566 respectively. Temperature was maximum in September and minimum in January. Annual AOD was 0.4144 ± 0.0434 and AE was 0.7022 ± 0.1209 . AOD and AE was at peak in 2008 and 2006 respectively. Wind speed was high in May and low in November. Sea level pressure was at top in January. RH was maximum in July and minimum in February. A two mode lognormal structure for the aerosol volume size distribution was observed. The seasonal variations in aerosol volume size distribution exhibit high variability in the coarse mode, whereas minor variations are observed in the accumulation mode. The volume concentrations in the coarse mode are larger in summer than in other seasons. The SSA values showed a significant increasing trend in the wavelength range 440 nm - 675 nm in all the seasons, then spring season shows significance decrease at 870 nm-1020 nm wavelength. The highest average value was observed in summer (0.9577) and the lowest in spring (0.9035). The real part of the RI is larger at higher wavelengths because of high absorption due to coarse-mode aerosols. During spring, the real part of the RI is found to be consistently high >1.52 at all the wavelengths indicating the dominance of desert dust aerosols. The high value of the imaginary part of the RI at each wavelength during winter indicates the dominance of absorbing aerosols in the Atmosphere over Karachi. The ARF values are highest for summer season i.e. JJA (June July and August) due to the dust storm activities in the southern part of Pakistan. Another factor of high ARF values due to some dust plumes and high black carbon concentrations over Karachi. Calculated ASY for Winter Spring Summer and autumn was 0.6962 ± 0.0244 , 0.7013 ± 0.0239 , 0.7132 ± 0.0238 and 0.7019 ± 0.0245 respectively. As compared to other seasons ASY was high at all wavelength during summer season. In general, the ASY decreases with increasing wavelength over Karachi. The greatest decrease occurs during the winter at study site, suggesting that absorbing anthropogenic aerosols are dominant during the winter season.

34. CLIMATE ACTION, GENDER, YOUTH AND LEADERSHIP

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KEYWORDS: Climate Change Action, Gender, Mitigation, Ecological Concerns

ABSTRACT

This panel comprises of four papers which address various aspects of Climate Induced Disaster Mitigation. This panel is part of the project being carried out in the twin cities of Rawalpindi and Islamabad and is being funded by the European Union through the Norwegian Church Aid in Pakistan. The project is being carried out in collaboration with Rozan and is currently in its second phase. The three phase project which is spread over 30 months focuses on Community Awareness in selected communities of the Rawalpindi and Islamabad region. The selection of communities has been made on the basis of density of population and the project highlights the mitigation practices that need to be spread to the under-served communities. The project also focuses on raising awareness in the youth of the communities and highlights the significance of the necessity of creating Community Leaders among the youth, with particular emphasis on Persons With Disabilities and Religious and other Minority groups. The priority areas of the project are kitchen gardening, tree plantation and plastic waste management, and the presentations will focus on how the youth of the under-served communities is being motivated to work towards the impact of Climate Change locally, in order to see the smaller picture in the backdrop of the larger, global picture.

The panel, comprising of four presenters, will focus on the following aspects of Climate Action:

- 1) The Role of Gender in Climate Action/Mitigation
- 2) Leadership for Climate Change
- 3) Environment and Disaster Mitigation
- 4) Ecological Concerns at the Community and Global Level

35. PERCEPTIONS ON PEACEFUL USES OF NUCLEAR ENERGY AND ITS ROLE IN ACHIEVING SDGs: A CASE STUDY OF PAKISTAN

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KEYWORDS: Nuclear energy, Pakistan, clean energy, climate change, environmental sustainability

ABSTRACT

This study examines public perceptions on peaceful uses of nuclear energy and its role in achieving Sustainable development goals (SDGs), primarily focusing on SDG 7, affordable and clean energy, SDG 13, Climate action, SDG 8, Decent work and economic growth, SDG3 Good health and well-being, and SDG1, poverty alleviation, in Pakistan.

Nuclear energy is vital in various sectors, especially in clean energy transition; however, its uses have been a disruptive discourse in society for decades. The perceptions on the impacts of nuclear energy have become a hot discourse among students, academics, and policymakers. Since public opinion regarding the peaceful use of nuclear energy in various sectors plays a significant role in policymaking, thus, this research will be a valuable addition to provide a Pakistani perspective and discourse on the subject.

Pakistan's nuclear program aims to meet its energy requirements while also contributing to achieving SDGs. It has a robust nuclear program with six power plants and other facilities operating under the International Atomic Energy Agency (IAEA) guidelines. The power plants produce a significant part of the country's needs and help to reduce dependence on fossil fuels. Furthermore, Pakistan's nuclear technology is also used for other peaceful means, including agriculture, medical, and industrial applications, contributing to economic development and technological innovation.

The study will be carried out using primary and secondary sources and will conduct extensive fieldwork, including interviews and surveys (online and in-person) in Pakistan. The study will adopt a cluster sampling method and the respondents from the selected universities and think tanks of Islamabad, Sindh, KPK, Baluchistan, and Gilgit-Baltistan regions. The author will prepare and distribute questionnaires among the targeted sample aged 18 to 60. The collected data through surveys will be analyzed by applying ANOVA and T-test using SPSS. The study is unique as it will provide fresh discourse and data on peaceful uses of nuclear energy for achieving SDGs through public opinion. The study will also help to debunk the myths and bring a positive image on the subject.

36. DISASTER MANAGEMENT AND RISK ANALYSIS LEARNING THROUGH REAL THINGS AND TEXT-CUM-PICTORIAL MATERIALS

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KEYWORDS: Disaster management; Real things; Science Education; Text-cum-pictorial materials.

ABSTRACT

The purpose of the current study was disaster management and risk analysis learning and the comparative role of text-cum pictorial material and real things on students' learning in the subject of (science). Educational psychologists recommended that teaching with real things is more effective than teaching through text-cum pictorial materials. The present study verified the relation of the given variables. There are two independent variables i.e. text-cum pictorial materials and real things, while students' achievement is a dependent variable. The students of class four were taken as sample of the study. The study was conducted on two groups. One group of students was taken as control group who was taught through text-cum pictorial materials. The other group was experimental group taught with the help of real things. The researcher developed science achievement test and given to the both groups after the treatment. The t-test for independent sample was used to analyze the obtained data. The findings of the study were that there was statistically significant difference between the mean achievement scores of the students taught with real things and of those taught with text-cum pictorial materials. The overall conclusion of the study is that disaster management and risk analysis learning of the students taught through real things is higher than that of the students who were taught by text-cum pictorial materials. So, in the light of conclusions, teaching strategies through real things and concrete operational stages should be included for risk assessment and disaster management pre-service and in-service teachers training and curriculum.

37. URBAN EXPANSION, LAND USE LAND COVER CHANGE AND HUMAN IMPACTS: A CASE STUDY OF GILGIT CITY, PAKISTAN

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KEYWORDS: Land use land cover, Change, Urbanization, Remote sensing, GIS

ABSTRACT

Land Use Land Cover Change (LULC) assessments have become essential in changing global circumstances. Similarly, Gilgit is experiencing significant changes due to extensive lateral urbanization, good climate, fertile soils, and improved infrastructure. In the present study, the urbanization and evaluation of LULC, as well as their detection of changes, were carried out using digital image processing techniques in combination with metrological data from the last 30 years, discussions focus group and key informant interviews to determine drivers of LULC, urbanization and climate change impacts. Classification and analysis of four different images of the study area revealed that built-up areas have increased rapidly over the past 30 years, ranging from 0.51% to 55.46% of the area's landscape study between 1990 and 2020, resulting in a significant reduction in barren lands from 54.94% to 5.17% over the same period. While agricultural land decreased from 38.10% to 32.63%, the change in water bodies or rivers was minimal (6.45% to 6.73%). The generated maps of the periods 1990, 2000, 2009, and 2020 showed an overall accuracy of 88.12%, 88.22%, 86.2%, and 90%, and a kappa coefficient of 0.85, 0.85, 0.82, and 0.86, respectively. Rapid population growth, a massive wave of migration from the adjoining villages to the study area, the growth of tourism and investment activities, the expansion of infrastructure, and economic constraints in the study area have been identified as the main drivers of LULC and urbanization by local people and key informants during group discussions and interviews. The global average annual temperature has increased slightly while the trend of annual average precipitation has slightly decreased. Unplanned horizontal development towards the outskirts of the city is caused by the lack of access to affordable housing and the resulting gap between supply and demand. In this context, failure to effectively define and implement sustainable urban development policies could have serious socio-environmental consequences, such as economic stagnation, poor infrastructure, poor quality of life and increased poverty. From a holistic urban management perspective, this could be a significant impediment in the future, requiring immediate attention from government and other stakeholders.

37. CLIMATE CHANGE: A COMPARATIVE ANALYSIS ON THE EFFECT OF NATURAL DISASTERS ON THE DEVELOED AND DEVELOPING COUNTRIES

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KEYWORDS: Climate Change, Disasters, Preparedness, Communities

ABSTRACT

One of today's most urgent global concerns is climate change, mostly caused by human activity. It is still a frequently disregarded and underrated man-made disaster despite its extensive effects. Natural disasters represent a pervasive global challenge, affecting nations and communities with increasing frequency and severity. This study conducts a comprehensive comparative analysis of natural disasters that have occurred in Turkey and Pakistan. By examining trends, impacts, and disaster preparedness efforts in both countries, this research aims to shed light on the unique vulnerabilities and responses in these diverse regions. This study provides an overview of the types and frequencies of natural disasters in Turkey and Pakistan, drawing from historical data. It explores the underlying geographical, climatic, and geological factors that contribute to the distinct disaster profiles of each nation, including earthquakes, floods, landslides, and extreme weather events. Furthermore, the research delves into the socio-economic consequences of these disasters, evaluating their impact on infrastructure, human lives, and the economy. Through quantitative and qualitative analysis, it seeks to identify commonalities and disparities in disaster resilience and recovery efforts, emphasizing the role of government policies, community engagement, and international cooperation. In addition, the abstract highlights key lessons learned from past disasters in both countries and their implications for future disaster management strategies. It examines the effectiveness of early warning systems, emergency response mechanisms, and disaster risk reduction initiatives, drawing insights from the experiences of Turkey and Pakistan. This comparative analysis contributes to the broader discourse on disaster management and resilience-building in regions prone to natural hazards. It underscores the significance of context-specific approaches to disaster preparedness, highlighting the importance of adaptive strategies tailored to the unique challenges faced by Turkey and Pakistan. As natural disasters continue to pose formidable threats to communities worldwide, the findings of this study provide valuable insights for policymakers, researchers, and disaster management practitioners, aiming to enhance the resilience of these two nations and contribute to global disaster risk reduction efforts. This study highlights the urgent need for solutions for mitigation and adaptation while illuminating the many facets of climate change as a major disaster and calamity.

38. SAR BASED FLOOD MAPPING AND IMPACT ASSESSMENT UNDER COUPLED MODEL INTERCOMPARISON PROJECT PHASE 6 SCENARIOS IN TRANSBOUNDARY CHENAB RIVER, PAKISTAN

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KEYWORDS: SAR, DEM, GCMs, Hec-GeoRAS, Remote sensing

ABSTRACT

Real time flood mapping and impact assessment is crucial for climate induced natural disasters and emergency response. In this research, Salal reservoir on the transboundary River Chenab was monitored using Synthetic Aperture Radar (SAR) Sentinel satellite data. Different methods of SAR flood classification were utilized. Digital Elevation Model (DEM) data was utilized for generating Area Elevation Curve (AEC) whereas changes in water level of Salal reservoir were monitored using SAR data. This study also evaluates various climate scenarios on flooding by identifying future streamflow, flow change and floodplain flows regarding future greenhouse gas emissions. Various General Circulation Models (GCMs) were utilized to create historical (1986–2014) and future (2022–2100) scenarios to assess the risk of flooding due to changes in flow under future climatic conditions using Coupled Model Intercomparison Project Phase 6 (CMIP6). The Delta Correction (DC) method was used to correct biases in the CMIP6 data to reduce uncertainty. Based on precise multimodal coupling data, different statistical distributions such as the Generalized Extreme Value (GEV), Log-Pearson's Type III, and Gumbel distribution were used to assess the flood return period for various climate conditions. The Delta Change Method (DCM) was utilized to estimate future peak flows, where the Delta Change Factor (DCF) assisted in estimating different design flood events. The threshold technique achieved the best results whereas K-means clustering also performed well for flood mapping. Changes of water reservoir using AEC and water level of Salal reservoir were maximum prior to the spillways opening. SAR based methods were considered accurate and low cost for flood mapping and monitoring in transboundary rivers. SSP 3-7.0 had the highest projected streamflow out of all the projections along with final processing results from Hec-GeoRAS which was processed into HEC-RAS model to generate flood hazard maps and flood inundation maps. The future flow was then used to estimate and project the future floods flow. The results from the calibration and validation revealed good simulation of the river Chenab streamflow values of HEC-RAS. The results indicate that flood inundation extent will increase in the future, suggesting a higher flood hazard. This study emphasizes the significance of projecting future flood hazards and using predicted climate data to obtain crucial evidence for developing effective floodplain management strategies.

39. ASSESSMENT AND RISK MAPPING OF GLACIAL LAKE OUT FLOOD PRONE AREAS FROM GORASHI CLUSTER OF LAKES USING GEO-INFORMATICS TOOLS

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KEYWORDS: GIS, RS, HKH, Disasters, GLOF

ABSTRACT

People living on mountains are faced with disasters such as landslides, avalanches, rainfall flash flood, earthquakes, snow fall flash floods and GLOF events. With climate change, the frequency of such disasters is expected to increase. Pakistan is one of the most adversely affected countries due to climate change because of glaciers depletion in Hindu Kush, Karakorum and Himalayan (HKH) region. The HKH region is considered as a Hot spot for climate change effects. Pakistan does not emit much greenhouse gasses that are responsible for global warming and thus climate changes as compare to developed country. The climatic condition in HKH region dramatically affects it's the land and economy of Pakistan due to heavily intensity of flash floods and landslides. The Gorashi lakes consist of eight glacial lakes formed due to a landslide and if any of those lakes breaks, water volume of Gorashi can be increased at such an extent which causes landslide. The water flow from Gorashi lakes can cause heavily floods with landslide material. This type of event can be disastrous for downstream villages such as Ghandoos, Kharmang and GambatBrok. The GLOF event trigger flash flood, if any event GLOF event occurred on upper side of blocked Gorashi lake that will make heavy flood like situation downstream of the lake. Using Geo-Hec software drainage network extracted from DEM (Digital Elevation Model).

40. CLIMATE-INDUCED NATURAL DISASTERS LEADING TO NUTRITIONAL CRISES IN MOUNTAINOUS COMMUNITIES

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KEYWORDS: Mountain, Communities, Malnutrition, Climate, Disasters Nutritional, Crises

ABSTRACT

Mountainous communities worldwide face an escalating threat from climate-induced natural disasters, which are precipitating nutritional crises of alarming proportions. Climate change is amplifying the occurrence and intensity of extreme weather events, including floods, landslides, droughts, and wildfires, disproportionately impacting these geographically vulnerable regions. This delves into the intricate dynamics linking climate-induced natural disasters to the deteriorating nutritional conditions of mountain communities. The aim of this study is to explore the complex interplay between climate-induced natural disasters and their adverse effects on the nutritional well-being of mountain communities. Mountain regions are characterized by fragile ecosystems and limited agricultural land, making them highly dependent on the delicate balance of climate conditions. However, as global temperatures rise, mountainous areas are witnessing altered precipitation patterns and the melting of glaciers, leading to an increased incidence of flash floods and landslides. These sudden disasters often result in the destruction of vital infrastructure, including roads and bridges, which can impede the delivery of food aid and access to markets, further exacerbating food insecurity. Moreover, prolonged droughts and erratic weather patterns are wreaking havoc on crop yields and livestock, diminishing food production. The challenges posed by geographical isolation and constrained resources make it increasingly arduous for mountain communities to cope with the relentless onslaught of climate-induced shocks. Consequently, malnutrition rates are surging, particularly among the most vulnerable segments of these communities, namely children, women and the elderly. To mitigate the nutritional crises engulfing mountainous communities, a comprehensive approach is imperative. This entails the reinforcement of early warning systems, the enhancement of disaster preparedness and response mechanisms, the promotion of sustainable agricultural practices, and the diversification of livelihoods. Furthermore, international collaboration and concerted climate change mitigation endeavors are pivotal in reducing the frequency and ferocity of climate-induced natural disasters, thereby fortifying the nutritional security of mountain communities. In conclusion, the mounting peril of climate-induced natural disasters in mountainous regions poses an existential threat to food security and nutrition. Swift and collaborative interventions are essential to tackle these vulnerabilities and cultivate resilience among mountain communities grappling with the relentless impacts of climate change.

41. DISASTER EDUCATION: PREPARING CHILDREN FOR DISASTER MANAGEMENT

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KEYWORDS: Disaster, Children, Earthquakes, Climate Change, Risk Reduction

ABSTRACT

Schools are a center of social learning and networking for children and play an important role in learning about disaster mitigation activities a child can learn. The Government of Pakistan has initiated a number of different program aimed at teaching disaster management to school going children. Programs' effectiveness is yet to be objectively measured. (Shah, Gong et al. 2020). A number of studies on disaster management highlight that the number of natural disasters (frequency and severity) has increased in the recent years and raises new climatic issues for both developed and developing countries (White, Pelling et al. 2005) and (Shah, Shaw et al. 2019). A vulnerable group in these disasters specially floods and earthquakes is children accounting for more than 50% of affected ones (Seballos, Tanner et al. 2011). Injuries include casualties, physical injuries, severe illness, physical invalidity and psychological depression as a result of loss of loved ones and sometimes migration (Tuladhar, Yatabe et al. 2014).

Climate control is a long term effort that will yield in decades and not in years. However, to reduce its devastating impact on children, disaster education is necessary to prepare children to manage in times of any unforeseen disaster (Shaikh, Pal et al. 2021). Educating children to be ready and prepared for any disaster is the quickest way to reduce the impact of these calamities. There are different studies on disaster education to children. These studies include (Jaffar, Reba et al. 2023) on "Disaster Risk Reduction Curriculum Integration", (Mutasa 2016) on "A critical analysis of the integration of Disaster Risk Reduction in Primary School Curriculum", (Tanveer and Mashhadi 2020) on "Perception of Secondary School Teachers Regarding Emergency Education in Pakistan", (Wu, Yang et al. 2022) on Disaster knowledge and disaster avoidance behavior in China, (Wang, Peng et al. 2022) on Disaster education and risk perception among many other papers. There are different ways disaster education takes its shape. A number of models were identified by (Aroyandini, Rusilowati et al. 2023). The early childhood education involves fun and stories using classroom and outside the classroom activities. Elementary school activities include camping, disaster drills, learning cohesiveness and also smartphone usage. Secondary education takes another advanced level and run disaster preparedness exercises, and for Tertiary and college level, method includes blending these exercises with managerial roles. The current study aims at identifying different educational programs for kids in Pakistani schools to prepare them for any natural disaster so that they may combat the disaster with preparedness and incur as little loss as possible.

42. RESIDENT PERCEPTION OF IMPACT OF CLIMATE CHANGE ON RURAL LIVELIHOOD AND FOOD SECURITY: EMPIRICAL EVIDENCE FROM GILGIT-BALTISTAN

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KEYWORDS: Food Security, Climate Change, Rural Livelihood

ABSTRACT

Climate change is the key concerned of today's global village due to its long-term disastrous impacts on society. The effect of climate change on natural resources, the economy, food protection, health and living conditions is serious. Climate changes often threaten rural livelihoods; as rural people depend on natural resources. Gilgit- Baltistan region is also among the regions, which are facing environmental issues for example, deforestation, land degradation and biodiversity losses due to recent rise in economic activities. The current study aimed to explore the resident perception of climate change influences on rural livelihood and food security. The researchers have utilized the PLS-SEM technique for the empirical investigation. A questionnaire has been developed to collect the primary data is collected from the selected villages of the Gilgit-Baltistan. According to the study's findings, the study area's food security is negatively impacted by climate change. Additionally, the majority of people believe that climate change is negatively impacting physical capital.

43. CLIMATE CHANGE: A CASE STUDY OF NON- TRADITIONAL SECURITY THREATS FOR PAKISTAN

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KEYWORDS: Pakistan, Climate Change, Non-Conventional, Security, Mitigating

ABSTRACT

This research study investigates climate change as a non-conventional security threat for Pakistan. Extreme weather events, water scarcity, and population displacement are just a few of the difficulties Pakistan is facing as the effects of climate change become more pronounced worldwide. These difficulties could make the region's current security problems worse. As a complex global issue with substantial security ramifications, climate change is now more widely acknowledged to go far beyond environmental issues. The non-traditional security risks that climate change poses to Pakistan through a case study that focuses on that nation. Pakistan is particularly vulnerable to the negative effects of climate change due to its diverse topography, populace, and socioeconomic vulnerabilities. It emphasizes the relevance of adjusting to changing climatic circumstances to guarantee a more resilient and secure future for Pakistan and the wider region. It also emphasizes the importance of regional and international collaboration in mitigating climate change's impact on security.

44. EXPLORING PERCEPTIONS OF HEAD TEACHERS, TEACHERS, AND STUDENTS REGARDING CLIMATE CHANGE EDUCATION IN THE MIDDLE SCHOOLS OF DISTRICT GHIZER, GB

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KEYWORDS: Climate Change, Education, Knowledge, Teachers, Schools

ABSTRACT

Global urgency to address climate change challenges is increasing and climate change education is considered short, medium and long term solution to this phenomenon. Combating climate change is pivotal for the sustainable development and climate change education is cost effective solution to achieve it. Climate change education instills the climate friendly knowledge, skills and behaviors in the students. The purpose of this research study was to explore the perceptions of head teachers, teachers, and students regarding climate change education in the middle schools of Puniyal region of district Ghizer. Under qualitative research paradigm, a phenomenological study was conducted in two government middle schools (one boys and one girls) of the heavy flood hit (2022) village of *Bubar* in district Ghizer. The sample included two principals, 8 teachers, and 12 students from each of the selected schools. Data collection tools included semi-structured interviews with principals, focused group discussion with the teachers and students, classroom observations, general school observation and document analysis. Findings revealed participants perceived the need of reorienting the climate change education, pedagogical implication of climate change, aligning the local and global perspectives of climate change education, learning climate change education to act, and challenges to the implication of climate change education. Findings further revealed some coherency between climate change education in the subject areas they teach. Overall, the participants of enquiry expressed general and specific meaning of the climate change education in their personal and professional life. Findings further indicated to transform the curriculum and enrich it with the climate change education. This research study has significant implication for reforming the existing curriculum and enriching the curriculum with climate change education.

45. UNLOCKING THE BARRIERS IN THE ADOPTION OF BIG DATA IN THE HEALTHCARE SUPPLY CHAIN

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KEYWORDS: Barriers, Big data (BD), Healthcare supply chain (HSC), Natural Disaster, VIKOR method

ABSTRACT

The integration of big data (BD) into the healthcare supply chain has the potential to revolutionize the industry, improving efficiency, reducing costs, and enhancing patient outcomes even in natural disasters. However, the successful implementation of BD solutions in healthcare supply chains faces numerous barriers that warrant comprehensive investigation. This study seeks to explore and analyze the impediments and challenges hindering the adoption and effective utilization of BD in healthcare supply chains. This research study aims to investigate the intricate interplay of barriers within a specific context by employing the Multi-Criteria Optimization and Compromise Solution, known as the VIKOR method. The study's focus is on understanding how various barriers interact and influence decision-making processes. By applying the VIKOR method, this research offers a unique perspective on tackling complex challenges through optimization and compromise solutions, ultimately contributing to enhanced decision-making strategies in the examined domain. These barriers encompass data governance perspective, technological and expertise perspective, and organizational and social perspective. The outcomes of this research will provide valuable insights for healthcare stakeholders, including supply chain managers, policymakers, and technology providers, facilitating a better understanding of the impediments that need to be addressed to realize the full potential of BD in healthcare supply chains. As healthcare systems continue to evolve and strive for greater efficiency and patient-centric care, overcoming these barriers will be instrumental in leveraging BD as a transformative force in the industry. This study contributes to the ongoing discourse on the implementation of BD in healthcare supply chains, offering a roadmap for organizations to navigate the challenges and unlock the benefits of this data-driven paradigm shift.

46. UTILIZATION OF WEB GIS IN FORESTRY DRIVE FOR DISASTER RISK REDUCTION AND MITIGATION

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KEYWORDS: WEB GIS, Climate Change, NDVI, Natural Disasters

ABSTRACT

Pakistan is a country which is among the top ten countries vulnerable to climate change. Combating climate change requires very serious initiative one of the most effective ways is by increasing the forest coverage. Forests present a unique way of combating natural disasters as they are able to absorb carbon dioxide (CO₂) and thus greatly reduce the effects of this heat-trapping gas, mitigate local flooding, and stop soil erosion. In order to effectively mitigate the natural disasters Pakistan requires tree plantation on a large scale. Plantation sites need to be scrutinized and cataloged and the effects of pre and post plantation needs to be measured. GIS Technology can be utilized to effectively manage, monitor, and evaluate the impact of various plantations in Pakistan. It can be critical in the visualization of both the initial conditions and the subsequent effects of plantation initiatives on diverse sites throughout the country. A combination of GIS Technology with the web can yield the Web GIS which can provide an interactive tool for the researchers and general public as well. NDVI (Normalized Difference Vegetation Index) can be utilized to visualize the vegetation density within a specified area along with assessing the change in plant health. Coordinate data for the plantations along with the localized NDVI can be used to visualize the pre and post-effects the plantations have on that area. The above-mentioned techniques can be utilized in collaboration to select plantation sites that are more effective in stopping soil erosion and preventing local flooding.

47. ADAPTATION PLANNING FOR FLOOD RISK REDUCTION IN URBAN AREAS OF PAKISTAN

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KEYWORDS: Adaptation Planning, Floods, Disaster Risk Reduction, Climate Change Adaptation, Urban Planning

ABSTRACT

Climate change has increased the frequency, intensity, and severity of floods in urban communities. Flood risks and vulnerabilities are observed more in urban areas with limited coping capacity. Urban adaptation planning is an emerging concept that aims to enhance capacities, lessen vulnerabilities, and make informed decisions against natural and human-induced hazards. Several frameworks were developed with varying levels of scope and depth in terms of scale, dimensions, and components. However, they lack integration among disaster risk reduction, climate change adaptation, and urban planning domains. This study aims to develop an urban adaptation planning framework for effective flood risk reduction in flood-prone urban communities. Current literature on the respective domains and their dimensions, aspects, and approaches were critically reviewed. Considering their core elements and linkages, an integrated framework is proposed. The framework highlights the role of urban planning and governance in effectively managing the impacts of urban floods. The framework can be used to understand urban flood risks and vulnerabilities and the underlying concepts and linkages and can be tested further through empirical investigations.

48. SPATIOTEMPORAL MODELING AND MAPPING OF SOIL EROSION, SEDIMENT DELIVERY, AND RETENTION SERVICES IN THE TERRESTRIAL ECOSYSTEM OF PAKISTAN

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KEYWORDS: Soil erosion, vegetation cover, soil retention services, sediment delivery, precipitation

ABSTRACT

In Pakistan, a developing country, soil erosion (SE) has emerged as a pressing environmental issue due to higher poverty rates and overexploitation of natural resources, exacerbating climate change consequences. To address this concern, the SDR model and RUSLE model were utilized for a spatiotemporal analysis of erosion and retention services in Pakistan's landscape, using three decades of historical data from ERA-Interim and World-Climate to explore the erosivity factor. Findings revealed that areas without vegetation cover had a mean SE rate of 6.06 t/ha/y, but with vegetation cover, it decreased significantly to 2.2034 t/ha/y, resulting in a mean retention service of 4.46 t/ha/y. Mean sediment exported was 0.75 t/ha/y, while mean sediment retention was 1.25 t/ha/y. Vegetation cover, precipitation, and slope significantly affected the soil erosion process, with the RUSLE model overestimating compared to the SDR model. A positive linear correlation ($R^2=0.93$) between soil erosion rates estimated by both models from 1989 to 2020 was observed.

Regions with higher precipitation experienced more significant erosion rates, and locations with steep slopes and hills exhibited higher SE rates than flat plains. Vegetation cover played a critical role in determining nutrient and sediment flow. To mitigate soil erosion, conservation of natural resources should be incorporated into policymaking. Accelerating afforestation and reforestation efforts, like the billion tree plantation initiative, can positively impact Pakistan's terrestrial ecosystem sustainability. Implementing these recommendations can lead the country towards a more resilient and environmentally sustainable future.

49. EVALUATING LANDSAT DATA FOR GLACIAL ANALYSIS IN KARAKORAM, NORTH PAKISTAN

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KEYWORDS: Karakoram anomaly, Glaciers, climate change, third glacier pole

ABSTRACT

The ongoing collision of Indian and Eurasian plates in north Pakistan is reflected by the development of mountain belts including Pamir, Karakoram, and the western Himalayas. These mountains are evolving with the development of tectonic geomorphology and crustal deformation with earthquake and seismicity. Karakoram is the most dynamic region on earth in terms of active high mountains and tectonic geomorphology with a remarkable fluvial and glacial system. The second largest glaciers outside the Polar region are accumulated in Karakoram, such as Baltoro, Hispar, and Batura glaciers. The present study is carried out to understand the Karakoram anomaly in active mountain ranges such as Karakoram in this climate change era. GIS data (Satellite images and DEM data) with field validation were analyzed to conduct this study. Glaciers are generally oriented in NW-SE direction, similar to structural trends. The results demonstrate that snow accumulation has reduced from 44.02% in 2002 to 27.75 % in 2017. In general, glaciation is reported in the Karakoram ranges however, the Shimshal Valley and other parts of the study area indicate retreating of glaciers. From the results of satellite imagery, the Hispar and Baltoro glacier appears in equilibrium state. Further studies can be done by using high-resolution satellite imagery and ground-based data to properly monitor the glacier behavior in the study area.

50. SELECTION OF BEST SITES FOR CONSTRUCTION OF HOMES FOR THE FLOOD VULNERABLE PEOPLE

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KEYWORDS: Belief and Plausibility, BP-Distance Measure, BP-Similarity Measure,

ABSTRACT

Belief and plausibility measures are regarded as highly helpful approaches to express ambiguous information within the Dempster-Shafer Theory (DST) framework, including its generalization to fuzzy sets (FSs) and its expansions. Distance and similarity measures play an important role because of their applications in decision making, pattern recognitions, image processing, facial detection and clustering. Until now, DST is generalized to FSs and IFSs but as far as we know, no generalizations of DST to belief and plausibility intuitionistic fuzzy distance (BP-distance) and belief and plausibility intuitionistic fuzzy similarity (BP-similarity) are reported so far. Therefore, a novel belief and plausible intuitionistic fuzzy sets (BPIFSs) with their BP- distance and BP- similarity measures respectively are constructed under the framework of DST. The membership function is expressed as belief function and 1-nonmembership function (doubt function) is expressed as plausible function respectively. To show the reasonability of proposed BP- similarity measures, various numerical examples of pattern recognition, linguistic variables and clustering are stated. Finally, we use the modified ordered preference similarity to ideal solution (TOPSIS), to develop belief and Plausible TOPSIS (BP-TOPSIS) based on suggested distance and similarities. To test the validity of modified BP-TOPSIS, we employ it to manage daily life complex issues related to the selection of best site for construction of homes for the flood affected people involving multicriteria decision making (MCDM). Numerical examples related to linguistic variables and disaster management to attest the usability and practical applicability of our proposed method under the framework of DST to IFSs.

51. GLACIER LAKE INVENTORY AND GLACIER LAKE OUTBURST FLOOD RISK ALONG THE KARAKORAM HIGHWAY IN UPPER HUNZA, PAKISTAN

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KEYWORDS: Climate change, GLOF, Glacier Lakes Inventory, Hunza River Basin, Batura Glacier

ABSTRACT

On the planet Earth, global warming and climate change has resulted in shrinking of glaciers and a huge number of lakes have been appeared over the surface of those glaciers around the Globe. The consequences of Global warming have been witnessed in the mountainous regions of Hindukush Karakoram Himalaya. In the current study, glacier lake outburst flood (GLOF) risk assessment has been carried out in Hunza River Basin (HRB), and the study focuses to identifying lake inventory in the basin, assessing decadal dynamics (1990-2020) for lakes over Batura glacier and physical assessment of lakes, and evaluating GLOF vulnerability in the area. For making inventory of glacier lakes and decadal dynamics, Land Sat 8 satellites images were processed using Arc GIS software, while the physical observation of lakes were done through field visit and physically measurement of different parameters. House Hold questionnaire survey was conducted among Gulmit, Gulkin, Hussaini, and Passu in the tehsil GojalHunza using simple random sampling to assess the vulnerability of locals from the GLOF events. An inventory of 159 lakes were made over the glaciers of HRB, 78.38% of them falling below 0.01 km², 39 lakes were considered intermediate (0.01 km² - 0.05 km²), and 16 as larger lakes (0.05 km²- 0.5 km²). Positive trend was observed in the number of lakes on Batura glacier and 56 newly lakes were found over the glacier's surface from the period 1990-2020. Moraine dammed and supra glacial lakes were observed in the area of Batura glacier, having huge number of loose boulders in their moraine. Lakes were found with multiple numbers of inlets outlets, and seepages, while no trace of vegetation was found for the lakes over the glacier surface. Statistics of the questionnaire data shows that peoples in the region are well aware of GLOF and its associated hazards, and they have felt the changes in climate over time.

51. THE INFLUENCE OF MITIGATION STRATEGIES ON THE COMMUNITY: EVIDENCE FROM THE SELECTED VILLAGES OF THE GILGIT-BALTISTAN

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KEYWORDS: Mitigation, disaster, community, debris flow

ABSTRACT

The current research aimed to explore the influence of the mitigation strategies on local community in two villages i.e., Oshikhundass and Sher Qila. During the monsoon season of 2015 huge debris flow event occurred and almost 12 houses were completely damaged & 8 houses partially along with agricultural lands with standing crops and people were forced to leave in tents. Again, in the month of April 2016 a massive debris flow occurred and 3 houses damaged, people were again evacuated and shifted to emergency shelters. To reduce the damages in future, excavation of large ditches is carried out in 2018. Due to due to mitigation strategy adopted by AKAH the floods in 2022 did not damages the houses, agriculture land human displacement. Similarly, the same mitigation strategy adopted by AKHA in Sher Qila village. The outcomes of the mitigation strategies in both the villages have shown the reduction in damages to houses, agriculture land and human displacement in both villages.

52. A COMPARATIVE STUDY OF PREHISTORIC, HISTORICAL, AND POTENTIAL LANDSLIDE DAM SITES: A CASE STUDY FROM MAYOON TO ATTABAD ALONG CPEC IN HUNZA DISTRICT

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KEYWORDS: Landslide Dams; remote sensing; GIS techniques; RAMMS simulations

ABSTRACT

Landslide dams pose significant geohazard threats to communities and infrastructure along river valleys. This research presents a comprehensive comparative analysis of landslide dam occurrences, encompassing prehistoric, historic, and potential sites in District Hunza along the China-Pakistan Economic Corridor (CPEC)/Karakoram Highway (KKH). Employing a multidisciplinary approach integrating geological, geotechnical, and historical research methodologies and RAMMS simulations, the study aimed to understand the characteristics and implications of landslide dam events with safety and development concerns. Data collection involved extensive field surveys, remote sensing analysis, archival investigations, community interviews, subsequently analyzed using statistical methods, GIS techniques, and RAMMS simulations to identify and compare various attributes of prehistoric, historic, and potential landslide dam sites. The findings reveal distinctive features among prehistoric, historical, and potential landslide dam sites. These offer insights into the prolonged history of natural damming events, human settlements and infrastructure impact, and areas susceptible to future dam formation. Additionally, the study evaluates the economic, environmental, and safety implications of landslide dam occurrences within the specified area of interest, stretching from Mayoan to Attabad in District Hunza. This research enhances the understanding of how landslide dam events influence infrastructure planning in mountainous regions, offering a significant resource for policymakers, engineers, and researchers involved in similar global projects.

53. COMPARATIVE ANALYSIS OF TWO SPACE-BRONE DATASETS TO MAP THE SURFACE TEMPERATURE OF MOUNTAINOUS TERRAIN; A CASE STUDY OF KARAKURAM RANGE

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KEYWORDS: Karakoram Range, advanced satellite datasets, temperature metrics

ABSTRACT

Nestled within the towering peaks and deep valleys of the Karakoram Range exists a climatic puzzle that has long beckoned for comprehensive decoding. This research undertakes the formidable challenge of piecing together this puzzle by harnessing the dual strengths of advanced satellite datasets. With the Landsat-8's unmatched spatial resolution, we delve into the micro details, illuminating the nuanced temperature gradients across the range. Simultaneously, MODIS, known for its expansive temporal dataset, provides a broader lens, capturing overarching temperature trajectories from 2019 to 2021. At the heart of our research's methodology lies the steadfast role of ground stations. These strategically located stations, though finite in number, are pivotal in grounding the vast swathes of satellite data to tangible, ground-based realities which has never done before for this region. Their readings, when juxtaposed against satellite data, offer both a validation and a recalibration, ensuring the integrity of our findings. Emerging from this research is a multi-faceted understanding that transcends mere temperature metrics. The results unearth broader implications impacting regional water systems, ecological balances, and the evolving narrative of climate change in high-altitude terrains. Yet, while the insights are profound, they also pave the way for broader inquiries. The limited timeframe of our study and the scope for integrating more ground stations highlight potential avenues for future research. In culmination, this research encapsulates not just the journey and findings of our study but also stands as an invitation for deeper, more extensive explorations into the climatic heart of the Karakoram Range.

54 COMPARATIVE ANALYSIS ON SHISHPER AND KHURDOPIN GLACIER SURGING DYNAMICS AND GLOF HAZARD IN HUNZA RIVER BASIN, PAKISTAN

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KEYWORDS: Surging glacier, GLOF, Cascading hazards, Climate change

ABSTRACT

Understanding climate-glacier dynamics in High Mountain Asia (HMA) is essential for addressing a range of concerns, including water supply, mountain geodynamics, natural hazards, ecosystem sustainability, the water-energy-food nexus. A crucial aspect of this understanding involves gaining insight into glacier dynamics. Evidence of climate change is visible in mountain areas, where some glaciers are retreating while others are surging and, in some cases, generating hazards. The retreating and advancing behavior of glaciers has resulted in the formation of lakes by blocking valleys, ultimately leading to the occurrence of GLOFs in early summers. Recent events in northern Pakistan, such as the repetitive Shishper GLOFs over the last five years, and the Khurdopin glacier surge in 2017-18, which blocked the mainstream and formed a lake, have triggered cascading hazards downstream. The outburst floods resulting from these blockages have caused extensive damage to infrastructure, including hydropower facilities, bridges, roads, and water supplies. Additionally, they have led to the drying up of water irrigation channels, resulting in the loss of thousands of orchards with trees. The disruption of drinking water supply systems has compelled local communities to resort to unsafe water sources, which in turn has contributed to the spread of diseases. Furthermore, local communities have experienced severe electricity and water shortages for agriculture, leading to drought conditions in these areas. This has resulted in diminished drinking water supplies and restricted road access. The Karakoram glaciers have garnered scientific attention due to their anomalous behavior, with some glaciers surging while others are retreating. Shishper and Khurdopin glaciers, located in the Karakoram region of the Hunza Basin, are among the surging glaciers, and their dynamics have led to several GLOF events. The change in the global mean temperature has dramatically influenced the regional and local weather patterns worldwide. Moreover, liquid precipitation has increased, and winters have stretched and shifted. Mainly, the glaciers in Karakoram were influenced by winter snow for storage; now, with summer precipitation, glaciers above 4000-4500 get snow, and accumulation is higher than ablation, resulting in surging and advancing of glaciers. Through this study, a comparative analysis will be conducted for both glaciers to understand glacier dynamics and surge phenomena of these glaciers vis-à-vis temperature and precipitation climate change phenomena and its impact on these glaciers in terms of triggering GLOFs and its impact on the downstream.

55. CROSS VALIDATION OF GLACIAL LAKE OUTBURST FLOOD (GLOF) AND HAZARD MAP OF PASSU VILLAGE THROUGH MODELING USING RAMMS ON UAV-BASED DIGITAL ELEVATION MODELS (DEM)

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KEYWORDS: *GLOF, RAMMS Modeling, Aerial Photogrammetry for flooding, HVRA, Flood Simulation*

ABSTRACT:

Glacial Lake Outburst Floods (GLOFs) are one of the devastating geohazards in alpine glacial settings. Himalaya, Karakorum, and Hindukush regions have about one-third of the 25000 glacial lakes dammed by moraines, and some of these are potentially unstable (Ma-harjan et al., 2018). GLOFs are hard to predict as they may occur from the englacial (subglacial) lakes that are not visible from aerial or satellite images. Yet they are responsible for abrupt, unprecedented GLOFs events. Hunza Valley in the Karakorum region is home for over thousands of small and large glaciers, Batura, Khurdopin, Passu, Verzjerav, Shishper, and Yazghil Glaciers are some of the glaciers that are recipients of past GLOF events. Passu Glacier is one of the fast-receding, highly vulnerable glaciers which has triggered GLOFs in the past and present. On 13th May 2022, a massive discharge was recorded from the glacier which threatened houses and critical infrastructure on the main Karakorum Highway KKH. This study encompasses the study of Passu Glacier to investigate the potential impact of GLOF on the Passu village by using Unmanned Aerial Vehicles (UAVs) to generate high-resolution Digital Elevation Models (DEMs) for GLOF modeling using the RAMMS (Rapid Mass Movements Simulation) software. The simulations that have been created are based on various input field parameters such as lake volume, barrier failure scenarios, and downstream channel characteristics specific to Passu stream, which are used in the model. Additionally, this paper assesses the effectiveness of UAV-generated DEMs in GLOF modeling through RAMMS. It also validates the Hazard Vulnerability and Risk Assessment methodology, input parameters and output “hazard map of Passu” using the site-specific field parameters as mentioned above. At the same time the limitation of the hazard map which couldn’t reflect the flow velocities and variation in relative intensities. The high-resolution DEMs improve the reliability of GLOF simulations, providing an accurate representation of the glacial lake, run out profile and potential impact areas downstream and its surrounding. The modeled outputs offer valuable insights into flood inundation extent, flow velocities, and deposition patterns for the Passu Glacier area, which contribute to the HVRA validation.

56. QUICK HAZARD ASSESSMENT: AN EFFICIENT TOOL IN DESIGNING MITIGATION MEASURES FOR HAZARD SPOTS IN CHITRAL AND GILGIT-BALTISTAN, PAKISTAN

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KEYWORDS; Quick hazard assessment, Debris floods, Flash Floods, Mitigation measures, Risk reduction

ABSTRACT

The settlements in Chitral and Gilgit-Baltistan are always exposed to the natural hazards comprising landsliding, debris flooding, snow avalanches, flash flooding, glacial lake outburst flooding (GLOF), banks collapse, gully erosion, and seismicity. The recent shift in the climate trend has increased the frequency and intensity of these hazards drastically. Each hazard site requires extensive as well as intensive study and analysis to arrive at meaningful and effective remediation measures, which is always not possible given the tight budget, remoteness of the area and time constraints. The unavailability of hydrological and precipitation data is another challenge that usually must face while conducting a detailed analysis. In the absence of such data some assumptions have to be made to make study output conclusive. There is no means to verify these assumptions except back analysis of the past event or the future unfortunate event(s).

Alternatively, the consultants have devised a methodology for the quick hazard assessment for designing the mitigation measures. In this methodology, salient features are; to characterize the hydrology and geological and geotechnical parameters by desktop review and through site visits. Among the hydrological parameters are catchment area characteristics, types of streams, estimation of flows, available water ways, stream gradients, highest flood marks, among geological and geotechnical parameters are the geomorphology, surface distribution of soil and rock units, rock structure, vegetation type and cover, foundation conditions, evidence of slope instability or features, etc. These parameters are blended with the experience and review of available information to arrive at designing meaningful mitigation measures. The key to proposed interventions is effectiveness both in terms of efficiency and cost. About 150 sites have been mitigated using this methodology in Chitral District and Gilgit-Baltistan (GB) and were found efficient in achieving the target objectives. The success rate is quite high >90%. Efforts are always made to provide measures which are environment friendly and can be constructed from the local construction materials. To enhance life and maintain effectiveness of the provided measures, seasonal inspection repair/ maintenance or after every event is recommended mandatory. Among the mitigation measures, it was observed that clearance and channelization of streams is the most important and economically viable solution to reduce the risk against flood debris, flash flooding and banks erosion. However, it is stated that the quick hazard assessment is not an alternative to the detailed study required in places where magnitude and dynamics of

the hazards cannot be understood a site visit or a desktop review of the available literature. Such sites are always proposed for detailed topographical, geological, and hydrological studies for hazard & risk modelling/analyses for the design of mitigation measures.

57. MULTI-HAZARDS VULNERABILITY AND RISK ASSESSMENT IN HUNZA-PAKISTAN, THE CHALLENGES AND WAY FORWARD

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KEYWORDS: Landslide, debris flow, vulnerability, risk assessment, topological data. Pakistan

ABSTRACT

The physical, tectonic, environmental and climatological settings and anthropogenic activities coupled with the climate change in northern Pakistan, provide an ideal landscape for the frequent and damaging multi-hazards mainly landslides, debris flows, GLOF and earthquakes. However, given the complex terrains and data-poor region, comprehensive multi-hazard, vulnerability and risk assessment are rarely available for effective disaster management. Methodologies are developed to utilize the available data, techniques and models for regional-scale landslide, debris flow, GLOF and seismic hazards and risk assessments. Manual and semi-automatic techniques are applied to develop multi-hazard inventories that are related to the physical and environmental settings; and potential triggers to acquire the susceptibility and hazard assessments. The elements at-risk database comprising the settlement's footprints, topological information, communication network, landuse, critical infrastructure, and social vulnerability indicators are utilized for vulnerability assessment and eventually risk analysis. The morphometric analysis of the drainage basins and statistical models are useful for investigating the watershed susceptible to debris flows and for applying local scale simulation models. The element-at-risk features on the alluvial fan of the respective watersheds are analysed for their exposure, vulnerability and risk analysis. Seismic site characterization maps are produced through field-based measurements of the shear wave velocities and relevant proxies such as the geology and terrain slope. The GLOF hazard and risk are accomplished for the high-risk glacial lakes. The integrated multi-hazard is analysed with the element at-risk databases for the multi-hazard vulnerability and risk assessment. Considering the unprecedented devastation caused by the intense monsoon in 2022, dynamic and quantitative risk assessment and adaptation/mitigation planning are critical for disaster risk reduction and therefore offer opportunities for collaboration for joint research studies on climate change impacts on dynamic multi-hazard risk assessment in the region.

58. ROLE OF AGA KHAN AGENCY FOR HABITAT (AKAH) IN SUSTAINABLE AND RESILIENT DEVELOPMENT IN PAKISTAN

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KEYWORD: Natural Hazards, Climate Change, Climate Resilient, Communities, AKAH

ABSTRACT

Natural Hazards are posing substantial risk to sustainable development across the globe. Pakistan is among the top 10 climate vulnerable countries suffering from impacts of climate change and its induced disasters, amplified due to weak community resilience and emergency preparedness, and a combination of geographic, socioeconomic, and environmental factors. Sustainable and resilient development in a country like Pakistan is crucial to address the challenges posed by climate change, while promoting socio-economic growth and well-being. This requires a multi-faceted approach combining Disaster Adaptation, Mitigation & Resilience, covering rehabilitation of degraded land, habitat loss, offsetting carbon emissions, and conserve biodiversity.

There is a need to mainstream environmental and climate concerns into national development planning processes. Climate Change Policy describes the adverse effects on the country's ecosystem with decreased productivity, alterations in composition of species, decreased forest cover, unfavorable conditions for biodiversity and massive increase in disasters and hazards. Sustainable development should consider marginalized and vulnerable communities disproportionately affected by climate change and keep inclusivity in planning and implementation.

Building climate-resilient habitats is not just an investment in our future; it's a commitment to foster sustainable growth and global recovery in a world shaped by environmental stewardship. There is a need to invest in climate research and data collection to better understand local climate impacts and adapt development strategies accordingly. Addressing vulnerabilities requires a combination of adaptation strategies, improved infrastructure, increased climate resilience, and global cooperation to mitigate the drivers of climate change. The Aga Khan Agency for Habitat is an apex agency under the umbrella of AKDN, playing a leading role to address the climate related challenges, through improving community resilience at grass root level and providing services, so that the communities can thrive. AKAH Pakistan has revived its global and country strategy for 2023-27, with a commitment to leverage innovative technologies for the benefit of the vulnerable population, underscoring its dedication to sustainability and responsible & committed approach towards environment protection and reduction of carbon emissions. By working in partnership with communities, government, and stakeholders, employing sustainable practices, and addressing the unique challenges of human habitats, AKAH Pakistan is contributing significantly to improving living conditions, transforming dreams into the reality of growth, recovery, and a brighter future for communities, paving the way for a sustainable tomorrow.

59. VARIABILITY OF SOIL PROPERTIES IN DIFFERENT FLASH FLOOD-RISK ZONES IN GILGIT RIVER BASIN, NORTHERN PAKISTAN

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KEYWORDS: Soil Morphology, Soil Carbon, Soil Total Nitrogen, Soil Texture, Flood Risk Zone

ABSTRACT

The study highlights the importance of understanding and managing the consequences of flash floods, especially in mountainous ecosystems like the Gilgit River Basin. The study evaluate the effects of flash flood on soil physicochemical properties in mountainous ecosystem of Gilgit River Basin. In this study, we carried out soil sampling and laboratory analysis of soil properties, including organic carbon (SOC), phosphorus (P), soil total nitrogen (TN), potassium (K), pH and soil texture in different flood-risk zone and in no-flood zone. We used a paired-site approach to measure the effects of flash floods on soil properties in riparian zones of the Gilgit River Basin, and further implemented statistical analysis on experimental datasets as to determine soil differences between flood zone and no-flood zone. Flash floods significantly altered various soil properties, including: Firstly, it indicated that soil properties were significantly changed after flash floods; Flash floods likely brought in sediments and debris, leading to an increase in rock fragments in the soil. these resultant changes, particularly in regard to high rock fragments. The pH value of the soil likely shifted due to changes in the composition of floodwaters. Silt content increased, while clay and sand content decreased, possibly due to sediment deposition and erosion. Decreased total nitrogen and organic carbon: Flash floods may have washed away or leached these nutrients from the soil. These changes can have significant implications for soil fertility and agricultural productivity. No significant differences were observed in exchangeable potassium and available phosphorus between flood-prone areas and no-flood zones. This suggests that these soil properties were relatively unaffected by the flash floods, possibly due to their inherent stability or the specific nature of the flood events. The changes in soil properties, particularly the decrease in total nitrogen and organic carbon, can have adverse effects on soil fertility. Reduced fertility can limit agricultural productivity, which is critical for the livelihoods of local communities. The deterioration of soil properties can also negatively impact riparian ecosystems, as the health of the soil directly affects plant and animal life in the area. The findings from this study can inform local policymakers and land managers about the potential long-term consequences of flash floods in the region. It underscores the need for implementing strategies to mitigate the impacts of flash floods, such as soil conservation practices and land-use planning in flood-prone areas. It provides practical data that can be used for re-farming, revegetation, and land management strategies. Rebuilding soil fertility and

resilience is crucial for sustainable land use. The data and insights generated can be valuable for both immediate recovery efforts and long-term land management and conservation strategies.

60. CLIMATE-INDUCED HAZARDS, AND IMPACT ASSESSMENT IN SHIGAR AND KHAPLU VALLEY, BALTISTAN, PAKISTAN

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KEYWORDS: Water Induced Hazards, Land use, Remote sensing, People's Perceptions.

ABSTRACT

Natural hazards and disasters are very common events across the globe and in countries like Pakistan due to rapid climatic change. Over the past few decades, the areas of Shigar and Khaplu of the Baltistan region in the Karakoram Mountains have been prone to impacts of climate change like water-induced hazards. This is because the area is covered with numerous glaciers and snow cover. The aim of this study is to analyze the damages that occurred in various land use practice areas mainly agriculture, barren, and watershed. This study evaluates the degree of vulnerability and impacts of climate change in thirteen small towns or villages in the Shigar District and nine small towns in Khaplu main town of the Ghanche District of Baltistan region. This study employs the people's perceptions through questionnaires and Focus Group Discussions (FGDs) of various affected groups and remote sensing data to analyze the impact of floods in the area. The results indicate that that 90% of the people perceived the experience of climate change and water-induced hazards occurrence in Shigar while 63 % of the people in Khaplu area in the last 30 years. The remote sensing analysis indicates that the percentage of area change between 2000 to 2018. In the year 2000 water bodies cover 16.04% of the area in the Shigar. After one decade in 2010 percentage of water bodies area increased to 25.18% due to floods. Conversely, the flood area percentage of water bodies decreased gradually in 2013, 2014, and 2017 to 22.77%, 16.23%, and 16.89% respectively. Similarly, in Khaplu area 20.1% of the area was covered with water bodies in the year 2000. The percentage of water bodies increased to 40.28% due to floods in the year 2010. Conversely, the percentage of water bodies decreased to 24.46%, 18.7% in 2013, and 2014, and again increased to 35.25% due to floods in the year 2017. This study gives an indication of the impact of climate change in the area and encourages further research to help the mountain communities cope with the challenges of climate change.

61. MACHINE LEARNING ALGORITHMS FOR EXTRACTION OF GLACIAL LAKES USING GROUND RANGE DETECTED (GRD) DATA: A CASE STUDY FROM HUNZA RIVER BASIN, PAKISTAN

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KEYWORD: Batura, Supervised Classifiers, Glacial Lakes, Hunza river basin,

ABSTRACT

In the Karakoram mountain range, glacial lakes are essential elements of the cryosphere. As a function of climate change and increasing temperature, these glacial lakes are threatening downstream existence and the ecosystem by short time glacial lake outburst floods (GLOF). Therefore, Glacial Lake mapping technique is vital task to observe GLOF hazards. In this study, microwave Sentinel-1 Ground Range Detected (GRD) data is used. It has dual polarization capability (HH+HV or VV+VH) and ability to penetrate even through clouds or any type of weather condition. The objective of the study is to explore the application of GRD data and to evaluate the efficiency and accuracy of machine learning algorithms for the extraction of glacial lakes. The study method is based on two main procedures, GRD backscattering analysis and supervised Machine Learning classifiers. The most commonly used machine learning classifiers are considered: Random Forest (RF), K-nearest neighbor (KNN), and Maximum Likelihood. Although both procedures show better results for glacial lakes mapping in the study area that is the mean backscatter parameter has the best accuracy rate than others in total backscattering analysis. Likewise, in the classification approach, accuracy assessment was executed by comparing the results obtained for each classifier with the reference data. For all experiments, KNN performed the best at given training samples (Accuracy= 93%, Error rate =0.06%) for both classes, compared to RF (Accuracy= 92%, Error rate =0.07) and Maximum Likelihood (Accuracy= 90%, Error rate =0.09%). The high classification accuracy obtained to extract glacial lakes using our approach will be useful to determine the short time flood outburst and take future precautionary measurements.

62. BUILDING HUMAN AGENCY AND RESILIENCY IN A RAPIDLY CHANGING CLIMATE WITH DISASTERS

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KEYWORDS: Climate Change, Resiliency, Human, Disasters, transformations, mitigation

ABSTRACT

In a world marked by rapidly changing climate patterns and an increasing frequency of disasters, the need to cultivate human agency and resiliency is more pressing than ever. This abstract explores the multifaceted challenges posed by climate change and its associated disasters, highlighting the essential role of human agency and resiliency in addressing these issues. Drawing from various disciplines and real-world experiences, this abstract delves into the key concepts of agency and resiliency, shedding light on their significance in the face of climate-related upheavals. Through the lens of both individual and collective agency, the abstract discusses the strategies and practices that empower individuals and communities to adapt, mitigate, and recover from the impacts of climate change. Moreover, it emphasizes the crucial interplay between internal and external transformations for sustainability and climate action. In light of a rapidly changing climate, this abstract serves as a foundational guide for understanding the importance of building human agency and resiliency, offering a path toward a more adaptive and sustainable future.

63. PREVAILING CLIMATIC TRENDS PERSPECTIVE IN KARAKORAM MOUNTAIN RANGE, UPPER INDUS BASIN, PAKISTAN

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KEYWORDS: climate change, precipitation, solar radiations, relative humidity, Barpu glacier,

ABSTRACT

In this study climatic variability trends in the Karakoram Mountains range of the Upper Indus Basin (UIB) was studied. The data obtained from two stations including WAPDA (1995-2010) and PMD (1986-2015) were analyzed for mean annual and seasonal trends. Results showed decline in mean seasonal (summer, winter and autumn) minimum and maximum temperature and solar radiation, while increase in temperature observed during the spring season. Moreover, an increase in seasonal precipitation except spring season and increase in mean maximum and minimum relative humidity were observed in all seasons. The mean thickness of supra glacier debris at central Karakorum region (Barpu glacier) was measured 1–1.5 feet at the study area (ablation zone). Questionnaire study was also conducted to record the indigenous perception. According to the local inhabitants, the rate of retreating of Barpu glacier is slowly and no considerable changes of snout observed during the last two to three decades. It is also confirmed by taking snout coordinates during the year 2013 and 2016, so there is no any fluctuation of snout throughout the study period. Due to decrease in seasonal (summer, winter and autumn) temperature, solar radiation, increase in summer and winter precipitation and all seasonal relative humidity consequently facilitate the establishment of Karakoram anomaly. Therefore Barpu glacier in central Karakorum shows stable or low melting rate. The glaciers in Karakorum region shows diverse response to global warming as their counterpart elsewhere.

64. FLORISTIC DIVERSITY ASSESSMENT AND ETHNOBOTANICAL STUDY OF KHUNJERAB NATIONAL PARK (KNP), PAKISTAN

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KEYWORDS: Diversity, Ethnobotany, Indigenous knowledge, Inventory, Khunjerab National Park,

ABSTRACT

Khunjerab National Park (KNP), is one of the famous national park of Pakistan. It is the third largest national park locate on the gate way of Pakistan China economic corridor (CPEC), adjacent to the Taxkorgan Natural Reserve of people republic of China. The present study aims to document the floristic distribution and record of indigenous knowledge about medicinal plants in ten selected Nallahs of Khunjerab National Park, Pakistan. Field visits were conducted during the month of June-July and Aug-Sep, 2021-22 to collect information about medicinal plants in the area. Ecological information about medicinal plants were collected by using purposeful sampling methods and use Global Positioning System (GPS) for proper location identifications. The ethnobotanical information was collected from 100 knowledgeable local people and health practitioner by using semi structured interview and questionnaire. A total of 72 plant species belonging to 57 genera and 35 families have been found to be used by the local people for curing various diseases. The most important medicinal plants of the study area belong to families Asteraceae, followed by Rosaceae, Brassicaceae and Polygonaceae. About 30 types of ailments were treated with various parts of the 72 medicinal plant species. For treating ailments, the use of the aerial part was higher (61%) followed by leaves (10%), flowers and berries (8%).

Due to poor collection practices and storage, overgrazing and anthropogenic activities, medicinal plants of this area are under pressure and in verge of extinction and there is an urgent need to provide awareness regarding conservation strategies, sustainable utilization and management of medicinal plants with special focus on medicinal plants that are used widely and traded outside the region. Overall, this study provides useful baseline information on medicinal plants distribution and traditional knowledge and could play a vital role in conservation of medicinal plants. Indeed, it's time to establish regional flora, display it with a digital herbarium and develop conservation strategies especially for the endemic and endangered flora of this ranges before going to extinction.

65. EXAMINING THE ROLE OF GREEN SPACES IN MODERATING THE LAND SURFACE TEMPERATURE EFFECT IN GILGIT CITY

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KEYWORDS: Land use land cover, Gilgit City, Remote Sensing, GIS, land Surface temperature

ABSTRACT

Rapid urban expansion has negative impacts on Land-use Land-cover (LULC) by changing vegetation with built-up areas, which leads to an increase in Land Surface Temperature (LST). Rapid urbanization has taken place in Gilgit city because of population growth and large population inflows from other regions in northern Pakistan. The main purpose of the proposed study is to assess the impact of LULC changes on LST trends in Gilgit city and to control the urban heat island (UHI) by increasing green spaces. The study will be based on Landsat Satellite (TM, ETM and OLI) data for 1990, 2000, 2010, 2020 and 2022. In addition, field surveys will be conducted to verify the accuracy of satellite imagery. Remote Sensing Indices such as the Normalized Difference Vegetation Index (NDVI), and Normalized Difference Water Index (NDWI) will be calculated. The Land Surface Temperature will be recaptured from the Thermal band of satellite images. The link between LST and indices such as NDVI, and NDWI will be assessed by correlation analysis. Supervised Classification with Machine Learning (ML) Algorithms will be used to determine land-use types from remote sensing data.

67. ICE STUPAS: THE ARTIFICIAL GLACIERS HELPING COMBAT THE EFFECTS OF CLIMATE CHANGE IN CENTRAL HUNZA, PAKISTAN

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KEYWORDS: Climate Change, Ice stupa, Artificial, Governance, farming

ABSTRACT

The current study is experimented in Hyderabad/Karimabad Nallah (stream) in Hunza valley district Hunza, Pakistan. Ice stupa artificial glacier what we attempt to freeze water in winter when nobody need and still stream flow, is not useful anyway. The piped water from the stream way up in the valley for this one, it is about 0.5km away and bring water to the ice stupa. So in December, January and February, when there is still water in the stream and nobody need or as such high demand to farming. The piped water brought down stream; it is very simple science that water want to maintain its level in a pipe that 40m height. Here in the pipe water want to that height, there is pressure go to that height. Therefore, we take advantage of that and put a fountain at the tip, so water splashed in the air, in to the – 15 C air. Water in the pipe should remain above zero, otherwise water freeze in pipe. We bring pipe underground and just above the freeze but not frozen and make in flow in itself and then make it rise and spray in to the air, there it is lose that critical heat that keep its liquid which is call Latin heat. So it loses it latin heat in the -15 C air and then when it falls down and it loses it critical heat and freezes, freezes and slow it take shape of a cone that is natural shape. Cone is one of the shape that has minimal surface area for volume and that makes ice stupa late into the summer. Therefore, it stays up to April and May when their acute need of water to farming in the valley. This Ice stupa will provide water in a right time when there is need of water in a right time. We hope to build dozens of ice stupas and plant trees in barren lands.

The region of Gilgit-Baltistan in Pakistan is currently experiencing a water crisis, caused by an unprecedented influx of tourism and ecologically fragile region and the glacial retreat due to climate change. An "ice stupa" is a unique and innovative method of conserving and managing water resources in arid and mountainous regions. The concept of ice stupas was developed by Sonam Wangchuk, a Ladakhi engineer and innovator, as a solution to the water scarcity problem. The Ice Stupa project, which involves water harvesting methods using alternative artificial glaciers. While the prototype of the Ice Stupa has been noted to be successful, the plans for the expansion of the project are still ongoing. The current experiment was conducted in Hyderabad/Karimabad Hunza district Hunza, located in the Gilgit-Baltistan, Pakistan.

The Karakoram International University can find various solutions to climate change adaptations. This way we can help youth in finding scientific solution to the unique problems that we face in the mountain. This

study applies a governance assessment tool to assess the governance context around the Ice Stupa project in alleviating the water crisis in the region and thereby aims to shed light on the multiple facets of governance conditions of this water harvesting system and its role in water resources management. The analysis reveals that in the governance context of the Ice Stupa project, self-governed, voluntary institutions and public participation together form a highly supportive system of governance, by giving power to the people and making them self-reliant in managing the water resources with little or no supervision from governmental actors

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Some Glimpses of the conference









Commadar 10th Core was Chief Guest at the concluding Ceremony



