Sponsored by: Ministry of Earth Sciences, Government of India

BOOK OF ABSTRACTS

37th ANNUAL CONFERENCE of the Indian Institute of Geomorphologists (IGI)

FOCAL THEME:

GEOMORPHOLOGY, ENVIRONMENTAL CHANGE, WEATHER EXTREMES, AND DISASTER RISK MANAGEMENT

02 – 04 September, 2025

Organized by

Department of Geography & Disaster Management
UNIVERSITY OF KASHMIR
Srinagar-190006, J&K

ABOUT THE CONFERENCE

The 37th National Conference of the Indian Institute of Geomorphologists (IGI) aims to explore recent developments in the field of geomorphology, covering theoretical models, field investigations, and laboratory experiments. Particularly, the event underscores advancing scientific knowledge and practical approaches to improve our understanding on the focal theme: "Geomorphology, Environmental Change, Weather Extremes and Disaster Risk Management". The conference provides a platform to researchers, practitioners, and policymakers to share their knowledge and develop pathways for bridging the gap between science and policy formulation in the face of changing planet.

The scope of the conference includes (but is not limited to):

FOCAL THEME

Geomorphology, Environmental Change, Weather Extremes, and Disaster Risk Management

SUB-THEMES

- TS-1: Fluvial, Glacial, and Tectonic Geomorphology
- TS-2: Climate, Cryosphere and Extreme Weather
- TS-3: Hydrology and Water Resources
- TS-4: Mountain Ecosystems and Environmental Change
- TS-5: Natural Hazards & Disaster Risk Reduction
- TS-6: Social Vulnerability and Resilience Building
- TS-7: Natural Resources Management
- TS-8: Land Use and Development Planning
- TS-9: Sustainable Development
- TS-10: Socioeconomic Development and Policy Action
- TS-11: Award (Young Geomorphologist)

CHIEF PATRON

Prof. Nilofer Khan
Hon'ble Vice Chancellor
University of Kashmir

PATRON

Prof. M. Sultan Bhat
Dean Research
University of Kashmir

CONVENER

Prof. Pervez Ahmed
Head
Department of Geography & Disaster Management
University of Kashmir

ORGANIZING SECRETARY

Dr. Akhtar Alam
Assistant Professor
Department of Geography & Disaster Management
University of Kashmir

सत्यमेव जयते

CHIEF MINISTER
Jammu & Kashmir

MESSAGE

I am happy to learn that the 37th National Conference of the Indian Institute of Geomorphologists (IGI) is being organized by the Department of Geography & Disaster Management, University of Kashmir from 2nd to 4th September, 2025 on the focal theme "Geomorphology, Environmental Change, Weather Extremes, and Disaster Risk Management."

This Conference brings together leading researchers, academicians, practitioners, and policymakers to deliberate on some of the most pressing issues of our times. The Himalayan region, and in particular Jammu & Kashmir, is highly vulnerable to the impacts of climate variability, extreme weather events, and natural disasters. I am confident that the deliberations of this Conference will contribute significantly to building resilience, safeguarding our fragile ecosystems, and ensuring the well-being of communities living in vulnerable environments.

I extend my good wishes to the Vice Chancellor and her team at the Department of Geography & Disaster Management for organizing this important conference.

I wish the Conference grand success and hope that it will provide fruitful insights and constructive pathways for addressing the challenges of environmental change and disaster risk management in India.

(Omar Abdullah)

Prof. (Mrs.) Nilofer Khan

Vice Chancellor
University of Kashmir
Hazratbal Srinagar - 190006
Jammu and Kashmir (India)

August 26, 2025

MESSAGE

It is a privilege to extend a warm welcome to all the participants/ delegates of the **37th National Conference of the Indian Institute of Geomorphologists (IGI)** on the theme *"Geomorphology, Environmental Change, Weather Extremes, and Disaster Risk Management" organised by* the Department of Geography & Disaster Management, University of Kashmir under the aegis of IGI.

During this crucial time when the impact of climate change and natural disasters are felt more strongly than ever before, such conferences could inspire innovative ideas and practical solutions for disaster risk reduction and sustainable development, thereby generating hope for building a safer and more resilient environment for people around the globe.

I appreciate the Department of Geography & Disaster Management of our university and the Institution of Indian Geomorphologists (IGI) for creating a platform to foster dialogue among geoscientists, environmentalists, and policy planners. I firmly believe that the outcomes of this conference will bridge the gap between scientific research and practical policy implementation to strengthen resilience and sustainable development efforts in this region and across the country.

I hope the delegates will have a very fruitful and productive academic discourse.

Prof. Nilofer Khan

Email: vcoffice@kashmiruniversity.ac.in | Website: www.kashmiruniversity.ac.in | Phone No: + 91 194 - 2272000 / 2001 | Fax No: + 91 194 - 2272086

International Association of Geomorphologists

MESSAGE

I am pleased to know that the Department of Geography and Disaster Management, University of Kashmir, Srinagar, Jammu and Kashmir, is going to organise the thirty-seventh Annual Conference of the Indian Institute of Geomorphologists (IGI) on the focal theme 'Geomorphology, Environmental change, Weather Extremes and Disaster Risk Management', during September 2-4, 2025.

Because of the ongoing climate change, rainfall has been erratic in most parts of the tropical monsoon region. Cloud bursts have become a common phenomenon in the Himalayan region, which creates severe flash floods and debris avalanche events. These extreme events not only claim hundreds of lives and loss of property, but also change the micro- and meso-landforms. The frequency and magnitude of all such extreme events have been increased enormously by both natural and anthropogenic activities. We need to find out the ways and means of saving the lives, properties, as well as the overall environment. From this point of view, the focal theme of the conference is of utmost importance.

The conference organisers have selected eleven subthemes related to the focal theme of the conference, including the Young Geomorphologists Conference. All of the subthemes are relevant to address the issue. I hope and believe that the conference will be held in a befitting manner and the outcome of the meeting will be worthy for all the concerned authorities to take proper necessary measures to save our environment.

On behalf of the International Association of Geomorphologists (IAG), I wish the Conference a grand success.

Prof. Sunil Kumar De
President, International Association of Geomorphologists (IAG)

To
Prof. Pervez Ahmed, *Convener, 37th IGI*
Department of Geography and Disaster Management,
University of Kashmir, Srinagar

University of Kashmir

NAAC Accredited A++
Srinagar-190006

25 August, 2025

Prof. M. Sultan Bhat
Dean Research
University of Kashmir

It is with immense pleasure that I introduce this Book of Abstracts, a rich compilation of cutting-edge, data-driven, and policy-relevant research presented at the 37th National Conference of the Indian Institute of Geomorphologists (IGI). This event is being hosted by the Department of Geography & Disaster Management at the University of Kashmir. As Patron of the conference, I warmly welcome all delegates to our campus, located in the heart of Kashmir—often referred to as paradise on Earth.

This conference aims to convene scholars and researchers from global, national, and regional platforms to deepen understanding around the central theme: "Geomorphology, Environmental Change, Weather Extremes, and Disaster Risk Management." In light of escalating environmental changes, we are witnessing an alarming rise in the frequency and intensity of extreme weather events—resulting in profound ecological, human, and economic impacts. These evolving disasters continue to challenge our preparedness and response mechanisms, underscoring the urgent need for robust risk assessment and innovative disaster management strategies.

Our preparations for this conference coincided with distressing visuals of cloudbursts and floods wreaking havoc in Dharali (Uttarakhand) and Kishtwar (Jammu & Kashmir), a stark reminder of the vulnerability of the Himalayan region and the pressing need for resilient solutions.

At the University of Kashmir, we are deeply committed to advancing high-quality research that addresses both national and global challenges. Supported by a distinguished faculty and a dynamic community of scholars, our university has earned international recognition for producing impactful, forward-thinking research. We strive to serve as a bridge between science, society, and policy, working toward the vision of building safer, more sustainable communities in a rapidly changing world.

Operating under the School of Earth & Environmental Sciences, our institution houses several prominent departments, including Geography & Disaster Management, Geology, Environmental Science, and Geo-informatics. Together, they form an intellectual ecosystem focused on the critical intersection of Earth systems and human society. Our faculty and researchers are actively engaged in diverse fields such as geomorphology, hydrology, climatology, environmental change, natural hazards, and sustainable resource management.

At this juncture, I extend heartfelt congratulations to the Organizing Committee for their dedicated efforts in bringing this timely and significant conference to fruition. I also express my sincere appreciation to the faculty and, most importantly, to all the participants who have contributed to this academic endeavor.

I look forward to meaningful and enriching discussions over the course of the conference. May your time at the University of Kashmir be both intellectually stimulating and personally memorable!

Prof. M. SultanBhat
Dean Research
University of Kashmir

University of Kashmir

NAAC Accredited A++
Hazratbal Srinagar-190006

August 30, 2025

Prof. Gh. Jeelani
Dean, School of Earth & Environmental Sciences
University of Kashmir

Message

It gives me immense pleasure that the Department of Geography & Disaster Management, School of Earth and Environmental Sciences, University of Kashmir is organizing ***37th National Conference of the Indian Institute of Geomorphologists (IGI)*** from **2nd to 4th September, 2025** on the focal themes *"Geomorphology, Environmental Change, Weather Extremes, and Disaster Risk Management"*. The themes are very relevant to the present scenario amid the climate vagaries and related disasters, and have tremendous social and scientific importance.

The adverse environmental changes, the frequency and intensity of weather extremes have been swelling, incurring colossal environmental, human and economic losses. With increasing pressure of population, overall environment of each and every nook and corner of our country is at stake. The geomorphic and climate related hazards lead to major destruction: floods, landslides, tsunamis, earthquakes, river bank and coastal erosion, soil erosion often pose threat to life and livelihood. The theme of seminar is very much relevant to the contemporary situation of the country in general and the Himalaya in particular.

This Conference brings together the leading researchers, academicians, practitioners, and policymakers to deliberate on some of the most pressing issues of our times. The Himalaya is highly vulnerable to the impact of climate variability, extreme weather events, and natural disasters. The Conference will act as a vital platform for sharing knowledge and developing practical pathways to translate scientific findings into actionable policies. It will be of immense value for advancing scientific understanding, which, in turn will lead towards achieving the Sustainable Development Goals.

I am confident that the deliberations of this Conference will mark a significant shift from a reactive, post-disaster response to a comprehensive, proactive strategy centred on prevention, mitigation and resilience, safeguarding our fragile ecosystems, and ensuring the well-being of communities living in vulnerable environments. I wish the Conference a grand success and hope that it will pave the way for resilient and sustainable future.

Prof. Gh. Jeelani
Dean, School of Earth & Environmental Sciences
University of Kashmir

Indian Institute of Geomorphologists

37th Annual Conference

Ramkrishna Maiti
President

MESSAGE

I am happy to know that Department of Geography & Disaster Management, University of Kashmir, Srinagar, Jammu and Kashmir is going to organise 37th Annual Conference of Indian Institute of Geomorphologists (IGI) on the focal theme 'Geomorphology, Environmental Change, Weather Extremes, and Disaster Risk Management' during September 02 – 04, 2025. I hope this conference will become a huge confluence of geomorphologists across the country and will offer an engaging platform for meaningful discussion, exchange of ideas and knowledge, fostering professional bondage and cooperation. I am sure this conference will promote new insight in various relevant issues and pave the path for achieving new thresholds of Geomorphology in India.

I extend my best wishes and warm greetings to the organisers and the participants of this conference. May this conference explore new collaboration, stimulate ground-breaking research, and significantly contribute to the social need.

Ramkrishna Maiti
Professor

30-08-2025

Vidyasagar University
Midnapore, West Bengal

To
Prof. Pervez Ahmed (Convener)
Head
Department of Geography &
Disaster Management
University of Kashmir
Mobile: (+091)-99067 97287

Prof A. R. Siddiqui
M.Sc, M.Phil, PhD,
PGD in Earth Observation Science-Geo Hazards from IIRS-ITC, The Netherlands
Professor & Former Head
Department of Geography
University of Allahabad
Secretary General, IGI
(Indian Institute of Geomorphologists)

Message/Progress Report (IGI)

The Indian Institute of Geomorphologists (IGI) aims to promote research on methodological advancement in the field of geomorphology in India. The idea of forming an association was conceived by Prof. Savindra Singh, Department of Geography, University of Allahabad during an International Conference on Geomorphology and Environment held from January 17 to 21, 1987 under his convenorship in the Department of Geography, University of Allahabad wherein more than 200 delegates from European Countries and India participated and presented their research papers. After long discussion for two days regarding the name and logo of the association, its goals and objectives, mode of formation, constitution etc. were finally decided to call a general house meeting of all the delegates on January 19, 1987 to finalise the modalities. Ultimately the general house agreed that the name and logo should be Indian Institute of Geomorphologists and IGI respectively. The following objectives were formulated

1. To bring the entire earth scientist dealing with geomorphology and allied disciplines on a commonplatform under the banner of IGI.
2. To hold annual conferences in different places of the country.
3. To publish a research journal entitled Indian Journal of Geomorphology now it is Journal of IndianGeomorphology.
4. To coordinate research being carried out on geomorphology and allied disciplines in different universities and laboratories in the country,
5. To encourage young research scholars doing research in geomorphology by giving awards andcertificates.
6. To give more emphasis on research related to human society and its welfare such as environmental geomorphology, urban geomorphology, environmental hazards and disasters and their management on different spatial and temporal scales etc.

Most of the above-mentioned goals and objectives of the IGI have been fulfilled. Till now 35 annual conferences of IGI with different focal themes have been organised at different places namely Andhra University, Visakhapttanam (First, 1988); Rajasthan University, Jaipur (2nd, 1989), Poona University (3rd 1990); North Eastern Hill University Shillong (4th, 1992), University of Calcutta, Kolkata (5th,1993), University of Allahabad, Allahabad (6th, 1995), Tamil University, Tanjavur (7th, 1995), Viswa Bharati University, Shantiniketan (8th, 1996), University of Delhi, Delhi (9th, 1998), Kurukshetra University, Kurukshetra (10th, 1999), University of North Bengal, Siliguri (11th, 2000), University of Calcutta, Calcutta (2000-01), Annamalai University, Chidambaram (14th, 2001), University of Rajasthan, Jaipur (15th, 2003), Indian Institute of Remote Sensing, Dehradun (16th, 2003), University of Pune, Pune (17th, 2004), Manonmaniam Sundaranar University, Tirunelveli (18th, 2005), University of Jammu, Jammu (19th, 2006), Benaras Hindu University, Varanasi (20th, 2008), Tripura University, Tripura (21st, 2008), University of Allahabad, Allahabad (22nd, 2009), Gauhati University, Guwahati (23rd, 2010), Anna University, Chennai (24th, 2011), University of

Allahabad (25th, 2012), Maharaja Sayajirao University of Baroda, Vadodara (26th, 2013), Vidyasagar University, Medinipur (27th, 2014), North Eastern Hill University, Shillong (28th, 2015), University of Calcutta, Kolkata (29th, 2016).

In the year 2017 under the banner of IGI a mega event of Geomorphologists i.e., 9 ICG washeld in Vigyan Bhawan, New Delhi during 6 to 11 November, 2017. This was the first international conference on geomorphology held in India and the second ICG in Asia. The ICG is the official conference of the International Association of Geomorphologists (IAG) and is held once in every four years. The first conference was held in Manchester (U.K.) in 1985, the second one in Frankfurt (Germany) in 1989, third one in Hamilton (Canada) in 1993, fourth one in Bologna (Italy) in 1997, fifth one in Tokyo (Japan) in 2001, sixth one in Zaragoza (Spain) in 2005, Seventh one in Melbourne (Australia) in 2009 and the eighth one in Paris (France) in 2013. The main objectives of the conference were (i) to bring together leading and young geomorphologists to exchange and share their research findings on all aspects of geomorphology, (ii) to provide a platform for active researchers to present and discuss trends, innovations, challenges and solutions adopted in various fields of geomorphology, (iii) to advance knowledge related to earth surface processes, extreme events and natural hazards for the benefit of the society, and (iv) to foster capacity building for young researchers. Nearly 388 foreign delegates and 178 Indian delegates participated in the conference there were participation of 46 countries. IGI also released the Atlas of Geomorphosites in India during the inaugural function of 9th ICG conference. I must congratulate Professor Savindra Singh, President, 9th ICG; Professor Sunil Kumar De, Convener, 9th ICG and Professor V. S. Kale, Professor Sunando Bandopadhyay and entire IGI family for making the event successful.

The 30th conference of IGI was held in the Department of Geography, Jamia Millia Islamia University, Delhi during 03-05 October, 2018. The 31st conference of IGI was held in the Department of Geography, University of North Bengal, Siliguri during 12-14 November, 2019. The 32nd conference of IGI was held in the Department of Geography, West Bengal State University, Barasat, Kolkata during 21-23 January, 2020. The 33rd conference of IGI was held in online mode in the Department of Geography, University of Allahabad, Prayagraj during 02-04 December, 2021. The 34th conference of IGI was held in online mode in the Department of Geography, Savitribai Phule Pune University, Pune, Maharashtraduring 02-04 November, 2022. The 35th conference of IGI was held in the Department of Geography, Jawaharlal Nehru University, New Delhi, between 25 and 27 November, 2024. The 36th conference of IGI was held in the Department of Geography, Maharshi Dayanand University, Rohtak between 11 to 13 January, 2025.

The family of IGI has grown rapidly with its life members exceeded to 600. It has been observed that young geomorphologists are coming very fast and they are doing quality research in the field of geomorphology. All the life members have contributed much in the growth and progress of this organization.

Now the **37th conference** of **IGI** is going to be held inthe **Department of Geography & Disaster Management, University of Kashmir** from 2 to 4 September, 2025. I take this opportunity to extend a very warm welcome to all the delegates coming from various parts of the country. I wish the conference a grand success.

A. R. Siddiqui

Prof. A.R. Siddiqui

Secretary General,

Indian Institute of Geomorphologists (IGI)

University of Kashmir, Srinagar-6, J&K
NAAC Accredited Grade "A++"
P.G. Department of Geography & Disaster Management
(DST-FIST and UGC-SAP (DRS-II) Assisted Department)

Message

It is with great pride and privilege that I welcome all distinguished delegates, scholars, and participants to the **37th National Conference of the Indian Institute of Geomorphologists (IGI)** being hosted by the **Department of Geography & Disaster Management, University of Kashmir, Srinagar**, during **2nd–4th September, 2025**. The focal theme *"Geomorphology, Environmental Change, Weather Extremes, and Disaster Risk Management"* is of immense contemporary relevance, especially for regions like the Himalayas that are witnessing rapid environmental transformations and heightened vulnerability to natural hazards.

The Department of Geography & Disaster Management has consistently endeavoured to promote rigorous academic discourse and innovative research in the fields of geomorphology, climate studies, hydrology, and disaster risk reduction. This conference provides a unique platform for interaction among eminent scientists, young researchers, and policymakers to deliberate upon critical issues and explore pathways for sustainable development and resilience building.

I am deeply grateful to the **Indian Institute of Geomorphologists (IGI)** for entrusting us with the responsibility of organizing this prestigious event.

I am confident that the deliberations and outcomes of this conference will greatly enrich our collective understanding of geomorphic processes, environmental change, and disaster management, and will pave the way for meaningful collaborations and policy interventions.

I extend my warmest wishes for fruitful discussions and a memorable academic experience amidst the scenic surroundings of the University of Kashmir.

Prof. Pervez Ahmed
Convener, 37th IGI Conference
Head, Department of Geography & Disaster Management
University of Kashmir

Visit us at www.kashmiruniversity.net Email Ids: geord@kashmiruniversity.ac.in
Ph. No 0194-2415078,2415405 // Fax: 0194-2272004/2006

Department of Geography & Disaster Management
(DST-FIST and UGC-SAP Assisted Department)
University of Kashmir
NAAC Accredited Grade "A++"

30 August, 2025

Organising Secretary's Message
37th IGI Annual Conference

Dear Delegates,

I am delighted to welcome you to the 37th IGI Annual Conference on Geomorphology, Environmental Change, Extreme Weather, and Disaster Risk Management, organised by the Department of Geography and Disaster Management, University of Kashmir, from 02 – 04 September 2025.

This conference highlights the role of geomorphology in understanding landscape evolution, and the interplay of natural and social environment. The event is also aimedat exploring recent developments in the field of geomorphology.

At a time when the planet faces increasing environmental change, extreme weather, and mounting disaster risks, this conference offers a vital platform to share knowledge, spark collaboration, and drive action.

By bringing together experts, we aim to deepen understanding and inspire solutions that are both innovative and effective.

I wish you an enriching and inspiring experience at the conference.

Thank you for being a part of this effort.

Kind regards,

Dr. Akhtar Alam
Organising Secretary
37th IGI Annual Conference

Website: www.kashmiruniversity.net | Email: geord@kashmiruniversity.ac.in | Phone: 91-194-2415078, 2415405

ABOUT HOST ORGANISATION

UNIVERSITY OF KASHMIR
NAAC ACCREDITED A++

Department of Geography & Disaster Management
School of Earth & Environmental Sciences
University of Kashmir

Established in 1948, the University of Kashmir is a premier institution of higher learning, with its main campus nestled along the picturesque western bank of Dal Lake in the Srinagar City. To expand the reach of quality education, the University has set up Satellite Campuses in Anantnag (South Campus), Baramulla (North Campus), and Kupwara, ensuring greater access for students from remote and underserved areas. Dedicated to academic excellence and innovation, the University offers a dynamic and intellectually enriching environment that promotes high quality teaching and cutting-edge research across a wide spectrum of disciplines. Its academic portfolio spans major faculties including Arts, Business & Management Studies, Education, Law, Applied Sciences & Technology, Biological Sciences, Physical & Material Sciences, Social Sciences, Medicine, Dentistry, Engineering, Oriental Learning, and Music & Fine Arts. Evolving to meet the changing demands of students and society, the University regularly introduces innovative and interdisciplinary programmes, reinforcing its commitment to relevance and academic leadership. Recognized as one of the leading state universities in India, it achieved the 14th rank among State Public Universities in the NIRF-2024 rankings and was awarded the prestigious NAAC A++ accreditation in 2025, which is a testament to its unwavering pursuit of academic and research excellence.

Established in 1979 as "Department of Geography & Regional Development" with a vision to promote geographic knowledge and research, the department holds a prominent position on the education landscape and has progressed to address emerging academic and societal needs. With the launch of a specialized postgraduate programme in Disaster Management in 2014, it was aptly renamed as "Department of Geography & Disaster Management" in 2021, reflecting its broad academic scope and relevance. The Department of Geography & Disaster Management at the University of Kashmir is one of the pioneering academic centers in the region, offering postgraduate and doctoral programs. With a team of experienced faculty and modern laboratory facilities, the department encourages critical thinking, scientific inquiry, and interdisciplinary research on domains such as Geomorphology, Climate, Cryosphere, Hydrology, Water Resources, Urban Planning, Mountain Ecosystems, Environmental Change, Natural Hazards, Disaster Risk Reduction, Natural Resources, Tourism, Sustainability, Socioeconomic Development and Policy Formation. The Department has earned recognition for academic excellence and research capacity. It has been awarded funding by the Department of Science and Technology (DST) under the prestigious FIST (Fund for Improvement of S&T Infrastructure) programme. Additionally, it has been inducted into the University Grants Commission's (UGC) Special Assistance Programme (SAP) at both DRS-I and DRS-II levels, highlighting its leadership in geographic and disaster studies at the national level.

SPONSOR

सत्यमेव जयते

Ministry of Earth Sciences
Government of India

The Ministry of Earth Sciences (MoES), under the Government of India, is mandated to provide services for weather, climate, ocean and coastal state, hydrology, seismology, and natural hazards; to explore and harness marine living and non-living resources in a sustainable manner for the country and to explore the three poles of the Earth (Arctic, Antarctic and Himalayas).

MoES was formerly the Department of Ocean Development (DOD), which was created in July 1981 as a part of the Cabinet Secretariat directly under the charge of the Prime Minister of India. It came into existence as a separate department in March 1982. The erstwhile DOD functioned as a nodal institution for organizing, coordinating and promoting ocean development activities in the country. The Government of India notified DOD as the Ministry of Ocean Development in February 2006.

In July 2006, the Ministry of Ocean Development was reorganized by the Government of India vide Presidential notification into the new Ministry of Earth Sciences (MoES). This brought the Indian Meteorological Department (IMD), Delhi, the Indian Institute of Tropical Meteorology (IITM), Pune, and National Centre for Medium Range Weather Forecasting (NCMRWF), Noida under the purview of MoES administration. The Government also approved the setting up of Earth Commission on the pattern of Space Commission (government department responsible for administration of the Indian space program) and Atomic Energy Commission (governing body of the Department of Atomic Energy).

NATIONAL ADVISORY COMMITTEE

Prof. Talat Ahmad
Prof. M. N. Koul
Prof. Anil V. Kulkarni
Dr. O. P. Mishra
Prof. Tasawoor A. Kanth
Prof. Sunil Kumar De
Prof. Sunando Bandyopadhyay
Prof. Haroon Sajjad
Prof. Milap Punia
Prof. Karanjot Kaur Brar
Prof. Mohd. Sarfaraz Asgher
Prof. Milap Chand Sharma
Prof. Siumendu Chatterjee
Prof. Sudhakar Pardeshi
Prof. Mehtab Singh
Prof. R. K. Ganjoo
Prof. A. R. Siddiqui
Prof. Masood Ahsan Siddiqui
Prof. B. W. Pandey
Prof. Atiqur Rahman
Prof Shahab Fazal
Prof. Anuradha Sharma
Dr. Parmanand Sharma
Dr. Suraj Mal

LOCAL ADVISORY COMMITTEE

Prof. Ghulam Jeelani
Prof. Fayaz Ahmad
Prof. Bikram Singh Bali
Prof. Farooq A. Mir
Dr. Sami Ullah Bhat
Dr. Arshid Jehangir
Dr. Irfan Rashid

ORGANIZING COMMITTEE

Prof. M. Sultan Bhat
Prof. Shamim A. Shah
Prof. Pervez Ahmed
Prof. G. M. Rather
Dr. Javeed A. Rather
Dr. M. Shafi Bhat
Dr. Akhtar Alam
Dr. Farooq A. Dar
Dr. Gaggan Kumar
Dr. Hakim Farooq Ahmad
Dr. Zahoor Ul Islam
Dr. Shahnawaz A. Baba
Dr. Atiqullah Malik
Dr. Imran Khan

DOCTORAL SCHOLARS' MANAGEMENT COMMITTEE

Tahir Ahmad Wani
Shafat Aarif Peer
Syed Hameem Gulzar
Azhar Ud Din Waza
Javid Ahmad Rather
Shahid Saleem
Saqiba Hussain
Shabeena Mapnoo
Madiha
Zeenat Cherag

Presidential Lecture

37th Annual Conference of Indian Institute of Geomorphologists, University of Kashmir

Title: Common Misconceptions in Geomorphology; An Introspection

Ramkrishna Maiti
President, Indian Institute of Geomorphologists (2025)
Professor & Head, Department of Geography
Vidyasagar University, Midnapore 721102, West Bengal
Email: ramkrishna@mail.vidyasagar.ac.in

Respected dignitaries, distinguished guests, my esteemed colleagues, and dear young geomorphologists, ladies and gentleman, I extend warm greeting from my own behalf and on the behalf of our beloved association, Indian Institutes of Geomorphologists to you all. I feel honoured and privileged to address the gatherings of so many fantastic minds at the auspicious moment of the 37th annual conference of Indian Institute of Geomorphologists, at the University of Kashmir, the *paradise on earth*. This gathering is the reflection of our professional bondage, our shared commitment to academic excellence and innovation in geomorphology. I deeply appreciate your presence, which will enrich our experience, and strengthens the unity of Geomorphologists in India. I also appreciate the efforts of the organisers to make this event successful under a very difficult situation. In this connection, I like to take the opportunity to thank and acknowledge the efforts of my predecessors who collectively built this platform for meaningful and engaging discussions, and professional cooperations for the betterment of geomorphology in India. After 38 years of its formation in 1987, this platform is still relevant to exchange ideas, building cooperations and collective support to shape the better future for our field.

In this background, I feel it is the right time and the right platform to bring before you some of the very common misconceptions that our younger minds are trained with in their school days. The ideas and perceptions entrenched initially in their minds are very difficult to reform. We must collectively work together to edit and modify the ideas inscribed in the young minds for the betterment of geomorphology to which we are committed.

1. **Origin of River System**
   Let us start with the ideas on origin of river system. Commonly it is believed that river originates from mountains, hills or uplands and flows downstream to meet a larger river, lake, or sea. Horton's (1945) model of drainage network development out of surface runoff shows that river channels develop at the lowermost part of the landscape where critical energy is available to cut a channel by accidental concentration of surface flow. Out of number of shoe-string gullies dominant channels survive and grow through cross-grading and micropiracy. Channel network gradually extends headward and upward through bifurcation and branching up to the water divide with a small gap (belt of no erosion) where surface flow is dominated by sheetwash (Maiti, 2016).

River network may also develop from sub-surface flow. In such case, a channel starts from the base of a slope cutting (or a spring) from which seepage water emerges after achieving the threshold condition. The channel continues to grow headward, if process continues (Dunne, 1980, 1990). At the source (channel head) sinking and slope failure are common that facilitate rapid headward growth (Knighton, 1998; Maiti, 2016).

Simulation model of river network development shows that channel starts at suitable site preferably at the lowermost part of the landscape where overland and subsurface flow accumulates (Willgoose and others, 1991).

2. **Classic Downstream Trend of a River**

General idea on the classic downstream trend of a river shows that from source to mouth river width increases, flow becomes shallower and slower. This idea is embedded deeply into the younger minds. Leopold and Maddock in 1953 compiled huge amount of discharge records from the rivers of USA and established relationship between discharge and hydraulic variables (channel width, depth, and velocity). They found that with increasing discharge (at a station), channel width, depth, and velocity increase. Downstream from source to mouth, with increasing discharge width increases more, but downstream velocity increases at a slower rate than that at a station. Bierman and Montgomery (2014) shows that width, depth and downstream flow velocity depends on the power-relation of the discharge.

"*The wetted width increases with increasing discharge; $W = aQ^b$, where b typically varies between 0.1 and 0.3. Flow depth increases as discharge rises and the channel fills with water; $D = cQ^f$, where f typically varies between 0.3 and 0.4. Downstream flow velocity increases with increasing discharge due to deeper flow submerging obstacles and reducing the effective channel roughness; $U = kQ^m$, where m typically varies between 0.3 and 0.6*" (Bierman and Montgomery, 2014).

Geometry and roughness of the channel determines the flow velocity of the channel. Manning's equation (1889) also described the importance of flow depth (hydraulic radius) and channel roughness in determining flow velocity.

The idea of downstream reduction of velocity due to reduction of gradient is rooted deeply in our mind because we ignored the role of channel roughness and boundary friction. Ritter (1986) and Ritter et al. (2011) expressed dissatisfaction over this misconception.

'The suggestion that mean velocity, and probably bed velocity (Leopold,1953) increase downstream came as a shock to most geologists who intuitively 'knew' that small tributaries flowing on steep slopes must be travelling faster than the low gradient trunk rivers' Ritter (1986); Ritter et al. (2011).

3. **Floodplain Formation**

It is a common belief that floodplain develops by overbank flood. But, Mackin (1937), Leopold et al. (1964) and Fryirs and Brierley (2013) suggested that in many of the floodplains, in-channel deposits (lateral accretion deposits generated by in-channel processes having no connection with flood) comprise 60-90% of entire flood plain deposits. In proximal floodplain these lateral accretion deposits are exposed on the surface but that

are buried under suspended overbank flood (vertical accretion) deposits at distal floodplain. These are common for the large rivers migrating laterally over the valley bottoms quite frequently. Here floodplain formation is associated with meander migration through bank erosion and point bar formation which are not directly linked with flood. The secondary flow at the meander bend shifts materials from thalweg to convex bend on the point bar. This bar gradually accretes laterally and vertically to form scroll bar. This scroll bars are incorporated into flood plain as the channel shifts laterally. As this process continues, over time, a series of ridges with intervening swales are formed (Mackin, 1937 and Maiti, 2023).

Although, some of the floodplains are developed by vertical accretion through overbank flood (Oka River in Russia, mentioned in Chorley et al. 1985). Again, in some floodplains especially with braided channels, braid-channel accretion and side channel abandonment dominate. Even, along a same river at different place different mechanism dominates. For example, in lower Mississippi at Louisiana, floodplain dominantly develops by overbank flood whereas, at Illinois, Mississippi floodplain develops mainly through point bar accretion (Bierman and Montgomery, 2014).

4. Misconceptions on Weathering

4.1 **Definition of Weathering**: In the definition of weathering, the change of rocks *insitu* is given much importance. Following Chorley et al. 1984 this '*insitu* change' is a misconception as any change (disintegration or decomposition) in the rocks or minerals involve either microscopic or megascopic displacement and transfer of materials. In favour of this argument, they cited following examples:

- Much of the chemical weathering involves chemical change in crystal lattice which results from absolute or relative movement of water or other materials.
- Weathering on slopes 'under gravity field' involves net downslope displacement. Under those circumstances, it is impossible to 'distinguish between the mechanisms of weathering and those of mass movement'.
- All of section of cliff face is the manifestation of macro-weathering and mass movement.
- Debris creep induced by hydration of feldspar and associated expansion of volume are the results of both weathering and mass movement. It is difficult to separate them.
- On major portion of earth's surface landscape evolution results from integrated interaction between weathering, slope processes as well as fluvial processes (Chorley et al. 1984; adopted from Maiti, 2023).

4.2 **Classification of Weathering as Separate Process:** In most of the text books weathering is classified into physical, chemical, and biological types as a different process. But, weathering is the result of complex interaction among all the physical, chemical, and biological processes (Chorley et al. 1984).

"No chemical weathering takes place without the production of physical stresses; (physical) disintegration of rock by thermal expansion probably does not occur in the absence of chemical processes associated with the presence of water"- (Chorley et al. 1984).

4.3 **Lowering of Surface by Weathering:** Ollier (1975) reported against the popular belief on lowering of surface by weathering. He confirmed that unless there is no removal of weathered materials, surface is not lowered by weathering. He argued that

- Materials do not shrink but expand by weathering.
- Weathering produces materials of lower density and so volume will expand than original.
- It is well known that minerals swell due to weathering that leads to granular disintegration and exfoliation.
- After physical disintegration, percentage of pore space will increase that leads to rise of general surface.
- Etch plain in between the tors or inselbergs lowers due to stripping of regolith not by weathering.
- Although dewatering by evaporation and seasonal drying may cause temporary shrinkage of surface anywhere, but that could not be attributed to weathering (Ollier, 1975; adopted from Maiti, 2023).

5. **Misconception on the lubricating effects of rainfall on slope materials (Terzaghi 1925, 1936, 1960)**

Most of the landslide events occur in rainy season. Based on this observation, geomorphologists believe that rain is directly responsible for landslide as applied water leads to lubrication. But, Terzaghi (1960) suggested that this water cannot lubricate the slide because:

- Water in slope materials increases the ***coefficient of static friction*** and thus actually acts as anti-lubricant.
- In humid region, always a thin moisture film (hygroscopic moisture) surrounds each soil particle, which may be sufficient to lubricate the grains contacts.
- For a first-time slide, no slide surface develops until failure occurs and so there is no possibility of lubricating the slide surface. Since there is no fracture, soil or rock becomes intact initially and water or clay does not have any chance to enter.

Rain water increases pore-water pressure and increases weight of the soil as it becomes wet. These two collectively lead to slope failure (Terzaghi,1960 adopted from Maiti, 2023).

6. **Inversion of Relief**

Inversion of relief is very common and develops under wide range of circumstances. On one hand, it may develop when surface topography does not bear the expression of underlying structure. On the other, it develops when former lowland turns into topographic highs being covered with either lava flow or formation of duricrust.

Development of topographic ridges on structural valleys (syncline) and / or topographic valleys on the structural ridges (anticline) is treated as the instance of inversion of relief.

But this is very uncommon as it can only happen if the soft rock occurs along the crest of the anticline and the folded structure is simple Jura type. It is reported at Burkes Garden (Massanutten Mountain) in Virginia (https://sites.radford.edu/~jtso/GeologyofVirginia/ValleyRidge/VRPhysio-6.html).

More erosion on the crest of a domal structure may also develop such inverted topographic relation to structure, for example Nashville basin of Tennessee.

Unfortunately, the most common occurrences of dissimilar topographic relationship between former and present landscape are not frequently discussed in this connection (Ollier 1967,1988; Pain and Ollier 1995).

- Lava flow: Basaltic lava may cover a river valley and thus protects it form further erosion. Thus, by protecting erosion, a former valley with basaltic capping becomes a ridge surrounded by the lowlands which were formerly the elevated lands. Bullengarook lava flow, to the west of Melbourne, Australia covered the former valley floor, is now turned into a ridge bounded by Lerderberg river and pyrite creek (Ollier 1967, 1988; Pain and Ollier 1995).

- Duricrust: Lateritic duricrust developed through illuviation and capillary movement of water may cover a river valley. Sesquioxide of iron deposit develops Ferricrete (laterite) while that of bauxite develops Alcrete and that of silica develops Silcrete. Calcrete (caliche) develops by the accumulation of the sesquioxide of calcium carbonate and Gypcrete develops by the accumulation of gypsum. In all the cases the lowlands (river valley or lake bottom) are capped with the duricrust which protect erosion due to more resistance. The less resistant surrounding regions are lowered by subsequent erosion. Thus, gradually the former lowlands capped by duricrust are turned into highlands. The residual hills capped by duricrusts are very common worldwide (Summerfield,1991; Pain and Ollier, 1995; Maiti 2023).
    - Silcrete armoured inversion develops 2.5 km wide and 80 km long upland-divide containing silicified alluvium (silica-cemented) in the Permian Kirup Conglomerate in western Australia (Fairbridge and Finkl,1978). Similar inversion also occurred along the Shoalhaven valley of Australia being armoured by the presence of hard silicified alluvium (Ollier 1991).
    - Ferricretes formed on the valley bottom are now seen in the plateau top in northern Queensland (Australia) (Pain and Ollier, 1995). Ollier and Gallows (1990) reported several such cases of inversion of relief ssociated to ferricrete from Australia, India and Africa.
    - Calcrete is the hard layer made up of cemented alluvium rich in calcium carbonate, developed mainly in arid and semi-arid region. Miller (1937) reported calcrete guided inversion from wide region (10,000 sq.km) in eastern Saudi Arabia. These are common along the Pleistocene channels of Middle East (Brown 1960) and wide region of Texas and New Mexico (Reeves 1983).
- Boulder armoured inversion is identified from Appalachian of USA by Bryan (1940) and Mill (1981, 1990), where valley floor was covered with large boulders

(> 1m diameter) which armoured the valley floor and protected from erosion by running water. Erosion shifted to the valley sides which are progressively eroded. Gradually valley bottoms covered with boulders remained as elevated ridge bounded by depressions on either side (Pain and Ollier, 1995).

With these submissions, let me place a humble request to my fellow colleagues to carry forward and continue the dialogues beyond these walls. I believe that it is our ethical responsibility to bring correct knowledge to our younger generation and it is only possible through collective efforts and collaborative actions. With gratitude to the organisers for offering us such a wonderful platform and to you all for your support, enthusiastic participation, and dedication I formally conclude looking forward for a shared journey of progress to achieve an excellent future of Indian Geomorphology.

References:

- Brown, G.F., 1960. Geomorphology of western and central Saudi Arabia. 21st Int. Geol. Congr. Rep. Copenhagen, 21: 150-159.
- Bierman, P.R. and Montgomery, D.R. 2014 Key Concepts in Geomorpholgy, New York: W.H. Freeman and Company Publishers.
- Bryan, K., 1940. Gully gravure - a method of slope retreat. J. Geomorphol., 3: 89-107.
- Chorley R.J., Schumm S.A and Sugden, D.E. 1985 Geomorphology, Methuen, London.
- Dunne, T. 1980 Formation and controls of channel networks. Progress in Physical Geography 4, 211-39.
- Dunne, T. 1990 Hydrology, mechanics and geomorphic implications of erosion by subsurface flow. In Higgins, C.G. and Coates, D.R. (eds), Groundwater geomorphology: the role of subsurface water in earth-surface processes and landforms, Geological Society of America Special Paper 252, 1-28.
- Fairbridge, R.W. and Finkl, C.W., 1978. Geomorphic analysis of the rifted cratonic margins of Western Australia. 2. Geomorphol.. 22(4) : 369-389.
- Fryirs, K.A. and Brierley, G.J. 2013 Geomorphic Analysis of River Systems: An Approach to Reading the Landscape. Chichester: Wiley-Blackwell.
- Horton, R.E. 1945 Erosional Development of Streams and Their Drainage Basins, Hydrological Approach to Quantitative Morphology, Geol. Soc. Amer. Bull. 56, 275-370.
- Kington, D. 1998 Fluvial Forms and Processes; A new perspective, Hodder Education, London: UK. 384p
- Leopold, L.B. 1953 Down Stream Change of Velocity in Rivers, American Journal of Science, 251. 606-624.
- Leopold, L.B. and Maddock, T. 1953 The hydraulic geometry of stream channels and some physiographic implication. U S Geological Survey Professional Paper 252.
- Leopold, L.B. and Miller, J.P. 1956 Ephemeral streams – hydraulic factors and their relation to the drainage net. United States Geological Survey Professional Paper 282A.

- Leopold, L.B., Wolman, M. G. and Miller, J. P. 1964 Fluvial processes in geomorphology. San Fransisco: W. H. Freeman.
- Mackin, J. H. 1937 Erosional history of the Big Horn Basin, Wyoming, Geol. Soc. Amer. Bull., 48, 813 – 94.
- Maiti, R.K. 2016 Modern Approach to Fluvial Geomorphology, Primus Book (An Imprint of Ratna Sagar Pvt. Ltd) , Delhi https://primusbooks.com/modern-approaches-fluvial-geomorphology/
- Maiti, R.K. 2023 Geotectonics and Geomorphology: An insight into process-form relationship, Nabodaya Publications, Kolkata https://www.amazon.in/Geotectonics-Geomorphology-insight-process-relationship/dp/8196185324
- Manning, R. 1889 On the Flow of Water in Open Channels and Pipes, Transactions of the Institution of Civil Engineers of Ireland.
- Miller, R.P.. 1937. Drainage lines in bas-relief. J. Geol., 45: 432- 438.
- Mills, H.H.. 1981: Boulder deposits and the retreat of mountain slopes, or, “gully gravure” revisited, J. Geol., 89: 649460.
- Mills, H.H.. 1990. Thickness and character of regolith on mountain slopes in the vicinity of Mountain Lake, Virginia, as indicated by seismic refraction, and implications for hillslope evaluation. Geomorphology, 3: 143-57.
- Oilier, CD., 1967 Landforms of the newer volcanic province of Victoria. In: J.N. Jennings and J.A. Mabbutt (Editors), Landform Studies from Australia and New Guinea. ANU Press, Canberra. pp. 315-339.
- Ollier, C.D. 1975 Weathering. Longman Group limited: London.
- Ollier, C.D. 1988 Volcanoes. Basil Blackwell, Oxford. 228 pp.
- Ollier, C.D. and Galloway, R.W.. 1990 The laterite profile, ferricrete and unconformity. Catena, 17: 97-109.
- Ollier, C.D., 199lb. Laterite profiles, ferricrete and landscape evolution. Z. Geomorphol., 35(2): 165-173.
- Ollier, CD., 1991a. Aspects of silcrete formation in Australia. Z. Geomorphol., 35(2): 151-163.
- Pain, C.F., Ollier, C.D. 1995 Inversion of relief--a component of landscape evolution. Geomorphology 12, 151-165. https://doi.org/10.1016/0169-555X(94)00084-5
- Reeves, C.C., 1983 Pliocene channel calcrete and suspenparallel drainage in West Texas and New Mexico. In: R.C.L. Wilson (Editor), Residual Deposits: Surface Related Weathering Processes and Materials. Geol. Sot. Spec. Publ. 11: 179-183.
- Ritter D.F., Cochel R.C. and Miller J.R. 2011 Process Geomorphology (5th Edition), Waveland Press, Inc. Long Grove, Illinois.
- Ritter, D.F. 1986 Process Geomorphology. Wm. C. Brown Publishers, Dubuque, Iowa.
- Summerfield, M.A., 1991. Global Geomorphology: an Introduction to the Study of Landforms. Longman, London,
- Terzaghi, K. 1925 Erdbaumechanik, Franz Deuticke, Wien.
- Terzaghi, K. 1936 The Shearing resistance of saturated soil, Proc.1st Int. Conf. Soil Mech. Fdn. Engng 1, 54-66.

- Terzaghi, K. 1960 Mechanism of Landslides, Bull. Geol. Soc. Am. Berkey Volume, 83-122.
- Terzaghi, K. 1962 Stability of Steep Slopes on Hard Unweathered Rock, Geothecnique, 12, 251-70.
- Willgoose, G.R. Bras, R.L. and Rodriguez-Iturbe, I. 1991 Results from a New Model of River Basin Evolution. Earth Surface Process and Land forms 16, 237-54.

BOOK OF ABSTRACTS

TS-1

Fluvial, Glacial, and Tectonic Geomorphology

Transformation of the Bhasan Char, Meghna Estuary, Bangladesh: From Fluvial Sediments to Coastal Island, Rehabilitation of Refugees, and its Suitability

Abhijit Das[1] and Sunando Bandyopadhyay[1]*
[1]Department of Geography, University of Calcutta, Kolkata 700019, West Bengal
Email:abhijitndas@gmail.com

Situated at the outer Meghna Estuary, the Bhasan Char (30 km^2 in 2021) is one of the newly emerged islands of the eastern Ganga–Brahmaputra–Meghna Delta, Bangladesh. This island came into international news after its selection for rehabilitation of the Rohingya refugees.
To investigate the evolution and developmental stages of the Bhasan Char, IRS/Resourcesat (Sensors: Pan, LISS-3, LISS-4-mono, LISS-4-fmx), Landsat (TM, ETM +, OLI), Sentinel (MSI, SAR-C), and Google Earth images during 2001–2022 were utilised. We also focused on 1970–2021 tracks and intensities of cyclones landfalling within 100 km of the Bhasan Char, sea level rise derived from satellite altimetry product (1993–2023), land elevation, regional sedimentation, and tectonic setting to assess its suitability for relocation project.

The results showed that the Bhasan Char emerged in 2002 and took a coherent form in 2004 (14.96 km^2). It then shifted towards the southeast at 550 m/yr till 2007 when it became relatively stable. Subsequently, the island accreted in its supratidal and intertidal areas. Since 2017, 8.18 km^2 of the island was reclaimed by placing an 11.5-km marginal embankment for the relocation project. At cyclone periodicity of 3.5 yr, five storms passed within 25 km of the present position of the Bhasan Char. Despite sea level rise of 3.66–3.81 mm/yr at the eastern Meghna Estuary region, emergence and growth of the island and its position on a vast 850 km^2 tidal sand ridge that is accreting from the Meghna sediments and also uplifting as a part of an anticlinal axis of the Chittagong–Tripura Fold Belt support long-term stabilisation. These combined processes have elevated the island to 1.5–4 m above mean sea level. However, the recent trend of coastal erosion in the southwest of the Bhasan Char may undercut the embankment which will put the settlement at risk.

***Keywords**: Meghna Estuary; Island Evolution; Refugee Shelter; Erosion-Accretion; Island Stability.*

……..

Transformation of the Nayachar Island, Hugli Estuary, West Bengal

Sunando Bandyopadhyay
Department of Geography, Calcutta University, Kolkata 700019
Email: sunando@live.com

In tropical macrotidal estuaries, establishment of pioneer mangrove species initiates bio-tidal accretion on newly formed shoals. Through ecological succession, consecutive plant communities contribute to elevating the shoal by promoting tidal sedimentation and decreasing the frequency of inundation. This classical succession model of mangrove ecology is only observable in a regressive stratigraphic sequence, as in the 48.8-km^2 Nayachar that accreted during the last 77 years to become the second largest island of the Hugli Estuary in the westernmost Ganga–Brahmaputra–Meghna Delta.

Ground truth verification-based supervised classification and normalised difference vegetation index analysis of IRS-1C LISS-3 data of 1997 and IRS-P6 LISS-3 data of 2008, besides elevation survey, revealed that Nayachar had four discrete and semi-concentric Vegetation Zones (I–IV). With distinct mangrove species assemblages — dominated by *Porteresia coarctata* (Zone I, outermost), *Myriostachya wightiana* (Zones II & III), and *Excoecaria agallocha* (Zone IV, innermost) — they occupied successively higher elevation levels bounded by well-defined palaeostrandlines based on their maturity. The consecutively higher zones also had progressively lower drainage density & sand content and reciprocally higher clay & organic carbon content. Due to continuous biotidal evolution of the island, some areas of Zone II were matured to Zone III between 1997 and 2008.

Thereafter, aquaculture, initiated in the northern part of Nayachar in 1988, proliferated manifold and occupies nearly the entire island at present (2025) — effectively stopping its natural evolution. Construction of marginal dykes also stopped vertical accretion of the island and aided in removing the macrotidal Hugli Estuary from its morphological equilibrium. Nayachar joined with the 5.6-km^2 Balari Islet to its north in 2022 and is currently migrating westward. With gradual deterioration of the 2-km-wide Haldia Channel that separates it from the mainland, the island, following regional trends, is expected to merge with the bankline in the foreseeable future.

***Keywords**: Estuarine Island; Mangrove Succession; Aquaculture; Reclamation.*

……

Channel Morphological Adjustment and Anthropogenic Landforms of the Mayurakshi River, Eastern India

Abhishek Ghosh[*1], *Sonam Lama*[2], *Priyank Pravin Patel*[3] *and Sunil Kumar De*[4]
*[1]Corresponding author. Assistant Professor, Department of Geography, North eastern Hill University. Shillong-793022, Meghalaya.
[2]Assistant Professor, Department of Geography, Darjeeling Government College, Lebong Cart Rd, Darjeeling HO, Darjeeling-734101 West Bengal.
[3] Assistant Professor, Department of Geography, Presidency University, 86/1 College Street, Kolkata – 700073, West Bengal
[4] Professor. Department of Geography, North eastern Hill University. Shillong-793022, Meghalaya
Email: abhishekghosh20.3.90@gmail.com

The present study aims at examining the nature and trend of channel adjustment (CA) since the early 20th century due to growing human interferences across the Mayurakshi River of eastern India. The Active Channel Width Variation Index (ΔW%), Net Active Channel Change (NACC), and Geomorphic Status Index (GS) were used to measure the channel's lateral adjustment (CA). The Hemerobi Index (M_I) was computed to assess the intensity of various man-made structures and interventions that together constitute anthropogenic landforms. Finally, principal component analysis (PCA) and cluster analysis (CA) were performed to identify major anthropogenic factors distressing channel morphology. The result shows that the Mayurakshi River's channel width significantly altered following the installation of Massanjore Dam (1950s) and Tilpara Barrage (1970s). Several floods that occurred between 1990 and 2000 triggered the channel width (ΔW%: +10.8-+29.2%), NACC (2-12), and geomorphic activity (GS: 4.22-4.59). Between 2001 and 2024, the lower-middle reaches of the river went through degradation (GS: 3.03-3.67), narrowing, and stabilization (ΔW%: +19.0- -25.5, NACC: -1.13- -10.40) due to growing anthropogenic interventions (M_I: 0.71-0.90). From the aforesaid study it is found that instream sand mining, agricultural growth within the riverbed, urbanization, and rapid road construction are key anthropogenic landforms that are adversely disrupting the Mayurakshi River's pre-existing fluvial process-form relationship.

Keywords: *Anthropogenic Landform; Channel Adjustment; Geomorphic Status; Eastern India; Hemerobi Index; Mayurakshi River.*

……

Beachrock Formation and Aeolianite Overprint: Evidence from Lithostratigraphic Section along Diveagar Coastline, Maharashtra

Gaurav Gamre[1] and Anargha Dhorde[2]*
[1,2] Research Center and Post Graduate Department of Geography, MES's Nowrosjee Wadia College
(An Autonomous college affiliated to the Savitribai Phule Pune University), Pune.
*Corresponding author: gamregaurav@gmail.com

The coastal stretch of Diveagar, situated along the central Konkan coast of Maharashtra, exhibits a well-developed beachrock formation that forms a prominent bar system, capped by lithified aeolian dune deposits (aeolianites). This study investigates the stratigraphic architecture, lithological transition, and petrographic characteristics of these consolidated coastal sediments to understand their genesis, depositional environment, and diagenetic evolution. Well-sections were studied at selected sites along the bar, and stratigraphic profiles were prepared both across and along the bar orientation. The vertical sequences typically reveal a lower unit of beachrock, composed predominantly of cemented bioclastic sand with marine influence, overlain by aeolianites comprising fine grained, cross laminated dune sands, lithified under semi-arid conditions. Thin section petrography highlights differences in the grain size, sorting, cement types (marine vs meteoric) and textural maturity, offering insights into the alternating marine and sub aerial depositional regimes. The juxtaposition of the beachrock and aeolianites along this coast not only records the dynamic interaction of marine and aeolian processes but also provides valuable archive of past coast environmental conditions. This study contributes to understand coastal sedimentary dynamics and lithification processes in tropical settings, with implications for coastal evolution and preservation.

Keywords: *Beachrock; Petrography; Thin section; Stratigraphy; Lithology.*

…….....

Dynamics of river channel confluences of the transboundary Jaldhaka River system within the Eastern Himalayan Foreland Basin

Sudipa Sarkar[1] and Biswajit Bera [1]*
[1]Department of Geography, Advanced Geomorphology and Hydrology Laboratory, Sidho-Kanho-Birsha University, Ranchi Road, Purulia, 723104, India.
E-mail: sarkarsudipa56@gmail.com

River confluences are nodal junction points where a tributary debouches into the mainstream channel, which impacts the fluvio-hydrological setup of a river system. The vast tract of the Eastern Himalayan Foreland Basin (EHFB) is enriched with numerous alluvial river systems and multiple types of channel confluences. The primary objective of this study is to estimate the

spatiotemporal dynamics of channel confluence, including probable causes and variations in confluence bed morphology, in the Jaldhaka river system using geospatial and field datasets. Six major confluences have been studied using remote sensing, GIS techniques, and extensive field investigations. Measurements of confluence point shifting, junction width, bankline migration, estimation of river bed topography, and bank facies study were carried out for methodological assistance. Results indicate that the confluence of the Diana River is most dynamic in the Jaldhaka River system in terms of confluence point shifting distance (5.22 km), average confluence width (0.52 km) over the 67 years, but the Murti River was shifted 8.74 km (left bank) between 1980 and 1990 due to devastating flood occurrences after 1993. Simultaneously, the confluences of the Sutunga and Dharala rivers have been comparatively stable since 1990, primarily due to rapid urbanization in the confluence shifting zone and human encroachments. Confluence bed topography showed decreased water depth due to excessive siltation in the river bed at the confluence sites. Moreover, non-cohesive bank material, human intervention, and catastrophic floods are significant contributors to bank erosion and confluence dynamics. Proper sustainable environmental planning and management techniques can reduce the problem of excessive sediment generation on the river bed.

Keywords: *Confluence Dynamics; Bed Topography; Himalayan Foreland Basin; Jaldhaka River; Bank Material.*

……..

Encroaching the Floodplain: Geospatial Analysis and Field Observations of Urban Expansion and Riverbank Change Along the Saryu in Ayodhya (1995–2025)

Braj Kishor Dwivedi[1] *and Azizur Rahman Siddiqui*[2]
[1] Research scholar [2]Professor and Former Head
Department of Geography, University of Allahabad.
Email: braj_phd2023@allduniv.ac.in

Floodplains are vital for sustaining riverine health, regulating floods, supporting biodiversity, and maintaining sediment balance. However, rapid urbanization and associated anthropogenic activities are destabilizing these sensitive zones. Manjha kala is local name of saryu flood plain in Ayodhya which has about 7.2 SQ.KM area experiencing significant infrastructural transformation via creation of river front and expansion of settlement This study integrates geospatial techniques with field observations to assess transformation in Manjha kala between 1995 and 2025. Multi-temporal Landsat and Sentinel-2 optical imagery were analyzed using Google Earth Engine to delineate floodplain extents, monitor land-use transitions, and detect riverbank shifts. Indices such as the Normalised Difference Built-up Index (NDBI) and Normalised Difference Vegetation Index (NDVI), combined with bankline mapping, enabled precise change detection. GIS-based overlay and buffer analyses identified urban encroachment hotspots and erosion-prone reaches. Field investigations—including GPS mapping, photographic documentation, validated remote sensing

outputs and provided insights into socio-environmental impacts. Results reveal substantial narrowing of active floodplain width, increased channel confinement, and intensified erosion near high-density urban zones. The findings emphasize the urgency of adopting integrated floodplain management, enforcing zoning laws, and fostering community-based conservation to protect river corridor resilience amid accelerating urban pressures.

Keywords: *Floodplain; River Bank Changes; Anthropogenic Activities; Bank Line Mapping; Land Use Transition.*

……..

Dense Mineral Variation in the Different Geomorphic Units of Barakar River: Evaluation of the Hinterland

Pramod Kumar Pandey[1] and S.S. Das[2]
[1]Assistant Professor, Department of Geography, Patna University, Patna
[2]Professor, Department of Earth & Planetary Sciences, University of Allahabad, Prayagraj
Email: ppgeom@gmail.com

Recent sediments of Barakar River have been studied in four zones for their heavy minerals in various litho-facies of different geomorphic units and to evaluate their provenance. The heavy mineral suit predominantly made up of hornblende in all three zones. The other minerals include tourmaline, zircon, rutile, hypersthene, apatite, chlorite, biotite, ilmenite, magnetite and hematite. Andalusite and apatite are absent in zone 2, zone 3 and zone 4. Dense mineral concentration show inverse relationship with grain–size of sediments. It is also decrease in downstream direction. All together six namely St, Sp_1, Sp_2, Sr, Sh and SI sandy lithofacies are identified in Channel-bar, Point-bar and natural levee deposits of Barakar river sediment. St Lithofacies is absent in natural levee deposit. No specific relation exists in dense mineral concentration and lithofacies type. Heavy mineral grains are dominantly angular to sub angular with ZTR indices (below 40%) in different zones of the river indicating sediment immaturity, derivation from the igneous and metamorphic rocks, rapid erosion in the source region and less transportation of sediments. Few rounded to Sub rounded grains indicating multicyclic origin and are derived from the sandstones and Meta sedimentary rocks. Various rocks, namely granite, gneisses and schists are exposed in the catchment of the Barakar River acted as provenance of sediment.

Keywords*: *Barakar River; Heavy Mineral; Lithofacies; ZTR Index; Provenance.

……..

Reconstructing Quaternary Glacial History of Kolahoi Glacier, Kashmir, India

Syed Umer Latief[*1], *Meer Inayatullah*[2], *Jahangir Ahmad Bhat*[3] *and Milap C. Sharma*[4]
[1]Govt Degree College Magam, Budgam, Kashmir, India. [2]Govt Degree College Boys Pulwama Kashmir, India, [3]Independent Researcher, [4]Jawaharlal Nehru University, New Delhi
*Corresponding Author: 84.syedumer@gmail.com

Mountain glaciers are not just impressive landscapes; they are powerful climate indicators and geomorphic agents that shape the Earth. The unique landforms they leave behind, like moraines and outwash plains, serve as a record of past glaciations, providing clues about their extent and timing. By studying these glacial landforms and dating them, scientists can reconstruct ancient climates and environments, which is a core focus of paleoclimatic research. While the Quaternary climate of other parts of India has been well-researched, the glacial history of the Kashmir Himalayas remains less understood. Nonetheless, existing evidence shows that Himalayan glaciers are highly sensitive to climate changes and have fluctuated significantly over the Late Quaternary period. Early research on Kashmir's glaciers began in the 19th century and those researchers suggested that there were four major glacial periods. But Subsequent studies by researchers identified two major glacial epochs. More recent research points to at least three major glacial advances and several minor ones. A significant challenges in these studies is the lack of absolute dating methods to pinpoint the precise age of past glaciations. This makes it difficult to compare Kashmir's glacial history with other glaciated regions around the world. As a result, our understanding of the region's climate variability and glacial dynamics is limited. The current research aims to address this by conducting a detailed field study in the West Liddar Valley. It will combine traditional stratigraphic analysis with modern dating techniques, including Optically Stimulated Luminescence and Cosmogenic Radionuclide dating, on moraines and erratic boulders. This approach is essential for accurately reconstructing the glacial chronology and will be crucial for understanding past climate change and building better predictive models for the future.

Keywords*: Kolahoi Glacier; Himalayas; Quaternary Glaciation; Climate Change.*

…….....

Shoreline Dynamics in the Eastern Subarnarekha Coastal Region

Pritam Kumar Santra[1], Sunando Bandyopadhyay[1] and Abhijit Chakraborty[2]
[1]Department of Geography, University of Calcutta, Kolkata 700019
[2]Department of Geology, Jogamaya Devi College, Kolkata 700026
Corresponding author: santrapritam11@gmail.com

The Eastern Subarnarekha Coastal Region (ESCR), stretching between the Subarnarekha and Rasulpur estuaries along the West Bengal–Odisha coast, is characterised by shore-parallel chenier ridges and exhibits complex shoreline dynamics.The objective of this study is to analyse spatiotemporal patterns of shoreline change across the ESCR, with particular emphasis on the role of anthropogenic modifications such as the Great Sea Dyke and sectoral embankments. Historical records, topographic maps, and satellite imagery spanning ~166 years (1855–2021) were used for the present analysis. Shoreline change was quantified using the Digital Shoreline Analysis System (DSAS v5) through 609 transects spaced at 100 m intervals, while area-change analysis was standardised per kilometre length of coastal sectors. Shoreline oscillation was assessed through linear regression, endpoint rate (EPR), and area-change analysis. At the same time, the present high-water line (HWL) positions were used to validate predictive models of future shoreline positions.Results show strong spatial heterogeneity among beach sectors: Talsari consistently accreted (+1617 ha) at the average rate of +1.01 ha/yr/km; Junput exhibited a mixed regime, with a net accretion of 394 ha at the average rate of +0.38 ha/yr/km; while Digha (–317 ha; –0.31 ha/yr/km), Chandpur (–841 ha; –0.49 ha/yr/km), and Dadanpatra (–443 ha; –0.05 ha/yr/km) were erosion-dominated sectors. In the Chandpur sector, the villages of Chandpur, Dalbaladya, Jaldha, Jamra, Shankarpur, and Shyampur have historically been close to the coast. Although they have been protected by the Sea dyke, primarily constructed to defend against storm surges during cyclones over the past ~150 years, they are still suffering severe erosion. Estuarine sectors showed predominantly erosional behaviour, most severe in the Digha estuary (–274 ha), with episodic accretion in Jalda and Pichhabani.

Keywords: *DSAS; Coastline change; Embankment influence; Eastern Subarnarekha Coastal Region.*

……

Multidimensional Analysis of Mid-Channel Island of the Mayurakshi River: Geomorphological-Hydrological Variability, Socio-Economic Vulnerabilities, and Climate-Responsive Management Approach

Shreya Basak[1] and Arindam Sarkar[2]*

[1]Postgraduate Student (Final), Department of Geography, University of Calcutta, Kolkata

[2]Faulty, Department of Geography, Purash Kanpur Haridas Nandi College, University of Calcutta

*Corresponding author shreyabasak0607@gmail.com

The mid-channel island situated in the upper course of the Mayurakshi River constitutes a dynamic fluvial landform that exemplifies the intricate interaction among geomorphology, hydrology, and climate change. Geographically, the island lies within the coordinates 23.9360°N-23.9479°N and 87.5326°E-83.6361°E. It is associated with eleven Census villages, namely Bhejena (northwest), Kaniara, Behira, Daborda, Narasinhapur, Simulia, Baram, Ghasbera, Uttar Gobindapur, and Kultore (southeast). According to Census 2011, the village of Uttar Gobindapur records the highest household count (196) and population (895), while Kaniara has a population of fifteen and comprises three households. The island is situated in close proximity to Suri towards the west-southwest and Sainthia towards the east-southeast, within the Birbhum district of West Bengal. It is also located downstream of the Tilpara barrage of the Mayurakshi River. The objectives of this research include the characterization of the geomorphology of this landform and the assessment of its hydrological regime. Additionally, the study aims to examine the socio-economic dependencies (ecosystem services), vulnerabilities, and adaptation strategies of the island communities. Another goal is to evaluate the influence of climate variability and change on river discharge and sedimentation, and to propose sustainable management strategies for ecological preservation and livelihood security.

The methodology integrates remote sensing, GIS mapping, field surveys, and socio-economic questionnaires to evaluate geomorphological changes, hydrodynamic patterns, and community vulnerabilities. Climate data analysis will inform adaptive management strategies. The island holds ecological and socio-economic significance, characterized by human habitation. It serves as a notable example of a human-encroached micro-geomorphic landform. Human encroachment on the natural landscape renders the area susceptible to hazards. The island is vulnerable to factors such as channel behavior, sedimentation, flooding, climate variability, and anthropogenic activities, which directly impact livelihoods, land use, agriculture, and ecosystem services. Additionally, the region is a hotspot for sand extraction from the riverbed. The primary outcomes of this research include comprehensive spatio-temporal mapping, vulnerability assessment, and the development of a sustainable, climate-responsive management plan aimed at enhancing the resilience of the mid-Channel Islands.

Keywords: *Mid-Channel Island; Hydro-Geomorphology; Vulnerability; Adaptation.*

……

Neotectonics of right-lateral Srinagar strike-slip fault of Kashmir Basin NW Himalaya, India

Ahmad Bashir[1], Akhtar Alam[2], Shakil A. Bhat[3] and Falak Zahoor[4]*
[1]*Boys Higher Secondary School, Handwara, Kupwara, J&K India-193221.
[2,5] Department of Geography & Disaster Management, University of Kashmir, Hazratbal Srinagar, J&K India -190006.
[3] Geological Wing, J&K Power Development Corporation (JKPDC) Bemina, Srinagar, J&K India-190018.
[4] Department of Civil Engineering, National Institute of Technology, Hazratbal, Srinagar, J&K India-190006.

Stream offset by horizontal fault displacement enables to measure planform geometry of rivers to determine fault slip sense. To accentuate geomorphic matrices of offset river Jhelum, spatial relationship of three independent channel segments were used to measure upstream, offset and downstream reaches at the Srinagar City of Kashmir Basin. The nearly northwest flowing axial river Jhelum within the Srinagar City veers initially in one long reach near Lalmandi where it makes a great bend and flows due north up to Zainakadal thence turns southwest. This misalignment of single channel and subsequent capture by adjacent channel produces an anomalous curve or turn forming a "Z-like" geometric appearance analogous to a textbook illustration of offset stream caused by right-lateral strike-slip fault. The apparent horizontal fault displacement offsets river Jhelum by dragging a reach away from its upstream segment at Lalmandi to the other side at Zainakadal leaving an elongate convex offset segment 3.15 km. Observed convexity in the longitudinal profile impede upstream loop with sediment aggradation and downstream loop with degradation processes. Fault parallel channel lengthening and hydraulic processes seem to have torn-off sharp corners at offset points caused by the fault displacement in tandem with the erosion of soft Quaternary soils. The right-lateral offset rendered the river Jhelum in the upstream of southern loop with compressed meander belt having high sinuosity index in the east of fault plane; while as, in the west of this N-S fault, the river Jhelum is disposed with deflated meanders with relatively low sinuosity index. Recurrent movement along the Srinagar strike-slipfault is clearly indicated by the emergence of new deflection angles at *Kit[a]kul* and *Sonarkul* channel segments with deflection angle of $Ó_1$ and $Ó_2$ respectively with former having younger age. Srinagar strike-slip fault with due N-S strike is characterized by varied geomorphic markers including fault scarps tectonic depressions, marshes and ponds, offset drainage lines, shutter ridges and springs. Spatial regression analysis of hydrological anomalies (springs, line springs, boiling springs and sag ponds) with the fault trace show a strong semblance of best fit. These hydrological anomalies force ground water to communicate with the upper surface that yielded a total of 248 non thermal springs along a regression line indicative of neohydrotectonics. The obvious geomorphic imprint of Srinagar strike-slip fault includes the first-order, near-fault tectonic landforms at the Southern end of Pir Panjal range where, mountain ridges initially oriented in NW-

SE direction migrate laterally in conjunction with fault motion in a meridonial direction resulting in prominent wind gaps. Future work is intended to explore palaeoseismic investigation aimed at better age control and constrained slip rates along the Srinagar strike-slipfault.

Keywords: *Srinagar; Strike-Slip Fault; River Jhelum; Spring Alignment; Neohydrotectonics*

……

Avulsion of the Titi River's Lower Reach in the Eastern Himalayan Foreland, India: Tectonic Trigger or Natural Fluvial Process?

Sanchary Debnath[1], Deepangshu Chandra[1], Deeprita Ghosh[1] and Sayantan Das[2]
[1]Department of Geography, West Bengal State University, Barasat, India
[2]Department of Geography, Dum Dum Motijheel College, Kolkata, India
Email: sanchary.debnath.2002@gmail.com

Avulsion, defined as the abrupt diversion of a river from its established course, is a key geomorphic process shaping fluvial landscapes and influencing flood hazards. This study focuses on a notable avulsion in the lower reach of the Titi River, situated in the Eastern Himalayan foreland of West Bengal, India. The Titi, originating in the Bhutan Himalayas, historically flowed south-westward to join the Bangri River, making a sharp 90° bend before their confluence. Between 1999 and 2022, multi-temporal satellite imagery reveals the progressive development of a new south-eastward channel that now connects with the Holong River, leaving the former course largely abandoned. Field surveys confirm abandonment of the old channel, though some monsoonal flow still persists. Digital Elevation Model (DEM) analysis indicates that the avulsion site coincides with a distinct slope break and an elevation difference of ~11 m relative to the adjacent Bangri River. Application of the Avulsion Threshold Index (ATI) to ten cross-valley segments shows ATI > 1 (1.28) occurs only at the avulsion point, reflecting super-elevation and a hydraulic gradient favoring channel diversion. This segment also aligns with a disjointed NE–SW fault, suggesting structural influence alongside hydrological triggers such as high monsoonal discharge and the presence of loose gravelly alluvium. The new channel, ~1.7 km long, appears to have formed during high-flow events, demonstrating the combined effects of topographic, tectonic, and hydrological controls. The avulsion has altered drainage patterns and increased flood risk potential in the surrounding plains, with possible reactivation of the abandoned channel during extreme flows. These findings underline the complex interplay of geomorphic and tectonic processes in foreland river systems and highlight the importance of continuous geomorphic monitoring for effective flood hazard management in such a dynamic environment.

Keywords: *Avulsion; Eastern Himalayan foreland; Avulsion Threshold Index; Neotectonics; Flood hazard*

……

Reconstruction of Pleistocene Paleoenvironment through Trace fossils in lateritic badland terrain of Gangani, West Bengal

Arindam Sarkar[1], Abhijit Chakraborty[2] and Sunando Bandyopadhyay[3]
[1]Department of Geography, Purash Kanpur Haridas Nandi College, University of Calcutta, Howrah
[2]Department of Geology, Jogamaya Devi College, University of Calcutta, Kolkata
[3]Department of Geography, University of Calcutta, Kolkata
Email: arindam.srkr1@gmail.com

The reconstruction of paleoenvironmental conditions using trace fossils provides a unique insight into past ecological dynamics, substrate consistency, and climatic regimes. This study focused on the lateritic badland terrain of Gangani, Garhbeta, West Bengal, with a particular emphasis on ichnofossils preserved within the ferricrete and its associated lithofacies. The overall stratigraphy of the Gangani Badland, characterized by laterite, mottled ferruginous clay, and sandstone interbedding, preserves an array of trace fossils indicative of ancient biotic activity. The Badlands have developed on a Pleistocene-aged, deeply eroded, friable lateritic surface, which is highly susceptible to erosion. The objectives of the present study are to prepare a log of different outcrops from digitized photographs and collate all the photologs into a composite lithological succession. The research aims to decipher the depositional conditions through facies analysis. Another objective of the study is to identify and interpret the influence of climate on the depositional condition. The study has been conducted through systematic field mapping, photograph logging, ichnofabric analysis, Grain-Size analysis, and sedimentological logging.

The identified trace fossils include Thalassinoides, Planolites, Skolithos, and Palaeophycus, each indicating different behavioural modes like dwelling, feeding, and movement within a marginal to shallow marine depositional environment subjected to varying energy levels. The prevalence of vertical burrows and ministate structures points to episodic high-energy events interspersed with calmer sedimentation phases, suggesting a fluvio-marine transition zone with occasional subaerial exposure. The preservation of these fossils in the lateritic crust implies post-depositional chemical stabilization influenced by tropical weathering. Our findings indicate that the Gangani badland formed under dynamic paleoclimatic conditions, marked by oscillations between humid and sub-humid phases, affecting sedimentation, diagenesis, and fossil preservation. These signatures not only reflect paleo-hydrodynamic conditions but also provide valuable evidence for reconstructing the landscape evolution of the Bengal Basin's fringe areas during the Late Tertiary to Quaternary period.

Keywords*: *Ichnology; Laterite; Palaeoenvironment; Badland; Transition.

……

Inventory and Assessment of Geomorphosites and their Geo-Tourism Potential: Leh Valley and Surrounding Environments, Ladakh, India.

[1] Amjad Ali, [2]Prashant P Magar and [3]Virendra R. Nagarale
[1]Research Scholar, PG Dept. of Geography, Govt. Vidarbha Institute of Sci. and Humanities, Amravati 444604
[2]Professor & State Academic Coordinator, Directorate of Higher Education, Maharashtra State, Pune 411016.
[3] Sr. Professor, PGSR Dept. of Geography, S. N. D. T. Women's University, Pune Campus, Pune.

Geomorphosites are natural sites with high geological or geomorphological value that can serve as popular tourist attractions. These sites often offer unique opportunities for visitors to learn about Earth's geological history, experience awe-inspiring landscapes, and engage in sustainable tourism activities. Leh-Ladakh, a high-altitude region located in the northern part of India, has a unique landscape due to the complex geological processes, making it a favourable destination in terms of geo-tourism. The study aims to assess the geotourism potential sites of Leh Valley. These sites have been evaluated using a 10-digit geo-coding method (Kale,2015).Based on this method, six geoheritage and potential geomorphosites of the study area have been identified, evaluated, classified, and ranked. The results obtained after analysis, shows that Lamayuru Fluvio-lacustrine deposits (Moon-land), Spituk Sand Ramp, Magnetic hill, Sangam point (confluence of River Indus and Zanskar), and Shey Wetland have greater geotourism potential, while the Nurla Paleo River bend holds the least potential, due to less explored site. With the effective implementation of strategic conservation measures and promotion of sustainable geotourism as well as increased awareness among the people, these outstanding landscapes can be conserved for the long term and for future generations.

Keywords: *Geomorphosites; Leh-Ladakh; Flavio-Lacustrine Deposit; Magnetic Hill; Geotourism.*

……

Mapping sand mining induced landforms in rivers of southern West Bengal: their distribution, classification and ecological implications

Priyank Pravin Patel[1], Suraj Gupta[1], Tiyasha Ghosh[1] and Joyeta Sarkar[1]
[1]Department of Geography, Presidency University, Kolkata, West Bengal
Email: priyank.geog@presiuniv.ac.in

Sustained riverbed sand mining has deleterious effects on the local reach-level river ecology and markedly alters the channel geomorphology. We examine the changes induced in several rivers of southern West Bengal by continual sand mining, highlight the new class of anthropogeomorphic

(montanogenic) landforms that have been created in this process. Such features are classified into sand hollows, sand pools, sand tracks/roads and sand mounds and their spatial distribution has been mapped across the region from Google Earth images and IRS Resourcesat series datasets. Multi-temporal analysis highlights the marked growth of sand pools due to continual extraction, and these features cover greater extents over time. The seasonal growth of sand roads reveals the progress of the mining season, which typically occurs from late October to early June, encompassing the post-monsoon to summer period. The peak sand mining period occurs during January-February, aided by a more favourable weather. Precision UAV surveys and the subsequent generation of high-resolution DEMs reveal the amount of sediments extracted within a river stretch. Such riverbed sandmining has marked impacts on the local reach ecology, as has been ascertained from changes in the water quality parameters like DO, pH, turbidity and total suspended solids (TSS) levels, and computation of the Horton's Water Quality Index (WQI). Field measurement of these parameters alongside Sentinel-2 images derived turbidity and TSS values of the examined reaches highlights the marked difference in their values between sand pools and the open river channel. Seasonal variations in these attributes are assessed via time-series examinations from Sentinel-2 images through reach-level mapping of spectral indices related to water turbidity.

Keywords: *Sand Mining; Anthropogenic Geomorphology; Sediment Extraction; Water Quality*

…….....

Morphodynamic Response of Coastal Systems: A Comparative Analysis of Selected Sites along the Western and Eastern Coasts of India

Subhamita Chaudhuri
West Bengal State University, Barasat, North Twenty-Four Parganas, West Bengal
E-mail: subhamita.chaudhuri@gmail.com (Corresponding author)

The Arabian Sea and the Bay of Bengal coasts show distinct evolutionary history owing to their respective tectonic, geophysical and structural settings. To analyze the morphodynamic response of the two coasts selected stretches of the Central Konkan coast of Maharashtra and Kanthi coast of West Bengal have been considered. The dominant wave height and wave period in the pre- and monsoon months are more or less similar at the two coasts but the breaking wave energy during monsoon at Konkan is significantly higher than the Kanthi coast. However, the impact of major cyclones accentuates the short-term erosion-potential of the waves in Kanthi coast. The wave refraction pattern and nearshore bathymetry determines the coastal cells. Longshore sediment transport in Konkan is seasonally bi-directional, but the resultant sediment transport is predominantly southward. In Kanthi coastal tract the littoral sub-cells indicate a prominent westerly circulation. The inlet mouths often function as littoral cell boundaries. The rock-coast morphological features of the Konkan coast owe their evolution to the structure and composition

basaltic escarpment, which extends up to the coastline as the marine cliffs. Protruding headlands separated by beaches and estuaries is a typical characteristic of the Konkan coast. The tidal basins are seen as partially or fully reclaimed tidal flats or lagoons, the entrance of which are now blocked by the development of spits. Majority of the beaches form the sea-facing edge of spits. The average width of the beaches is 100–200m. Long sandy beaches having average width of 250–350m with occasional exposure of paleo-mud layer, paleo beach ridges, sand dunes and intervening tidal flats drained by tidal inlets represent the geomorphic setup of Kanthi coastal plain. The textural character of sediments, though broadly similar at both coasts, the composition varies significantly. In Konkan there is dominance of carbonate sand with extensive patches of black sand, rich in opaques and pyroxenes. Kanthi coast exhibits quartz-rich whitish sand. Geomorphic signatures of past higher sea level in the Konkan are well preserved in the rocky headlands. In the depositional environment indicators of past sea level high stands are preserved as littoral concretes (*karel*) in the Konkan and as paleo beach ridges in the Kanthi coastal plain, where around seven sets of beach ridges and sand dunes can be traced parallel to the existing shoreline. Being of comparable absolute age the beach rocks in Konkan are lithified by $CaCO_3$, contrary to the unconsolidated but weathered sand of the paleo beach ridges in Kanthi.

Keywords*: Coastal Systems; Morphodynamic Response; Konkan Coast; Geomorphic Signatures.*

…….....

A Comparative Study of Geomorphic Features and Shoreline Dynamics of the Gangasagar Coast

Arnab Saha[a], and Dola Chakraborty[b]
[a]Department of Geology, Durgapur Government College, Durgapur, West Bengal- 713214
[b]Assistant Professor of Geology, Sister Nibedita Government General Degree College for Girls, Kolkata- 700024
Email: arnabsaha1118@gmail.com

The coastal geomorphology of Sagar Island, situated at the southern margin of the Ganga Delta, reflects a highly dynamic environment shaped by the interaction of fluvial and marine processes. This study examines a stretch of approximately 11 km of the island's southern coastline, covering three key zones- Beguakhali, Gangasagar main beach, and Dhablat. The region is influenced by strong tidal activity and exhibits varied shoreline configurations and geomorphic expressions. Field observations, supported by satellite imagery, reveal contrasting shoreline behaviours across the three zones, with notable differences in sediment composition, surface morphology, and landform development. The western sector shows features associated with erosion, while the central and eastern sectors display a mix of both erosional and depositional landforms. In Western part of the Gangasagar Coast remnants of old vegetation along with sticky silty clay is exposed at places. Observed geomorphic features include paleomud exposures, clay balls, berms, runnels,

ripple marks, and neo-dunes, along with vegetated older dunes in certain areas. Sediment layering and surface textures suggest both recent reworking and long-term evolution of the coast. Aeolian processes are evident in dune formation, while anthropogenic influences such as embankments and surface disturbances have modified natural patterns in some locations. The overall shoreline condition varies significantly across the three zones, emphasizing the spatial diversity of geomorphic processes acting on this tidal island.

Keywords: *Gangasagar; Shoreline; Dunes; Ripple mark; Runnel*

……..

Assessment of Mining-Induced Thermal Alterations of a Riverbed in Upper Jhelum Basin of Kashmir Valley: A Geo-Spatial Approach

[2]Aakib Yaqoob Mir, [1] Dr Saleha Jamal,[2]Mohd Saqib and [2]Manal Ahmad
Associate Professor, Department of Geography, Aligarh Muslim University, Aligarh
Research Scholars, Department of Geography, Aligarh Muslim University, Aligarh
Email: aahaf008@gmail.com

This study investigates the long-term impacts of intensive mining activities on land surface temperature (LST) in a riverbed region from 2002 to 2024 using satellite-derived indices. Analysis of the Normalized Difference Water Index (NDWI) revealed a fluctuating yet overall declining trend in surface water availability, with NDWI values dropping from 0.155 in 2002 to 0.323 in 2024, following a peak in 2013. Over the same period, maximum LST rose from 34.55 °C to 35.39 °C, indicating notable thermal alteration of the riverbed environment. Spatial analysis shows that the NDWI decline is concentrated in zones of intensified mining, where sediment disturbance and vegetation loss have reduced the riverbed's water retention capacity. The corresponding rise in LST reflects surface modification and increased heat absorption, contributing to microclimatic stress. Together, these changes underscore how mining disrupts both hydrological and thermal dynamics, degrading river ecosystem health and affecting surrounding environments. The integration of NDWI and LST data in this research demonstrates the effectiveness of satellite-based monitoring for detecting anthropogenic impacts on river systems. The findings call for sustainable mining practices and targeted river restoration measures to mitigate water depletion, reduce thermal stress, and preserve ecological integrity.

Keywords: *Normalized Difference Water Index (NDWI); Land Surface Temperature (LST); Upper Jhelum Basin.*

……..

A century of channel morphological adjustment of the Mayurakshi River, Eastern India

Sonam LAMA[1], Abhishek GHOSH[2], Sunil Kr. DE[2] and Ramkrishna MAITI[3]
[1]Department of Geography, Darjeeling Govt college, Richmond Hill, Darjeeling, West Bengal, India
[2]Department of Geography, North-Eastern Hill University (NEHU), Shillong, Meghalaya, India
[3]Department of Geography, Vidyasagar University, West Bengal, India
Email ID-sonamgeo@yahoo.co.in

The study examines channel adjustment in the western Bengal Basin, Eastern India, using the Mayurakshi River as a case study. Three distinctive phases of channel adjustment have been identified since the early 21th century, those are: 1922-1969, 1969-1990, 1990-2001, 2001-2010 and 2010-2024. Six numerical indices, namely the Active Channel Width Variation Index (ΔW%), Erosion/Deposition Index (ED), Active Channel Stability Index (ACSI), Net Active Channel Change (NACC), Active Channel Formation Rate (ACFR), and Active Channel Abandonment Rate (ACAR) were used to measure channel adjustment. The result shows that construction of Massanjore Dam and Tilpara Barrage in the 1950s and 1960s altered the river's single-thread sinuous channel into a braiding-wandering one. High floods between 1990 and 2000 triggered channel width, and bankline erosion/deposition. From 2001 to 2024, the river experienced degradation and narrowing due to stabilization of the marginal bar area. Finally, Channel Recovery potential checklist was utilized for monitoring channel adjustment, sediment connectivity, geomorphological setup, and anthropogenic stresses. It suggests that upstream reaches have more chance of channel recovery compared to low-middle reaches.

Keywords: *Channel Adjustment; Eastern India; Mayurakshi River; Channel Recovery Potential.*

……

Spatial Analysis of Dissection Index: A Case Study in Hilly Terrain

**Dr. S. P. Singh, *Ankit Singh and *Gaurav Kumar Rai*
*Department of Geography, Deen Dayal Upadhyaya Gorakhpur University, Gorakhpur.
Email: shriprakash.geo@ddugu.ac.in

The finer elements of terrain cannot be revealed by discussing only the altitude (absolute relief) and relative relief. A discussion is, therefore, required on "dissection index' which is the ratio between relative relief and absolute relief. It gives a better understanding of the terrain. Dov Nir (1957, p. 568) states that "as a criterion of relief expression, the concept of relative altitudes is not entirely satisfactory. The word dissection index defines the roughness of the surface created by numerous valleys or ravines. It is an important parameter of a drainage basin and useful in the study of the terrain and the stage attained by the stream in the course of the evolution of the basin concerned. Very high values of dissection closely correspond to the youthful stage, whereas low

values are related to the penultimate stage. The study area is situated in the southwest of Himachal Pradesh. Physiographically, the Una district is located in the Mandi-Beas region of Himachal Pradesh. The present study aims to determine the frequency and spatial distribution of the dissection index in Una District, Himachal Pradesh. The analysis of the dissection index was conducted using Dov Nir's formula, which is most convenient for calculating the index and making quantitative generalizations. This study also seeks to analyse the degree of surface roughness in the study area. The numerical analysis of the spatial distribution reveals that the low dissection index category covers a larger area of 694.26 km^2, accounting for 46.38% of the total study area. The very low dissection index category is the second largest, covering 36.88% (552.5 km^2) of the total area. Areas with a moderate dissection index comprise 178 km^2 (11.88%), while those with a moderate-high dissection index cover 58.25 km^2 (3.83%). The high dissection index category accounts for 1% of the total area, occupying 15 km^2.

Keywords: *Dissection Index; Absolute Relief; Relative Relief;*

……..

Evolution and reconstruction of late Holocene Glacier Extents and Equilibrium Line Altitudes (ELA) in the Lahaul Region of the Upper Chenab Basin, Northwestern Himalaya.

Ishtiaq Ahmed and Pritam Chand
Department of Geography, Central University of Punjab, Bathinda, India
Corresponding Author E-mail: ishtiaqgeo786@gmail.com

The Lahaul sector of the upper Chenab basin contains numerous valley glaciers that have undergone pronounced retreat since the culmination of the Little Ice Age (LIA). However, their centennial-scale evolution remains insufficiently quantified. This study reconstructs glacier fluctuations from the LIA to the present through an integrated, multi-proxy approach. Former glacier extents were delineated using historical cartographic archives, published expedition reports, and repeated terrestrial photography, supplemented by high-resolution geomorphological mapping of LIA terminal and lateral moraines. Glacier length and area changes were quantified from multi-temporal satellite imagery and ground-based surveys, while shifts in Equilibrium Line Altitude (ELA) were derived using the Area-Altitude Balance Ratio (AABR) method in conjunction with paleo-glacier surface reconstructions. The results indicate a persistent and accelerating reduction in glacier area and length since the LIA, with the most rapid recession occurring in the late 20th and early 21st centuries. Reconstructed paleo-surfaces reveal substantial ice surface lowering and widespread down-wasting, consistent with enhanced frontal retreat. These findings provide robust centennial-scale evidence of glacier shrinkage in response to climatic variability in the western Himalaya and establish a critical baseline for future glacier–climate impact assessments in the region.

Keywords: *Geomorphological Mapping; Little Ice Age; Paleo-Glacier; Surface Reconstructions.*

……..

Multi-Proxy Provenance Analyses of the Basal Conglomerate Formation of Meghalaya, India

Kulhiu Mero[1*]
[1*] Department of Geography
[1*]William Carey University, Meghalaya
Email: akule.mero@gmail.com

The present studies focuses on the multi-proxy provenance analyses of the Basal conglomerate formation through various proxies of mineralogical analysis including heavy mineral, petrographic analysis and through Rare Earth Elements by using ICP-MS techniques.Preparation of thin-section, petrographic report and heavy mineral analysis was carried out at the Petrology and Chemical Division, Geological Survey of India.The results shows mixed provennace on the basis of the entire heavy mineral assemblage it can be interpreted that the source rock was from igneous origin mainly from acid igneous rocks, granite pegmatites, only few from basic igneous rocks and metamorphic rocks. The results from the REE distribution pattern of Chondrite-normalized shows fractionated REE trend with negative Eu anomaly. The pattern is indicative of the source being from porphyritic granite.The petrogenesis of the rock samples shows mixed provenance due to presence of both subrounded to subangular clastics of the rock some from near by sourced and others with subrounded grains suggesting of more distanced source with prolonged transport.Most of the samples are of a granitic or, gneissic provenance as the source for deposition.The rock of quartz-vein are medium grained in nature suggesting of relatively moderate rate of cooling Texturally the rock suggest of igneous origin later deformed and metamorphosed. Basal conglomerate formation belonging to the Khasi Group of Rocks holds a significant Geo-Heritage potential. The need for community awareness and preservation of this conglomerate formation becomes vital as they holds a key potential of becoming an important Geo-heritage site.

Keywords*: Basal Conglomerate Formation; Provenance; Rare Earth Elements; Geo-Heritage Potential.*

……..

Determining Geo-Environmental Parameters Causing Slope Instability in Parts of Western Ghats, Maharashtra, India

Sumant E. Autade[1], Sudhakar D. Pardeshi[2], Suchitra S. Pardeshi[3] and Mahesh Lavate[4]

[1]Department of Geography, Rashtriya Shikshan Sanstha's Swami Vivekanand Night College, Chhatrapati Bhavan, Ayre Road, Dattanagar, Dombivli East, Maharashtra, India - 421201.

[2]Dept. of Geography, Savitribai Phule Pune University (formerly University of Pune), Pune - 411 007, Maharashtra, India.

[3]Post-Graduate Department and Research Center in Geography, Prof. Ramkrishna More College, Akurdi, Pune – 44, Maharashtra, India.

[4]Department of Geography, KES's B.K. Shroff College of Arts and M.H.Shroff College of Commerce, Bhulabhai Desai Road, Kandivli (West), Mumbai – 400067.

Email: sumantautade@gmail.com

Western Ghats and undulated terrain of Konkan region are susceptible to slope failures of different types and varying intensities. Distinctive lithological properties, geomorphic characteristics combined with intense monsoonal rainfall are important factors responsible for slope instability in this region. Translational debris slide is the most common type of slope failure on the western slopes of Western Ghats up to the elevation of 350 m. whereas wedge failure and rockslides are common slope failure types at higher elevation (350 to 600 m.). The present paper attempts to determine geo-environmental characteristics of landslide affected areas susceptible to landslides in parts of Western Ghats and Konkan region of Maharashtra State. The study focuses on determining characteristics of slope, slope aspect, elevation, density of natural vegetation, land use and land cover, lithological characteristics, geological formations, structural discontinuity etc. based on landslide susceptibility map using Multi-criteria decision making approach. The parameters including distance from road, proximity to lineaments and proximity to major drainage have not been considered for establishing their relationship with actual slope failures. Since, only major drainage lines have been extracted for the present study and only seven slope failure events are found within the buffer of 100 m. distance from drainage lines. The distance from roads could not be considered for establishing its relationship with slope failure because all the slope failure events recorded during field survey are confined to roads. No major slope failure has been observed with proximity to lineaments. This may be due to the coarse resolution of the data used (SRTM DEM, Google Earthpro and Geological Quadrangles) for extraction of the lineaments. On the basis of the relationships between landslide causative factors and distribution of actual slope failures, it can be inferred that slope gradient, aspect, rainfall, lithology, land use and land cover are important geo-environmental factors in the initiation of slope failures in North Konkan. Since, rainfall is a main landslide triggering factor in the study area the consideration of landslide magnitude at the time of slope failure will be more useful rather than mean annual rainfall. One of the major limitations in calculating rainfall intensity is non-availability of details about exact date and time of slope failure. Therefore, generating complete landslide database with accurate date

and time of slope failure can be more effective in determining the role of rainfall in slope instability.

Keywords: *Landslide Frequency; Landslide Susceptibility Zonation; Western Ghats; Translational Landslides; Rotational Landslides; Landslide Density.*

……..

Assessment of morphotectonic signatures and depositional sequences in the Subarnarekha River Basin – geomorphometric and geochronological insights

Sayoni Mondal[1*] *and Manoj Kumar Jaiswal*[1]
[1]Department of Earth Sciences, Indian Institute of Science Education and Research- Kolkata (IISER-K), Mohanpur, Nadia – 741246, West Bengal, India
*Corresponding author email: sayonim91@gmail.com

Examination of form-process relations in cratonic regions have attracted much attention due to their subtle topographic surface expressions and long history of denudation. Such topographic signals can provide insights into the climatic and geological history of a region, thus helping in understanding overall landscape evolution. The Subarnarekha River Basin in eastern India, is a classic example of a Precambrian Cratonic complex, wherein the Archaean rocks of the upper–middle basin grade into undulating plains of Tertiary sediments, that are overlain by Quaternary deposits. The possible tectonic and litho-structural influence of this river is investigated on the basis of longitudinal profile analysis of the principal stream and its major tributaries, pertinent morphotectonic indices at the sub-basin scale using high-resolution terrain datasets and fluvial depositional records discerned from detailed field studies and laboratory analyses. Parameters like the stream gradient index and chi-plots were computed, along with discerning the relative variation in tectonic signatures based on collated morphotectonic parameters. Lithofacies plots at select locations within the middle Subarnarekha Basin were prepared to discern sediment textural changes along with OSL dating of the same. The presence of steep channel segments, multiple knickpoints in upstream reaches, and incised meanders on terrace surfaces indicate heterogenous response to past tectonic perturbations and ambient structural variations, and their spatial differences are mapped across the basin landscape. Geochronological analysis in select locations in the Middle-Subarnarekha Basin identifies the depositional sequences therein to be from the Late Holocence Period onwards, indicating the possible timeline of channel incision in this region.

Keywords: *Morphotectonics; River Longitudinal Profiles; Lithofacies; Luminescence Dating.*

……..

Planform MorphologyAnalysis of Oxbow Lakes in the Jaldhaka Floodplain of West Bengal

Dinabandhu Barman[1] and Priyank Pravin Patel[1]*
[1]Department of Geography, Presidency University, 86/1, College Street, Kolkata – 700073, West Bengal, India
*Corresponding author email: dinabandhu.rs@presiuniv.ac.in

Oxbow lakes or meander scars are remnant fluvial formswithin a floodplain landscape. Their planform morphology is strongly associated with their genesis, which is driven by cutoff and channel belt avulsion, and has a significant role in regulating the within-lake ecosystem function and processes (e.g., stratification, sediment dynamics, macrophyte diversity, and habitat availability). This study analyzes the fundamental planform characteristics, locational setting, and shape variations of oxbow forms and cutoffs in the Jaldhaka River floodplain of West Bengal, usingstatistical clusteringanalysis (PCA and K-means) based on the elicited morphological parameters for 251 oxbows in the region. Discerned parameters like the width-to-length ratio (WLR), perimeter development index (PDI), meander openness index (MOI), and index of sinuosity (ML/SL ratio) were used as relative indices of shape irregularity and complexity. Building on the prepared database, this study proposes a new morphological classification scheme for such remnant fluvial forms that succinctly encapsulates the planform configuration of the cutoff mechanism and parent channel morphology. This scheme may be useful quick assessments of basin- or regional-scale analysis of oxbow form typologies using only two morphological variables, i.e., the average oxbow width and meander openness index (MOI).

Keywords: *Oxbow Morphology; Meander Openness Index; Oxbow Lake; Morphometric Analysis.*

……..

Role of Geomorphology in Selecting Suitable Landfill Sites Under Different Physiographic Regions

*Itu Pal[*1] & Ramkrishna Maiti[2]*
[*1]Research scholar, Department of Geography, Vidyasagar University, Midnapore, West Bengal, 721102, India.
Email: itupal411@gmail.com
[2]Professor, Department of Geography, Vidyasagar University, Midnapore, West Bengal, 721102, India.
Email:ramkrishna@mail.vidyasagar.ac.in

Each Municipality faces a challenge in collecting and disposing of large amounts of waste due to rapid population growth. The absence of an appropriate large dump site can harm the environment and society. The MCDM technique and GIS platform can help choose a proper landfill site. With two municipalities and a population of almost seven lakhs, MKDA has the same difficulties. An appropriate landfill site for the MKDA region was identified in this study

using the AHP approach. Based on expert supervision, eighteen criteria were considered according to their weightage. A receiver operating characteristic (ROC) curve is used to validate the final results using 1000 randomly chosen prospective landfill-suitable site locations with greater precision. 84% of the area under the curve (AUC) has been determined to be significant in validating the spatial result. The results indicate that 23.67 percent (138.67 sq km) and 11.29 percent (66.11 sq km) of the MKDA area fall under the category of suitable and highly suitable landfill sites, while 30.29% (177.46 sq km) fall under the category of moderately suitable, and 24.30% (142.33 sq km) and 10.45% (60.22 sq km) fall under the category of less and unsuitable for landfill. The results of this study could help the city's waste management officials and urban planners create a solid waste management system that works well.

Keywords: *Suitable Landfill Site; AHP; Solid Waste Management; Geomorphology; MKDA.*

……..

Fluvial Landforms of the Bedrock Channel Reaches of the Damanganga River, Western India

Vitthal K. Anwat[1] and Pramodkumar S. Hire[2]

[1] KRT Arts BH Commerce and AM Science College (KTHM), Nashik. Affiliated to Savitribai Phule Pune University, Maharashtra.

[2] HPT Arts and RYK Science College, Nashik, Maharashtra.

Email: vitthalanwat87@gmail.com[1]

Bedrock channel morphology is dominated by erosive processes and the resistance of channel bed and banks. The controls on these interactions change with spatial scale. Fluvial erosional processes of bedrock channel occur through the processes such as solution, cavitation, corrosion, corrasion or abrasion. In the present investigation an attempt has been made to study the channel morphology, erosional and depositional features of the Damanganga River (149 km), Western India. Damanganga River's bedrock channel is principally erosive and nevertheless, it exhibits a range of mid-channel and bank attached depositional features. The maximum relief of the basin is 1244 m. The average annual rainfall of the basin is 2292 mm. The Damanganga Basin extends over a thick pile of Deccan lava flows which is a part of the Deccan Basalt Province. The SOI toposheets, satellite imagery, DEM, statistical methods and extensive field survey, are used to identify the landforms. The GIS techniques particularly raster analysis, profiles and volumetric analysis performed to prepare maps using ArcGIS software and identify the erosional and depositional sites. The analysis reveals that the bedrock channel of Damanganga River seen all type of erosional and depositional landforms like alluvial channel. The hypsometric integral value for the Damanganga River is 0.50 which represents equilibrium or mature stage and further it indicates that the watershed is susceptible to erosion. The zones of deposition and bars can persist as shallowing creates hydraulic conditions for deposition. Bedrock channel of Damanganga River has observed 25 erosional and 19 depositional sites. Erosional landforms mainly includes V

shaped valley, grooves (06), knickpoints (16), potholes (324) and inner channel (4). It is concluded that rapid decrease in flood energy and competence consequence in extensive deposition in the form of longitudinal bars (5), expansion bars (5) and point bar (9) in the bedrock channel of west flowing of Damanganga River. It is noticed that the deposited coarse-grained sediment are made available from tapered reaches located upstream of the depositional features.

Keywords: *Bedrock Channel; Erosion; Deposition; Landforms.*

……

Estimation of morpho-sedimentary variations in beach cusp formations along the southern Konkan region, Maharashtra state, West Coast of India.

Lalit Thakare[1] and Shreya Chavan*[2]
[1]Department of Geography, S. P. College, Pune
[2]Department of Geography, Wadia College, Pune
[*]Corresponding author: thakarelm@gmail.com

The Beach cusp is an indicator of the wave-dominant coastal process. It forms regular undulations along the shore zone and is characterized by a distinct sequence of bay and horn patterns. Similar patterns were observed along Palghar and Ladghar beaches, the southern parts of Konkan coast of Maharashtra state. The main objective of the present study was to assess the seasonal variations in morphology and sedimentary characteristics of beach cusps formation and quantify their changes over the spatio-temporal scale. A field survey was carried out post-monsoon to investigate a beach cusp system and relate it to the synoptic hydrodynamic nature. An extensive dataset was generated from beach profiling, sediment sampling, and GPS surveys. The 5.4 m depth profile along high beach level cusps indicate a series of seasonal and annual coastline regressions. Lower beach level cusps form multilevel depositional patterns of height up to 2.2 m and 2.6m, respectively form during every tidal cycle along Palshet and Ladghar. Middle beach level cusps form a bay–horn pattern with 2.7 m and 3.2 m height, indicating a high tide zone. High beach level cusps form between spring and neap tide with a height of 3.3 m and 2.2 m, respectively. A 3D model of the Palshet and Ladghar beach cusp system was generated using the above data. Shoreline changes were detected using multi-temporal Landsat satellite data series from 2005, 2011, 2016, and 2022 for both beaches. The temporal changes along both the beaches were also assessed. Delineation of the coastline was performed at various temporal scales using DSAS and ArcGIS software. A resultant statistical mapping indicated the stages of development of beach cusps along both coasts. These findings gave a better understanding of the evolution of beach cusps parameters and can be used to formulate similar coastal geosystems research.

Keywords: *Beach Cusps System; Synoptic Hydrodynamic; Palshet, Ladghar; DSAS Software; Statistical Mapping.*

……..

Performances of ADCP and Digital Bathymetric Model (DBM) to explore spatio-temporal variations of hydraulic geometry and channel bed morphology in upper and lower tidal part of river Hugli, India

Professor Sujit Mandal
Department of Geography, Diamond Harbour Women's University
West Bengal-743368
Email: mandalsujit2009@gmail.com

The River Hugli as a distributary channel of the River Ganga, denotes the western boundary of the Ganga-Brahmaputra-Meghna (GBM) Delta and exhibits variation in hydraulic geometry and and bathymetry influenced by various natural and anthropogenic factors. The present study applied Acoustic Doppler Current Profiler (ADCP) in the field and Digital Bathymetric Model (DBM) to assess the river's hydraulic geometry and bathymetry from the Jalangi confluence at Nabadwip to the Rupnarayan confluence at Noorpur in West Bengal, India. ADCP technology provided accurate observations of discharge, velocity, and depth across multiple cross-sections while quantification of flow characteristics at different parts of the river has been made through Reynolds and Froude number. Digital Bathymeric Model (DBM), generated from secondary sources and field-verified data, facilitated to assess spatio-temporal alterations of channel bed forms which depicted the changes in channel morphology, thalweg shifts, and sediment deposition trends over the years. The upper tidal reach is highly dynamic, which experiences rapid bank erosion, frequent thalweg shifts and redistribution of sediments within the channel, which results in unstable channel morphology and flow alterations. In contrast, the tidal reach has relatively stable morphology but is affected by anthropogenic modifications where siltation and sediment deposition are persistent issues. The study accentuates the effectiveness of ADCP and DBM in capturing real-time changes of hydraulic geometry and channel bed morphology, which is essential for river restoration and sustainable river management.

Keywords: *Hugli River; Acoustic Doppler Current Profiler (ADCP); Digital Bathymetric Model (DBM); Hydraulic Geometry; Channel Bed Forms.*

……..

A GIS-based characterisation of channel morphology and sinuosity indices: A case study of Vaghotan river basin of south Konkan region, India

Shreya S. Chavan[1] and Lalit M. Thakare[2]
[1]Department of Geography, Nowrosjee Wadia College, Pune
[2]Department of Geography, S.P College, Pune
Email: Shreyachavan1452@gmail.com & thkarelm@gmail.com

The Vaghotan River basin in Sindhudurg district of Maharashtra state in India is undergoing geomorphic development. The present study was directed to comprehend the development of the basin and factors influencing in form of tectonic effects, fluvial processes, and human activities. One important indication of these elements is sinuosity, which gauges the river's meandering tendency. The impact of human activities like dam building and land use changes on the river's sinuosity and general geomorphology is also being researched. The Vaghotan River originates from the Kajirda region of the Western ghat (Sahyadri) and flows through the Konkan region to the Arabian Sea (Vijaydurg Creek).By using geospatial techniques, the morphometric parameters like basin area, basin perimeter, bifurcation ratio, stream length, drainage density(0.57 (km/km2), stream frequency, relief ratio, form factor, circulatory ratio(0.22), elongation ratio(0.58), ruggedness number(0.57), drainage texture, wandering ratio(1.81), fitness ratio(0.47) and compactness coefficient(2.10) were assessed and mapped. The hypsometric integral of Vaghotan River is 0.44 determines the mature stage or in the equilibrium stage of the channel as a geomorphic development. For the analysis of the morphological changes in the river channel, the sinuosity index plays a crucial role in understanding the degree of meandering and the channel stability. The sinuosity index of the Vaghotan river was calculated by dividing the whole river channel into three stages. The estimated sinuosity Index (SI) of the upper stretch, middle stretch and lower stretch were 1.67, 1.54 and 1.29, respectively. The channel morphometry of the stream indicated that there is a pediment-pediplain complex along the banks. This is an indicator of retreat of the mountain front and a gently sloping erosional surface is formed.

Keywords: *Sinuosity Index; Morphometric Analysis; Pediment-Pedeplain Complex; Hypsometric Integral.*

……..

Sinuosity Index as a Diagnostic Tool for Flood Susceptibility in Bedrock-Controlled Rivers: Insights from the Upper Krishna Basin, India

Tushar P. Raut[1&3], Sudhakar D. Pardeshi[1] and Suchitra S. Pardeshi[2]
[1]Department of Geography, Savitribai Phule Pune University, Pune
[2]Department of Geography, Prof. Ramkrishna More College, Akurdi, Pune, India
[3]DES's, Nowrosjee Wadia College, Pune
Email: tusharraut103@gmail.com

River sinuosity reflects the interaction of hydrological, geomorphic, and structural controls, and plays a central role in understanding flood susceptibility. In basaltic terrains, unlike alluvial systems, sinuosity is strongly governed by relief and drainage dynamics rather than sediment load. This study investigates the hydro-geomorphic significance of the sinuosity index (SI) morphometric parameters and flood sustainability across six sub-basins of the Upper Krishna Basin, Maharashtra, A GIS-based approach was used to extract channel and valley lengths for SI estimation, while twenty morphometric indices—including drainage density (Dd), relief ratio (Rh), infiltration number (If), elongation ratio (Re), and circularity ratio (Rc)—were derived from DEM and topographic data. Correlation analysis and Principal Component Analysis (PCA) were applied to identify controlling parameters and clustering patterns. SI values varied from 1.58 (Doodhganga River) to 2.20 (Warna), indicating marked differences in channel irregularity. Correlation analysis revealed strong positive associations of SI with Dd ($r \approx 0.72$), Rh ($r \approx 0.68$), and If ($r \approx 0.65$), while basin shape parameters (Re, Rc) showed weaker or negative relationships. PCA results explained 89.4% of total variance, with PC1 dominated by hydro-geomorphic parameters (Dd, Rh, If) that clustered with SI, and PC2 controlled by basin geometry (Re, Rc). The findings demonstrate that in the basaltic bedrock terrains of the Upper Krishna Basin, sinuosity and flood susceptibility are primarily controlled by drainage texture and relief energy, with basin geometry exerting only a secondary influence. Warna, Koyna, and Panchaganga River basins emerge as priority sub-basins for flood risk management. The integration of SI, morphometric analysis, and PCA provides a robust framework for assessing flood sustainability in hard-rock river systems.

Keywords: *Sinuosity Index; Hydrogeomorphology; Morphometric Analysis; Flood Susceptibility; PCA; GIS; Upper Krishna Basin.*

……

Spatial Variation of Crab Burrow Characteristics and Its Relation to Morphological and Anthropogenic Variables: A Case Study of Mandarmani Beach, West Bengal, India.

Soumen Ghosh[1] *and Subhamita Chaudhuri*[1]
[1]West Bengal State University, Barasat, West Bengal
Corresponding author's email: soumenghoshdigha@gmail.com

The intertidal zone of the Mandarmani coast is primarily dominated by two benthic species: the red ghost crab (*Ocypode macrocera*) and *dotilla (Dotilla myctiroides)*, which play a crucial role in nutrient cycling and sediment reworking processes, and are good indicators of beach health. The present study aims to investigate the variations in crab ichnofabric with changing geomorphic conditions and the degree of anthropogenic interference. Random data on bioturbation parameters, viz. burrow density, average burrow diameter and burrow orientations, were collected along the beach and tried to find out their relation with different geomorphic variables (elevation, submergence level, energy condition and mean sediment grain size). Red Crab burrow density is highest (5 burrows m^{-2}) and burrow diameter is larger in the higher intertidal zones with less than 40% submergence and gradually decreases towards the low tide line, as they primarily utilize lower beach areas for grazing but construct their burrows at higher elevations. The eastern section of the beach has a higher density of red crab burrows, likely due to limited anthropogenic disturbances, whereas the density is lower towards the tourism-dominated western part. In contrast, dotilla crabs predominantly inhabit the nutrient-rich lower intertidal zones, ideal for their filter-feeding activities. The increase in the dotilla population in the middle and western sector is possibly influenced by reduced beach elevation due to hotel construction and the presence of a runnel, which creates favourable microhabitat for dotilla colonization. The integration of Bioturbation related data with geomorphic variables enhances our understanding of benthic behaviour and the broader implications of anthropogenic influences on intertidal zones, which may help in the sustainable management of the beach environment.

Keywords: *Intertidal Zone; Crab Burrow; Bioturbation.*

……

TS-2

Climate, Cryosphere and Extreme Weather

Rainfall Regime and Urban Flood Vulnerability in the context of Climate Change: A Geomorphological Assessment of the 2006 and Recent Flood Events in Surat City, India

Dr. Kulsum Salahuddin
Department of Geography, Aligarh Muslim University
Email: klsmsldn7@gmail.com

Long-term meteorological data analysis is a very effective measure of climate change. Growing evidence exists on the causal relationship between the urban climate change and the increasing rainfall uncertainty. Contemporary climate change is mainly characterized with the increase in rainfall amount as well as the intensity of rainy spells. The maritime city of Surat has a high mean annual rainfall exceeding 1200 mm. A comparatively warmer air of Surat has a tendency to rise steadily to cause expansion, cooling, condensation and cloud formation of greater vertical depth and higher rainfall than the countryside. The study evaluates rainfall frequency and variability for the period 1971-2021. To examine the behaviour of, particularly, recent rainfall changes during 2001-2021 was of crucial importance due to its conformity with the high industrial-commercial growth during the corresponding period. The growing rainfall amount and intensity has increased the flood vulnerability in the city. Surat is not only meteorologically vulnerable to floods; the city is also geomorphologically flood vulnerable due to the catchment and command area Geomorphic personality of the Tapi River Basin. The variation in the amplitude of relief in the river basin and the city has a high impact on the flood and its receding characteristics. The basin comprises three Geomorphic divisions of the largest upper basin and the smallest lower basin. Urban floods in Surat City on the mouth of Tapi River are largely the result of basin geomorphology of the catchment area and the rainfall intensity. The narrow, elongated and compact Tapi Basin with large amplitude of relief is potentially vulnerable to floods. The paper examines the impact of Geomorphic landscape and slope types in accentuating the intensity of Surat Floods.

Keywords: *Rainfall Regime; Climate Change; Geomorphic Landscape; Urban Floods; Flood Recession.*

……

Spatio-Temporal Assessment of Agricultural Drought in Jaisalmer, Rajasthan Using Remote Sensing technique (2004–2024)

Anurag Yadav[1], Md. Juel Rana[2] and Ashutosh Kumar[1]*
[1] Research Scholar, Govind Ballabh Pant Social Science Institute Jhusi Prayagraj
[2] Assistant Professor, Govind Ballabh Pant Social Science Institute Jhusi Prayagraj
Email: anuragy910@gmail.com

Climate change has caused noticeable shifts in weather patterns, altering the spatio-temporal distribution of temperature and rainfall. Increasing occurrences of droughts and floods now pose serious threats to agricultural activities. While previous studies have indicated that the Thar Desert region of India is witnessing increased rainfall and vegetation cover, the dynamics of agricultural drought in this region remain underexplored. This study assesses the condition of agricultural drought in Jaisalmer district, Rajasthan, over the past two decades. Landsat 7, 8, and 9 satellite imagery from the years 2004, 2014, and 2024 was used to calculate vegetation- and climate-based indices including the Normalized Difference Vegetation Index (NDVI), Vegetation Condition Index (VCI), Temperature Condition Index (TCI), and Vegetation Health Index (VHI). Findings reveal a significant decline in areas under severe and high agricultural drought, with a notable shift towards no-drought conditions. VCI results suggest an increase in soil moisture, likely driven by rising rainfall over the last two decades. TCI analysis indicates a transition from high to moderate or low heat stress between 2004 and 2014, although considerable variability is observed between 2014 and 2024. Overall, the study concludes that agricultural drought conditions have lessened in the region, offering new opportunities for agriculture and livelihoods.

Keywords: *Agricultural Drought; Remote Sensing & GIS; Arid Region; Vegetation Indices.*

……

Impact of Climate Change on the Spatio-Temporal Dynamics of Glacial Lakes in Trans-Himalayan Region of Kargil-Ladakh: A 1994-2022 Inventory Using Remote Sensing Techniques

Habibullah[1], Kajol Mankotia[1] and Md. Sarfaraz Asgher[1,]
[1]Department of Geography, University of Jammu (18006)
Corresponding Author: Sasgher20@gmail.com

The warming climate has significantly accelerated glacier retreat in the Trans-Himalayan region of Kargil, Ladakh, leading to the formation of new glacial lakes and the expansion of existing ones. This trend heightens the risk of Glacial Lake Outburst Floods (GLOFs). To assess these changes, multi-temporal and basin-specific inventories of glacial lakes were created for the years 1994, 2008, and 2022 using Landsat 5 TM and Sentinel-2A imagery.A total of 252 glacial lakes

(731.94±95.7646 ha) were identified in 1994, increasing to 263 lakes (798.09±95.826 ha) in 2008 and 311 lakes (1094.60±24.4115 ha) by 2022, reflecting a 23.41% rise in lake count and a 49.55% increase in total area over the 28-year period. The Shingo basin exhibited the highest lake concentration. Notably, the largest lake in 2022 spanned 63.08 ha, and the number of lakes larger than 20 ha rose from two in 1994 to six in 2022. Supra-glacial lakes experienced the most dramatic growth, with a 216.66% increase in number and an 803.24% rise in area. While end-moraine-dammed lakes declined in number (from 17 to 12), their area expanded significantly from 96.297±8.1256 ha in 1994 to 216.971±1.4620 ha in 2022, a 125.31% increase. In 2022, 67.84% of the lakes were classified as "Other Glacial Erosion Lakes." Altitudinal analysis reveals that more than 80% of the lakes are situated between 4500–6000 m above mean sea level. Climatic trend analysis, based on the Mann-Kendall test and Sen's slope estimator, indicates a statistically significant warming trend ($p < 0.05$), with the most pronounced temperature rise occurring in September (Sen's slope = +0.08°C/year). Consequently, the combined effect of rising temperatures and decreasing precipitation is likely accelerating glacier mass loss, contributing to the expansion of existing glacial lakes and the formation of new ones. The rapid expansion of glacial lakes, combined with these climatic shifts, underscores an increasing risk of GLOFs. This study provides vital insights for identifying high-risk lakes and developing mitigation strategies. It supports the need for early warning systems, adaptive infrastructure planning, and policy integration aligned with Sustainable Development Goals (SDGs) 6, 11, and 13.

Keywords: *Trans-Himalayas; GLOFs; Mann-Kendall Test; Sen's Slope; Disaster Management.*

……..

Mapping Glacier Change in the Upper Tons Basin (1993–2023) Using Multi-Sensor Remote Sensing

Md. Mamoon Rashid[1] *and Sundaram*[1]
[1]Department of Geography, Faculty of Sciences, Jamia Millia Islamia, New Delhi, India 110025
Email address: md.2008929@st.jmi.ac.in

The glaciers of the Upper Tons Basin (UTB) in the Garhwal Himalaya are vital sources of freshwater for the Yamuna River system. This study investigates glacier changes over three decades (1993–2023) using a hybrid multi-sensor approach, supported by field validation. Synthetic Aperture Radar (SAR) coherence from Sentinel-1A served as the primary dataset for mapping glaciers in 2023, while thermal bands from Landsat served as a base for mapping glaciers in earlier years. Optical imagery from the Sentinel-2 and Landsat series was used to refine the base boundaries. The minimum mapped glacier size was less than 0.02 km² to exclude seasonal snow and firn. The total glacier area in 2023 is 87.36 ± 2.07 km², comprising 69.75 ± 1.65 km² clean ice and 17.61 ± 0.42 km² debris-covered ice. Between 1993 and 2023, total glacier area declined by 17.57 ± 1.20 km² (16.74 ± 1.15%), with clean ice losing 9.87 ± 0.68 km² (12.4 ± 0.85%) and

debris-covered ice 7.74 ± 0.50 km² (30.5 ± 1.97%). The maximum loss occurred from 1993–2001 (10.06 ± 0.70 km²), while 2001–2013 showed the slowest recession. The smaller glacier lost more than the larger glaciers in terms of relative area. Climatic analysis from 1993 to 2023 revealed significant increases in precipitation, temperature, and black carbon concentration. The climatic and non-climatic factors strongly influenced glacier dynamics. Clean-ice glaciers responded more rapidly to warming, while debris-covered glaciers showed decreased recession. This study shows that integrating SAR coherence, thermal, and optical datasets is effective for mapping glaciers with thick debris cover. The findings showed rapid glacier shrinkage during the 1990s, followed by a slower retreat, due to glaciers' adjustment to changing environmental conditions. The present study has implications for regional water security, hazard assessment, and climate adaptation planning in the western Himalaya.

Keywords: *Glacier Change; SAR Coherence; Debris-Covered Glacier; Topographic Controls; Upper Tons Basin.*

…….....

Trend analysis and forecasting of climate in Ladakh region of Western Himalayas using Mann-Kendall test and machine learning models

Saqib Iqbal Raina and Masood Ahsan Siddiqui*
Department of Geography, Faculty of Sciences, Jamia Millia Islamia, New Delhi
Presenting author: Saqib Iqbal Raina
*Corresponding author: saqibiqbalraina@gmail.com

The Ladakh region in the Western Himalayas, being at high-altitude with cold-arid ecosystem, is highly vulnerable to climate change. The climate shifts can trigger the severe environmental and socio-economic consequences in this region. Therefore, a comprehensive understanding of long-term trends and future forecasting of climate variables is necessary for effective regional planning. The current study investigates the past and future trends of rainfall and temperature in Ladakh region. Historical temperature and rainfall data from 1980 to 2024 were analyzed using the Mann-Kendall test and Sen's slope estimator to identify the time series trends and magnitude. Subsequently, the seasonal forecasting of rainfall and temperature was carried out using Random Forest (RF) and Extreme Gradient Boost (XGBoost) models for next 30 years (2025-2055). Model performance was rigorously evaluated using performance metrics namely mean absolute error, mean absolute percentage error, root mean square error and the coefficient of correlation. The analysis revealed a statistically significant and robust declining trend in rainfall across all seasons. Both maximum and minimum temperatures exhibited a consistent warming trend with most pronounced during the winter and summer seasons. The XGBoost demonstrated better predictive accuracy with lower errors than RF. Future forecasting indicated a continuation of these patterns with a significant decrease in rainfall in all seasons. Both minimum and maximum temperature is

projected to increase with significant rise in winter season. These findings provide critical evidence of rising temperature and aridification in Ladakh.

Keywords: *Climate Change; Non-Parametric Test; Random Forest; Xgboost; Ladakh.*

……..

Long-Term Trend Analysis and Seasonal Forecasting of Temperature and Rainfall in Sundarban Biosphere Reserve, India Using Non-Parametric and Hybrid Deep Learning Approaches

Daawar Bashir Ganaie, Haroon Sajjad and Md Sahil*
Department of Geography, Faculty of Sciences, Jamia Millia Islamia, New Delhi, India
* Corresponding Author: daawarb@gmail.com

Climate change has posed a severe threat to fragile deltaic ecosystems and densely populated regions. Despite increasing concern over changing climate, there is less understanding of dynamics of key meteorological variables in Sundarban Biosphere Reserve of India. The study aims to examine and forecast the long-term temporal changes in rainfall and temperature using data obtained from India Meteorological Department during 1972-2024. Modified Mann-Kendall test and Sen's slope estimator were utilized to examine the trend and magnitude of the temperature and rainfall on monthly, seasonal and annual timescales. Convolutional neural networks and bidirectional long short-term memory (CNN-BLSTM) hybrid deep learning model was employed for seasonal forecasting of temperature and rainfall for the next 30 years (2025-2054). The model's accuracy was accessed using mean-absolute error, mean-absolute percentage error, root mean-square error and correlation coefficient. Results revealed significant variability and shifts in rainfall and temperature. Rainfall trends exhibited significant increases in January, June and December while April showed a significant decline, highlighting disruptions in seasonal freshwater availability. An increasing trend in maximum temperature was observed during monsoon and early winter months with July, August, September and December months showing most rapid increases. Minimum temperature displayed widespread and consistent increasing trend across most months and seasons indicating enhanced nocturnal warming. Mean temperature trends aligned closely with maximum and minimum temperatures, with significant increase annually and during monsoon and post-monsoon seasons. Forecasting analysis of rainfall and temperature showed continuous increasing trend and more erratic pattern of rainfall. The forecasting indicated a declining summer rainfall and rising monsoon intensity. These findings underscore serious implications of climate change on mangrove ecosystem resilience, agriculture, water resource management and socio-ecological conditions in the SBR. The paper offers a novel reproducible methodological framework that can be applied to other geographical regions for analyzing and forecasting climate variability.

Keywords: *Climate Change; Sundarban Biosphere Reserve; Deep Learning; Modified Mann-Kendall Test; Forecasting.*

……..

Assessing Vegetation and Thermal Patterns to Detect Ecological Stress: A Spatio-Temporal Assessment of Sariska Tiger Reserve, Rajasthan

Vivek Raj Singh Chauhan[1], Lalit Singh Jhala[2] and Shrishti Raj Singh Chundawat[3]
[1]UGC-SRF Research Scholar, Department of Geography, Jai Narain Vyas University, Jodhpur (Rajasthan). Email- vivek.2491@gmail.com
[2]Assistant Professor, Department of Geography, Jai Narain Vyas University, Jodhpur (Rajasthan). Email- jhalalalitsingh97@gmail.com
[3]Assistant Professor, Department of Geography, Bhupal Noble's University, Udaipur (Rajasthan). Email- sraj25singhh@gmail.com

Maintaining the ecological integrity of the Sariska Tiger Reserve (STR) is paramount for biodiversity preservation and effective tiger conservation efforts. This study offers a comparative analysis of vegetation health and thermal patterns between 2014 and 2024, utilizing the Normalized Difference Vegetation Index (NDVI) and Land Surface Temperature (LST) derived from Landsat satellite imagery. The 2014 NDVI results indicate robust vegetation health in the Kali Ghati, Naldeshwar Mahadev, Nariyani Mata, Ajabgarh, and Thanagazi ranges, with elevated index values observed within interior forest zones and near water sources. Conversely, lower NDVI values were noted along reserve boundaries, degraded slopes, rocky outcrops, and scrub forests characterized by the presence of *Prosopis juliflora*, suggesting sparse vegetation or exposed soil. The 2024 NDVI map exhibits a comparable spatial distribution, yet reveals discernible shifts in vegetation density, thereby identifying potential areas of degradation and regeneration. Furthermore, LST analysis, employing thermal infrared bands and a split-window algorithm, has quantified spatial variations in surface temperature, enabling correlation with NDVI patterns. Initial projections, derived from established inverse correlations between NDVI and LST, indicated that areas with low NDVI values have experienced elevated surface temperatures due to diminished evapotranspiration and increased soil heat absorption. Conversely, zones with dense vegetation have exhibited lower LST values, contributing to microclimatic stability and enhanced habitat quality. By integrating NDVI and LST data across the two-year period, this study has identified ecologically stressed regions within STR, monitored decadal vegetation and temperature shifts, and pinpointed areas most susceptible to climate variability and anthropogenic influences. The results will provide a scientific foundation for focused habitat restoration efforts, improved

resource management strategies, and long-term conservation planning initiatives, as mandated by the Rajasthan Forest Department and the National Tiger Conservation Authority.

Keywords: *Sariska Tiger Reserve; NDVI; LST; Habitat Restoration; Vegetation Health.*

……..

Cryospheric change and water security challenges in cold-arid Ladakh: Evidence from the Ganglas Catchment

Riyaz Ahmad Mir, Sachchidanand Singh, Geogre Jose Pottakal, Ishan Sharma, Chandra Prakash and Ankit Khajuria*

National Institute of Hydrology, Western Himalayan Regional Centre, J&K, Jammu – 180003, India

*Corresponding author: riyazmir.nihr@gov.in , riyazgsi@gmail.com

Leh town and nearby areas depend heavily on water from glacier- and snow-fed streams, springs, and groundwater. This region lies in the cold-arid Trans-Himalayan part of the Upper Indus Basin, where rainfall is very low and water supply is highly seasonal. At the same time, fast urban growth, rising population, economic development, and increasing tourism are adding further pressure on already limited water resources. To ensure long-term water security, it is important to understand changes in glaciers, snow cover, and their effect on water supply. This study focuses on the Ganglas catchment, which is the main source of water for Leh – an urbanized town. Using Survey of India maps, Landsat and Sentinel images, Google Earth data, and ASTER DEM supplemented with field observations, changes in glacier and snow resources were assessed. Two glaciers, G-47 (Phuche Glacier) and G-20, showed steady retreat between 2000 and 2023. G-47 reduced from 0.64 km² to 0.57 km² (loss of 0.071 km²; 10.99%), while G-20 shrank from 0.41 km² to 0.36 km² (loss of 0.049 km²; 12.06%). These findings show that small glaciers are especially vulnerable, losing more than 10% of their area in just two decades. Mass balance data highlight further losses: between 2010 and 2024, Phuche Glacier lost –2.14 m w.e., while Khardung Glacier lost –7.9 m w.e., showing greater sensitivity to climate change. Seasonal patterns suggest that summer melting is far stronger than winter accumulation, making glaciers highly sensitive to even small temperature increases. Snow cover analysis (2021–2024) using Sentinel-2 NDSI shows strong seasonality, with ~15–16 km² cover in winter and less than 1 km² in late summer. On average, snow cover was 10.25 km², with the highest in January 2022 (16 km²) and the lowest in September 2024 (0.59 km²). Most snow was found at elevations of 5000–5500 m, while areas below 4750 m had only short-lived cover. In summer, snow was mostly limited to above 5500 m. Slopes between 20–40° retained more snow in winter, while gentle slopes (<20°) at high altitudes held snow into summer. Unusual patterns, such as very low snow cover in January 2024 (~7.9 km²), suggest mid-winter climate fluctuations. Overall, the study shows clear signs of glacier shrinkage, negative mass balance, and variable snow cover in the Ganglas catchment. These changes pose serious risks to water security

in Leh, which depends directly on these cryospheric resources. If current trends continue, domestic water supply, farming, and livelihoods will be heavily affected. The findings stress the urgent need for better glacier monitoring, sustainable water management, and climate adaptation measures to protect the people and ecosystems of Ladakh.

Keywords: *Landsat, Leh, Ganglas, Phuche Glacier, Snow cover, Water supply, Trans-Himalaya*

……

Advanced Landslide Forecasting in the Himalayan Region Using Geospatial Foundation Model

Shuvrangshu Jana
GeoMind AI, Bengaluru
shuvra.ce@gmail.com

The Himalayan region is highly prone to frequent and destructive landslides triggered by intense rainfall, snowmelt, earthquakes, and human activities, leading to significant socio-economic losses. Existing predictive approaches are often constrained by static susceptibility mapping, limited spatial–temporal resolution, and reduced reliability under cloud cover or in snow-dominated terrains. This study presents a framework for dynamic landslide susceptibility forecasting by fine-tuning a Geospatial Foundation Model (GFM) with multi-modal Earth observation data and real-time hazard indicators. The approach integrates multi-temporal optical imagery, all-weather Synthetic Aperture Radar (SAR), high-resolution Digital Elevation Models (DEMs), derived terrain hydrology metrics, and near-real-time rainfall estimates from IMERG and ERA5. The GFM is fine-tuned on region-specific datasets from recent Himalayan events, including Chamoli (2021) and South Lhonak/Sikkim (2023), to capture both geomorphological and hydrological precursors to slope failure. Model performance is evaluated against conventional machine learning and deep learning baselines using metrics such as F1-score, ROC-AUC, and spatial precision–recall. Preliminary results indicate notable improvements in predictive accuracy and a reduction in false alarms. These findings demonstrate the potential of foundation model-based, multi-modal fusion approaches to enhance early warning capabilities and support operational disaster risk reduction in high-risk mountain environments.

Keywords: *Landslide Susceptibility Forecasting; Himalayan Region; Geospatial Foundation Model.*

……

Holocene Flood Records of the Anas Basin, Western India: Implication to Climate Reconstruction

Gitanjali Bramhankar[1] Pramodkumar S. Hire[1], Archana Patil[2], Manoj Kumar Jaiswal[3], Dhiraj Kumar[4] and Sujata Phadol[5]*

[1^]Department of Geography, HPT Arts & RYK Science College, Nashik, India

[2]Nicolaus Copernicus University in Torun, Faculty of Earth Science, Lwowska, Torun, Poland

[3^]Department of Geography, RNC Arts, JDB Commerce & NSC Science College, Nashik, India

[4]Department of Earth Sciences, Indian Institute of Science Education & Research Kolkata, West Bengal, India

[5^]Department of Geography, KRT Arts, BH Commerce & AM, Science College,

^Affiliated to Savitribai Phule Pune University, Pune

*Email: gita279b@gmail.com

In India, high-magnitude floods pose a major natural hazard, with profound socio-economic and geomorphic implications. These extreme events are important in shaping the landscape, particularly in bedrock reaches where they leave behind distinct sequences of slackwater deposits (SWDs), often vertically stacked. Such deposits preserve valuable records of centennial to millennial-scale variations in fluvial dynamics and flood regimes, offering insights into long-term hydrogeomorphic processes within the Anas Basin (sub-basin of the Mahi Basin). To establish the chronology and stratigraphy of floods, Optically Stimulated Luminescence (OSL) dating is applied and discharge estimates are derived by slope-area method. The analysis of SWDs at Thapra-Sangrampura reveals that the Anas River experienced multiple Late Holocene flood events. The flood events recorded at the first site were dated and range from 461 ± 14 yrs. to 2521 ± 78 yrs. lying in the late Holocene period and the magnitudes of these flood events range from 12,495 m^3/s to 2188 m^3/s, respectively. At the second site, a minimum OSL age is of 249 ± 09 yrs. (Calibrated age 1771 ± 09 yrs. historical flood) and the maximum age of 322 ± 12 yrs. (Calibrated age 1698 ± 12 yrs. historical flood) with magnitudes 12,740 m^3/s and 4370 m^3/s. At third site (along SWD terrace), the flood events occurred during 180 ± 10 yrs., 2235 ± 105 yrs. and 4025 ± 150 yrs. and discharges range between 13,690 m^3/s and 16,289 m^3/s respectively. The investigation indicates that all palaeofloods occurred during the Late Holocene. However, the most significant recorded flood took place in 2006, with estimated discharges of 14,641 m^3/s and 14,952 m^3/s at the both tributaries. This extreme event was triggered by low-pressure systems (LPS) developed over the Bay of Bengal. The findings suggest that recent floods in the basin have exceeded the magnitude of palaeofloods.

Keywords: *Palaeoflood Records; Palaeoflood Discharges; Late Holocene; Anas River.*

……..

Rainfall Variability, trends and change detection across the Vaitarna Basin (India): A Spatiotemporal Investigation

Sujata Phadol[1], Archana Patil[2], Uttam Pawar[3], Pramodkumar Hire[4], Gitanjali Bramhankar[5] and Laxman Shendge[6]

[1, 4, 5 (^)] Department of Geography, HPT Arts and RYK Science College, Nashik - 422 005

[2, 6 (^)] Department of Geography, RNC Arts, JDB Commerce and NSC Science College, Nashik Road, Nashik – 422 101

[3] Department of Geography, Shri Bhausaheb Vartak Arts Commerce and Science College, Borivali, Mumbai - 400 091

[(^)] Affiliated to Savitribai Phule Pune University, Pune - 411 007

*Corresponding or presenting author's Email- phadolsujata924@gmail.com

The present investigation emphasizes the variability of rainfall, trends, and change point detection using long-term rainfall data (1901-2022) from ten rain gauge stations situated within and in the proximity of the Vaitarna Basin. In this study, rainfall variability was quantitatively assessed using the coefficient of variation (Cv). To detect trends within the time series, a combination of statistical techniques was applied, including the non-parametric Mann–Kendall (MK) test, Sen's slope estimator (SSE), and the Innovative Trend Analysis (ITA) method, enabling the identification of both monotonic and non-monotonic trend structures. Furthermore, Pettitt's Test was utilized to detect potential abrupt change points within the temporal dataset. The analysis showed that although the variability of monsoon and annual rainfall in the Vaitarna Basin is consistent at 19%, the rainfall variability fluctuates from 31% in July to 53% in September. The trend analysis results indicated a significant declining trend for Igatpuri in July (-1.84mm/y) and for Jawhar in August (-2.04 mm/y). In contrast, statistically significant increases in rainfall were recorded for Palghar in July (1.7 mm/year), for Wada (1.69 mm/year) in August, and for Dahanu in August (3.25 mm/year) and September (2.57 mm/year) at the monthly level. During the monsoon season, a decreasing trend was observed only for Jawhar (-1.69 mm/y), whereas Dahanu and Palghar demonstrated significant increases in monsoon rainfall (3.75 mm/y and 1.66 mm/y, respectively) and annual rainfall (3.71 mm/y and 1.7 mm/y, respectively). The ITA observations suggest that there is no considerable monotonic trend in rainfall on a monthly, monsoon, and annual scale. The change-point analysis revealed a coinciding shift year (1929) in both the monsoon and annual rainfall for the Vaitarna Basin. The outcomes of the present study are of great importance for the management of floods, droughts, and water resources within the Vaitarna Basin.

Keywords: *Vaitarna Basin; Mann–Kendall Test; Sen's Slope Estimator; Innovative Trend Analysis; Pettitt's Test.*

……

Climate change and landslides: Example from South Sikkim

Ria Naskar[1], Arindam Chowdhury[2] and Sunil Kumar De[1]
[1]Department of Geography, North Eastern Hill University, Shillong
[2]D. N. Wadia Institute of Himalayan Geology, Dehradun
Email: desunil@gmail.com

Climate change is terrestrial phenomenon since the evolution of earth that may be caused due to several processes, such as natural processes, external forcing agents and presently due to anthropogenic modification of the composition of the atmosphere and/or of land cover. As far as recent and present climate is concerned, the Fourth Assessment Report of the IPCC (2007) states that the warming of the global and regional climate system is unequivocal. We all have become familiar with the so-called 'hockey stick' temperature trend, representing the warming that occurred in the last 30–40 years. The issue of whether the temperature rise of the last 100 years crossed over the warm limit of the boundary defined by the Medieval Climate Anomaly has been a controversial topic in the science community. However, at present, it is true that the global average temperature during the last few decades was warmer than any comparable period during the last 400 years. The present study is based on relation between short-term climate change impacts from 1981-2021 and the frequency of landslides in the highly susceptible terrain of South Sikkim, India. Correlating landslide events with climatic patterns underscores the pivotal role of heavy rainfall, especially in lower elevation zones, as a predominant trigger for landslides. Human activities, particularly construction and road development, are identified as exacerbating factors for slope instability. Moreover, the incorporation of Scanning Electron Microscopy (SEM) results enhances the depth of the study by providing valuable insights into the microscale characteristics of soil and rock samples. These SEM results reveal intricate material properties influencing landslide susceptibility. According to numerical data, there was a 44% increase in the occurrence of new landslides, 2% of slides were reactivated, 3% experienced expansion, 10% began shrinking, 21% remained dormant, and 19% stabilized between 2019 and 2021-22, highlighting the growing concern of this issue.

***Keywords**: Climate Change; Landslide; South Sikkim; Scanning Electron Microscopy (SEM).*

……

Assessing Ecological Vulnerability to Climate Change in the Bhutan Himalayan Foothills of Assam

Nityaranjan Nath[1] and Dhrubajyoti Sahariah[2]*
[1*] Research Scholar, Department of Geography, Gauhati University, Assam, India
[2] Professor, Department of Geography, Gauhati University, Assam, India.
[*]Email: nityarnath@gmail.com

This study focuses on identifying ecologically vulnerable hotspots under climate change in a portion of the Bhutan Himalayan foothill region of Assam, spanning Kokrajhar, Chirang, Baksa, and Udalguri. The area lies within the Eastern Himalayan Biodiversity Hotspot, a globally significant landscape that supports rich biodiversity and vital ecosystem services. It includes two national parks and several wildlife sanctuaries, forming a connected mosaic of foothill forests, grasslands, river corridors, and human-modified lands. These protected and surrounding areas function as ecological pathways and buffers that sustain wildlife, regulate water and sediment, and underpin local livelihoods. Using a geospatial perspective, the study screens the region to highlight places where climate pressures are most likely to intersect with sensitive ecosystems and human uses. The main focus of the study is to deliver clear, map-based insights that can guide attention, monitoring, and future research across the four districts. By framing vulnerability at a landscape scale within a globally recognized hotspot, the work offers a concise baseline for anticipating ecological stress in the Himalayan foothill setting.

Keywords: *Ecological Vulnerability; Climate Change; Geospatial Assessment; Foothill Ecosystems.*

……

Application of Random Forest Classifier and Evaluation of Varying Intensity of Vulnerability in an Arid Environment Using Generalised Additive Model: A Case Study in Indian Desert

Azizur Rahman Siddiqui
Professor, Department of Geography
University of Allahabad, Prayagraj
Emial: arsiddiqui1970@yahoo.com

Indian Arid Lands reflect varying intensity of morphogenic vulnerability. This arid tract is reported as densely populated desert as compare to other deserts of the world. In last three decades, impact of climate change, extreme weather events and human adverse activities resulted into a drastic change in the desert landscape. The research objectives of this research paper are to assess Impact of climate change & extreme weather events. Impact of adverse human practices on weak and

fragile ecosystem, Detection and measuring varying intensity of morphogenic vulnerability. Generalized Additive Model (GAM)/application of random Forest classifier and evaluation of varying Intensity of vulnerability in the study area have been adopted. It has been observed that satellite derived data found suitable to predict production potential and intensity of vulnerability in the study area. This study applied RF classifier to classify Land classes. Pixel samples were utilized to classify land classes. A stratified random sampling method was employed to reduce sampling bias, with the collected samples being divided into 60% for training the Random Forest algorithm and 40% for validation, ensuring robust model performance. NDVI, NDWI, and LST trends from 1990 to 2023 across the LULC have been processed. Analysis reveals that there is regular gradient of increasing desertification risk is seen towards western margin and north western portion of the study area due to morphogenic vulnerability, climatic variability and human Intervention.

Key Words: *Morphogenic, Vulnerability, Fragile, Climatic Variability*

…….....

An Assessment of Retreat Pattern on Changme Khangpu and Kangkyong Glacier, Sikkim, India (1980-2020)

Bharti[1] and Mary Tahir[2]
[1] Research Scholar, Department of Geography, Faculty of Sciences, Jamia Millia Islamia, Delhi.
E-Mail- *dubeybharti007@gmail.com*
[2]CorrespondingAuthor- Prof. Mary Tahir, Professor, Department of Geography, Faculty of Sciences, Jamia Millia Islamia, Delhi.
E-Mail- *mtahir@jmi.ac.in*

A Glacier is a Stubborn Mass of dense ice constantly moving under its weight. Glaciers form where snow has accumulated over centuries, often centuries and beyond erosion. One of the most dramatic pieces of evidence that the global climate is warming is the retreat and disappearance of Mountain glaciers around the world. The present study is all about the Changing patterns of Changmekhanpu and Kangkyong Glacier in Tista Basin in Sikkim. The study is based on observations in 4 decades from 1980-1990, 1990-2010, 2000- 2010 and 2010-2020. The work is done with the help of Remote sensing techniques and Geographic Information System software. The Demarcation of Glaciers is extracted from NASA, USGS, GLIMS and Google Earth Pro Data with the help of SRTM DEM, Landsat 5 ETM and Landsat 8 OLI. The processed satellite images are obtained from ArcGIS 10.5. All these satellite images are used to delineate glacier boundaries, Estimate glacier length, and calculate snout retreat and snow cover. The Present Length of the Changmekhanpu Glacier is 6.4 km. The length increased by 197 meters in 40 years from 1980 to 2020. The current length of the Kangkyong glacier is 8 km. The Length was decreased by 660

meters in 4 decades. The area of both glaciers decreased by 1.19 km and 2 km, respectively. The snout recession had fluctuations. At last, the snow cover index (NDSI) indicates that the change in climate affects the glacier's topography. The results and analysis have been explained in this work.

Keywords: *- Cryosphere; Sikkim Himalaya; Changmekhanpu Glacier; Kangkyong Glacier Climate Change; Remote Sensing; Glacial Retreat; NDSI.*

……..

Climate Justice: Ethics Issues of Climate Change Impacts

Ramkrishna Maiti
Professor and Head, Department of Geography
Vidyasagar University, Midnapore 721102
Email: ramkrishna@mail.vidyasagar.ac.in

Poor and underdeveloped nations of South and Southeast Asia, Africa, and Latin America receives maximum burden of climate change impacts. Emission gap report of UNEP (2021) shows that richest 1% of the global population emits more than twice the combined carbon emission of the poorest 50% population. Poor countries who are least responsible for climate change shares most of the human casualty and property loss out of climate hazards. Ironically, global leaders and environmentalists made population and poverty responsible for environmental degradation and pollution. Thus, a false narrative of blaming the victims were set. Children and younger generation are to face more climate change burden than the older generation. Time has come when the climate management policies at global or domestic scales must address these ethical and justice issues. Larger burden are to be shared by them who are responsible for this crisis, who are mostly benefitted out of the actions that caused climate change and who has the more capacity to bear the burden.

Keywords: *UNEP (2021); Carbon Emission; Management Policies.*

……..

Dharali Disaster 5 August 2025 in Bhagirathi Valley of Garhwal Himalaya

D.D. Chauniyal and Savita Chauniyal***
*Nitya Nand Himalayan Research and Study Centre, Doon University, Dehra Dun
**Department of Economics, D.A.V. (P.G.) College, Dehradun
Email: devidattchauniyal@gmail.com

Dharali is a village situated at the confluence of the Bhagirathi River and its third-order tributary, the Khirganga stream, in Uttarkashi district, Uttarakhand. The Khirganga originates from the northern slope of the Srikantha Peak and joins the Bhagirathi at an elevation of approximately

2,600 m at Dharali. On 5 August 2025, a catastrophic flash flood struck the area, destroying residential houses, hotels, homestays, motorable roads, agricultural fields, and apple orchards. The event unleashed a violent torrent of water laden with large boulders, cobbles, pebbles, mud, and rock debris, impacting the settlement with such force that several structures were displaced from their foundations, while others were completely buried under sediment up to rooftop level within seconds. Preliminary geospatial analysis and rapid post-event assessment estimate that approximately 3.6×10^8 m³ of debris and water were mobilized, with the entire surge reaching the settlement in 25–30 seconds. The estimated peak discharge likely exceeded 10,000m³/s, placing this event in the extreme range for Himalayan Mountain catchments. Casualties include six confirmed fatalities, with at least 50 individuals missing. The total economic damage has been provisionally assessed at ₹500 crores**.** The trigger mechanism remains under investigation by scientists from the Indian Space Research Organisation (ISRO), the Geological Survey of India (GSI), and hydrometeorological experts. Plausible causative scenarios under consideration include:

- Orographically induced cloudburst or extreme convective precipitation,
- Sudden breaching of a landslide-dammed lake (Landslide Lake Outburst Flood, LLOF),
- Glacial ice-rock avalanche or glacier lake outburst flood (GLOF),
- A multi-hazard chain reaction**,** where multiple geomorphic and hydrological processes acted sequentially or simultaneously.

Given the event's rapid onset, high sediment load, and geomorphic transformation of the channel, the Dharali disaster may be classified as a high-intensity, short-duration mass-wasting and fluvial hazard typical of unstable Himalayan headwater environments. Investigations are exploring causes such as cloudburst, landslide lake breach, glacier-related events, or a multi-hazard chain.

Keywords*: Dharali; Flashflood; Cloudburst; Hazard; Debris Flow; Sediment Load.*

…….....

Disentangling Local Geomorphometric Controls from Climatic Drivers of Glacier Retreat in the North-western Himalaya

Mifta ul Shafiq[1]
[1]*Department of Geography, Cluster University of Srinagar, Gogji Bagh, 190008*
(Email ID: saabid9@gmail.com)

Glaciers in the Himalayan region are widely recognized as sensitive indicators of climate change, yet their response is not uniform across space and time. While large-scale climatic factors are primary drivers of glacier retreat, local geomorphic controls exert a profound influence on glacier

dynamics and variability. This study evaluates the role of glacier hypsometry, surface slope, and aspect in modulating the recession of Kolahai and Nehnar glaciers in the Kashmir Himalaya over the period 1962–2017. Multi-temporal remote sensing datasets, supported by ASTER-derived digital elevation models, were employed to classify glacier area across elevation, slope, and aspect zones. Results reveal that hypsometry strongly governs glacier sensitivity to climate variability. Kolahai glacier experienced maximum areal loss in the lower altitudinal bands (3600–4200 masl), whereas Nehnar glacier exhibited significant losses even at higher elevations (>4600 masl), primarily due to avalanche activity and steep gradients. Slope analysis indicates that steeper surfaces (>35°) recorded disproportionately higher losses, underscoring the role of slope in regulating ice velocity, mass flux, and snow redistribution. Aspect-wise analysis demonstrates pronounced retreat from southern and south western flanks, reflecting prolonged solar exposure and enhanced melt, while north-facing zones exhibited comparatively greater resilience. The comparative assessment highlights that even under similar regional climatic forcing, glacier response varies significantly due to local topographic factors. These findings underscore the necessity of incorporating geomorphometric parameters into glacier-climate interaction models to improve predictions of future glacier behaviour, water resource availability, and cryosphere-related hazards. This study contributes to a deeper understanding of cryospheric geomorphology and provides critical insights for climate adaptation strategies in the north-western Himalaya.

Keywords: *Glacier Retreat; Geomorphometry; Slope; Cryosphere; North Western Himalaya.*

…….....

Responses of Tropical Cyclones to Global Warming: Insights from Historical Trends and Idealized Simulations for the Bay of Bengal Region

Soumendu Chatterjee and Abhisek Pal
Department of Geography, Presidency University, Kolkata
Email: soumendu.geog@presiuniv.ac.in

This study assesses the projected impacts of climate change on the intensity and structure of tropical cyclones (TCs) over the Bay of Bengal using historical analyses and idealized modeling. Observational trends in lifetime maximum intensity (LMI), power dissipation index (PDI), and potential intensity (PI) were evaluated, along with thermodynamic drivers. While LMI and PDI showed no significant trends, PI exhibited a moderate but significant increase (Mann–Kendall value: 2.43; Sen's slope: 0.04). Projections from ten CMIP6 global circulation models indicate no statistically significant change in PI for the near-future (2041–2060) or far-future (2081–2100) relative to the present climate (2001–2020). Idealized simulations with the Weather Research and Forecasting (WRF) model, incorporating CMIP6-based perturbations via the pseudo-global warming method, suggest warmer sea surfaces and a moister atmosphere in future climates, accompanied by pronounced upper-tropospheric warming. These conditions result in reduced simulated TC maximum intensities by 9.05% (near-future) and 29.97% (far-future) from present

values (54.54 m/s). The near-future scenario produces the highest rainfall, whereas the far-future yields the lowest. Both future climates generate TCs with cooler cores, higher outflow temperatures, and diminished surface heat fluxes. The weakening of TC intensity is attributed to enhanced atmospheric stabilization from upper-tropospheric warming, which counteracts the intensifying influence of warmer sea surface temperatures. Overall, findings suggest that despite ocean warming, future TCs over the Bay of Bengal may exhibit reduced intensity due to thermodynamic constraints.

***Keywords**: WRF; CMIP6; LMI; PDI.*

……..

TS-3

Hydrology and Water Resources

Assessment of water demand and supply using WEAP model in the North Kashmir, India

Nahida Yousuf[1], Mohd Sultan Bhat[1], Akhtar Alam[1], Bilquis Shah[1] and Rabbya Ul Qalab[1]*
[1]Department of Geography and Disaster Management, University of Kashmir, Srinagar.
*Corresponding author: nahidageo2014@gmail.com

The Kashmir valley grapples with a paradoxical situation of abundant water resources and growing water scarcity, driven by increasing population, rising water demand, and the impacts of climate change, posing future freshwater availability challenges. Therefore, this study intends to analyze and estimate the water demand and supply for the Kupwara and Baramulla districts within the Jehlum and Pohru sub-watersheds of North Kashmir. Water Evaluation and Planning (WEAP) model was used to estimate agricultural, horticultural, and domestic water demand and supply requirements. To assess water supply and demand, data pertaining to the model parameters was used from the time period of 1991-2021 and the future demand situation was analyzed for the period 2021–2051 (forecasting period). The results depicted that in 2021, domestic water demand in Kupwara was 26.70 MCM, while Baramulla had a higher demand of 33.11 MCM due to its larger population. For agriculture, Kupwara's demand was 316.20 MCM with an unmet demand of 60.44 MCM, while Baramulla had a demand of 332.14 MCM with an unmet demand of 39.98 MCM. In horticulture, Kupwara's demand was 129.04 MCM with an unmet demand of 28.74 MCM, while Baramulla's demand was 142 MCM with an unmet demand of 17.01 MCM. The results of the study indicates that by 2051, changing precipitation patterns, increasing population growth and an increase in agricultural intensification will dramatically increase water demand, posing threats to the environment and humans. Therefore, the research emphasizes the importance of sustainable planning and management of water resources in the face of the mounting challenges from climate change and population growth in the Jehlum and Pohru sub-watersheds.

Keywords: *North Kashmir; WEAP; MABIA; Unmet Demands; Water Resource Management.*

……..

Geo-Morphometric Analysis of the Pabbar River Basin: Insights from the Lesser Himalayan Region of Himachal Pradesh and Uttarakhand

Anju[1*] and Anju Gupta[2]
[1]Research Scholar, Department of Geography, Kurukshetra University, Kurukshetra, Haryana
[2]AssistantProfessor, Department of Geography, Kurukshetra University, Kurukshetra, Haryana
Email:anjudhanda1998@gmail.com

The unsustainable use of natural resources, such as water and soil—driven by inefficient farming practices, population growth, and excessive use of fertilizers—has led to their rapid degradation. Watershed-based approaches offer an effective framework for conserving these resources. A watershed is a hydrological unit that channels surface runoff to a common outlet, such as a river or lake. This study presents a morphometric analysis of the Pabbar River Basin, a tributary of the Tons River in Himachal Pradesh, which ultimately feeds into the Yamuna River system. Owing to its diverse topography and hydrological importance, the basin was analyzed for its linear, areal, and relief characteristics using Digital Elevation Models (DEMs) and geospatial tools. Key parameters, including stream order, drainage density, stream frequency, and bifurcation ratio, were assessed. The results indicate a dendritic drainage pattern, moderate erosion, and a basin in its mature developmental stage. These insights are crucial for watershed management, flood risk mitigation, sustainable agriculture, and informed regional planning**.**

Keywords: *Morphometric Analysis; DEM; Form Factor; StreamOrder; Bifurcation Ratio.*

…….....

Reconstruction of Discharges Using Palaeostage Indicators (PSI) in the Gorge Section of the Kaveri River, Southern India

Archana Patil[1], Pramodkumar Hire[2] and Smita Pagare[3]*
[1] RNC Arts, JDB Commerce and NSC Science College, Nashik Road, Nashik – 422 101
(Affiliated to Savitribai Phule Pune University, Pune - 411 007)
[2 & 3]HPT Arts and RYK Science College, Nashik - 422 005
(Affiliated to Savitribai Phule PuZne University, Pune - 411 007)
* Corresponding author: archanapatil.geo@gmail.com

Flood hazard management in monsoon-driven rivers is hindered by high spatiotemporal rainfall variability and scarce long-term hydrometric records across the Indian subcontinent. In such data-limited settings, palaeoflood hydrology offers a rigorous framework for reconstructing the magnitude and frequency of extreme flood events from pre-instrumental periods, encompassing recent, historical, and prehistoric times, through detailed analysis of geomorphic and sedimentary flood archives. Quantitative palaeoflood discharge estimates are commonly derived using two principal approaches, palaeo-competence analysis, which infers flow strength from the calibre of

coarse bedload transported during the flood, and hydraulic reconstruction, which calculates discharge from the elevation of flood deposits as well as trim lines relative to prevailing channel geometry. This study integrates multiple palaeo-stage indicators (PSIs), including laterally continuous tree lines, slackwater deposits (SWDs), palaeo-competence analysis of coarse bedload, and historical maximum stages from documented and anecdotal sources, to constrain palaeoflood stages at five sites within the bedrock gorge section of the Kaveri River. Discharge estimation was supported by upstream and downstream gauging records, applying the slope-area method and supplementing it with one-dimensional steady-state hydraulic simulations in HEC-RAS. To assess the effects of large-magnitude floods, parameters of the hydraulics were computed. The bedrock-confined channel reaches of the Kaveri River yielded palaeoflood discharges between 5,641 and 13,420 m^3s^{-1}. Validation against gauged peaks at Kollegal (upstream) and Biligundulu (downstream) shows strong concordance, with reconstructed magnitudes closely matching the 2019 extreme flood. The historical inflow maximum at Mettur Dam (12,912 m^3s^{-1}) aligns with the upper bound of the reconstructed envelope. The highest values of stream power (59,643 Wm^{-2}) and bed shear stress (3,225 Nm^{-2}) indicate high erosive capacity, Froude number straddling unity denote subcritical and supercritical flows, while high Reynolds number confirms extreme turbulence. These findings provide critical insights for flood hazard management in data-sparse fluvial systems.

Keywords: *Discharge; Palaeostage Indicators; Kaveri River.*

……..

Tide Induced Sedimentation and Basic Nutrients Dynamics along a selected Transect of Kishorimohanpur Area in the Indian Sundarban

Arpan Roy Chowdhury[1] and Subhamita Chaudhuri[1]
[1]Department of Geography, West Bengal State University, Barasat, West Bengal
Email: arpan23rc@gmail.com

Indian Sundarban, home for rich mangrove diversity with a population over 4 million, experiences tide induced sedimentation, warranting comprehensive assessment of sediment properties and nutrient dynamics. This study aims at interpreting the sediment textural properties, basic nutrient distribution and mangrove zonation across a selected transect of Kishorimohanpur area of the Indian Sundarban. A representative profile was surveyed, initiating at the riverbank, continuing over the mudflat and terminating behind the embankment constructed for protection of villages. On that profile, mangrove zones have been delineated according to the tidal inundation levels. Four sediment samples were collected along the profile. Tidal levels were also monitored. The sediment texture shows the dominance of very course silt to very fine sand, indicative of tidal depositional environment. Nutrient analysis reveals that potassium is almost similar throughout the profile. Phosphorus and nitrogen are high at the upper part and decreases towards the river.

Organic carbon and organic matter content is low at the riverfront and upper part but high in the intermediate zone of the mudflats. This can be attributed to the higher litter production by mangroves and enhanced nutrient-trapping by their intricate root system. Salinity is high at the riverfront area and low at the upper part following the tidal inundation pattern. Such findings underscore the interplay between ecological processes and sediment-nutrient dynamics within the Sundarban ecosystem. The role of the embankment is also important in the sedimentation process. The riverfront side gains elevation due to tide-induced sediment but the presence of an embankment, restricts the entry of sediment-laden tidal water. As a result, sediment settles down from suspension and get deposited within the river, raising the bed of the channel. The opposite side of the embankment remains low due to the absence of tide induced sedimentation.

Keywords: *Nutrient Dynamics; Sediment Texture; Mangrove; Sundarban; Embankment.*

…….....

Logical Fusion of Optical and Microwave Satellite Data for High Accuracy Mapping of Glacial Lakes and River Streams in the Chandra Basin

[1]Sandeep Kumar Mondal, [1]Ruturaj Daphale, [1]Raghavendra Talawar, [1]Karthik C.B., [1]Pramod Kumar, [1]Litan Mohanty, [1]Ashutosh Kulkarni, [1]Parmanand Sharma, [1]Bhanu Pratap and [1]Meloth Thamban*

[1]Himalayan Cryosphere Studies, National Centre for Polar and Ocean Research (NCPOR), Ministry of Earth Sciences (MoES), Govt. of India

*Corresponding author: skmondal@ncpor.res.in

Surface water mapping in the Himalayan region is essential for understanding climate change impacts, water resource management, and risk assessment related to hydrological hazards such as glacial lake outburst floods (GLOFs). However, challenges such as cloud coverage during monsoon and spectral similarity of frozen surfaces during winter hinder automated mapping using conventional optical remote sensing techniques like band ratios. Manual delineation, though commonly practiced, is labor-intensive and time-consuming. This study proposes a more robust and effective technique for high-accuracy mapping of surface water features, including glacial lakes and river streams, by logically integrating optical and microwave datasets. Landsat-8 operational land imager (OLI) data of 23 September 2024, have been utilized to extract surface water features using multivariate statistical techniques: Principal Component Analysis (PCA), Independent Component Analysis (ICA), and Tasseled Cap Transformation (TCT). In parallel, Sentinel-1 synthetic aperture radar(SAR) data of 27 September 2024 have been processed to derive surface water features using Otsu thresholding of VV-polarized backscatter information. The binary outputs from PCA, ICA, TCT, and SAR datasets are then fused using a logical AND-gate operation to generate high-accuracy surface water map. This logical fusion reduces algorithm-dependent errors and enhances the reliability of final output. The closer the acquisition dates of optical and SAR data, the more effective the mapping, although a few days' gap is acceptable due

to the generally stable nature of glacial lakes over short periods. Accuracy assessment against water features derived from high-resolution LISS-IV data using normalized difference water index (NDWI) indicate an overall accuracy of 93.2%, Kappa coefficient of 0.83, conditional Kappa of water class at 0.87, precision of 0.86, recall of 0.87, a low false positive rate of 0.04, and a false negative rate of 0.09. McNemar test performed using 1,500 random sampling points confirmed the statistical significance of AND-fused output.

Keywords: *Himalaya; Hydrology; Logical Fusion; Multivariate Statistics; SAR.*

……

A Proposed Framework for Hydro-morphological Classification of India's Estuaries

Tiyasha Ghosh[1] and Priyank Pravin Patel[1]*
[1]Department of Geography, Presidency University, Kolkata, West Bengal
*Corresponding author
Institutional address: Department of Geography, Presidency University, 86/1, College Street, Kolkata – 700073, West Bengal, India
Email: ghoshtiyasha911@gmail.com

Estuaries, as transitional zones between riverine and marine systems, exhibit complex hydro-morphological characteristics that influence ecological and socio-economic functions. Despite India's 4,800 km long coastline and rich estuarine diversity, no standardized hydro-morphological classification exists, limiting any targeted management of specific estuaries. This study develops a comprehensive classification for river-mouth estuaries along the Indian mainland. Hydrological parameters (seasonal wave height, high and low tide level, tidal range, river discharge, salinity, catchment area) and morphological parameters (estuary length, channel sinuosity, mouth width, inlet width, depth, number of mouths, estuarine area) were derived from diverse geospatial datasets and repositories like ERA5, INCOIS, HydroRIVERS, HYCOM, and GSI Bhukosh, along with digitized topographic measurements from Google Earth images. All quantitative measurements were standardized using z-scores, followed by hierarchical cluster analysis with squared Euclidean distance and between-group linkage to classify similar group of estuaries. Hydrological and morphological classifications showed distinct patterns, with hydrological attributes showing stronger regional coherence. The integrated hydro-morphological approach identified 13 estuarine groups, validated through K-means clustering and elbow-plot analysis. The classification provides an effort for easier estuarine management processes, paving the way for predicting estuarine responses to climate change, environmental degradation and withstanding anthropogenic pressures. The creation of such an intensive dataset on India's estuaries is of added significance. Study limitations include restricted coverage relative to the total number of estuaries and reliance on mouth-based hydrological data instead of spatially distributed data along the estuary length due to lack of efficient alternatives. Expanding the study's spatial coverage, increasing data-efficiency and including anthropogenic indicators can further refine future estuary classifications, building

on the foundations provided herein. This study fills a critical gap in the Indian estuarine research domain, offering a replicable, data-driven tool for research, monitoring, and sustainable management.

Keywords: *Hydro-Morphological Classification; Indian Estuaries; Hierarchical Cluster Analysis; Remote Sensing & GIS*

…….....

The integrated study of basin character, flood plain, meandering dynamics, and channel behaviour of the Dwarka River in eastern India

Olivia Halder[1] and Arindam Sarkar[2]*
[1]Department of Geography, University of Calcutta, West Bengal, India
[2]Department of Geography, Purash Kanpur Haridas Nandi College, University of Calcutta, Howrah, West Bengal
Corresponding author*

The Dwarka River is a tributary of the Bhagirathi-Hooghly system situated in eastern India. It originates in the Santhal Parganas region of Jharkhand, traverses through the districts of Birbhum and Murshidabad in West Bengal, and converges with the Bhagirathi near Kalyanpur (23°43'37.18"N, 88°10'43.97"E) in Murshidabad. The Dwarka River basin is relatively small, predominantly composed of rain-fed rivers subject to seasonal variability, and contributes to local agriculture and floodplain sediment supply. Located along the Rarh fringe zone in eastern India, the basin exemplifies a geomorphologically dynamic fluvial system characterized by active river processes that shape the landscape. This study offers a comprehensive fluvial morphometric analysis of the basin, with particular emphasis on meandering stream behaviour and its implications for landform evolution. Employing topographic maps, satellite imagery, and GIS techniques, key linear, areal, and relief-based morphometric parameters were derived. The basin is distinctly dissected, exhibiting an elongated form and a dendritic to sub-dendritic drainage pattern, indicative of structural influences and ongoing geomorphic development. Special attention is directed to the analysis of meandering patterns in the middle and lower reaches of the Dwarka River. The extent and spatial distribution of meandering were evaluated through the calculation of the sine index, wavelength, amplitude, and radius of curvature. The findings show that lithological variety, human stresses, and decreasing slope all influence increasing sinuosity downstream. Active fluvial processes can be seen in the formation of oxbow lakes, point bar development, and lateral channel migration, especially in the alluvial plains. Temporal analysis using historical maps and satellite imagery reveals noticeable channel shifts, erosion-prone banks, and changes in meander shape over the past decades. Human activities such as sand mining, riverbank modification, and agricultural expansion have changed natural channel behaviour, affecting sedimentation and floodplain shape. The study emphasizes the connection between landform shape, river processes, and landform development in the Dwarka River Basin.

Understanding these relationships is key to effective watershed management, erosion control, and sustainable planning in the region, especially with increasing climatic and human pressures.

Keywords: *Plateau; Rain-Fed; Channel; Flood; Agriculture.*

……..

Assessment of Saltwater intrusion of Coastal Aquifer, Alibag Tehsil, Raigad District, Maharashtra

Mr. Rajat Bar[1] and Anargha A. Dhorde[2]
[1]Research Scholar, Department of Geography, MES's Nowrosjee Wadia College, (an Autonomous College affiliated to the Savitribai Phule Pune University) Pune
[2]Professor& HOD, Department of Geography, MES's Nowrosjee Wadia College, (an Autonomous College affiliated to the Savitribai Phule Pune University) Pune
Email: rajatbary2k@gmail.com, aadhorde@nowrosjeewadiacollege.edu.in

Saltwater intrusion is a natural process of encroachment of seawater into the near shore fresh groundwater due to density differences of saltwater and freshwater. Nowadays coastal aquifer are facing the issues of saltwater intrusion into the groundwater which is caused by both the natural and anthropogenic activity such as sea level changes, storm surges, over extraction of groundwater, land use land cover changes etc. The present study deals with identifying the saltwater vulnerability zone at the coastal aquifer of Alibag tehsil of Raigad District by using the GALDIT method, Saltwater mixing index and different geochemical facies. GALDIT result reveals that the northern part of the study region falls under the very high vulnerable zone as compared to the southern part in both the years (2022 and 2025). In 2022, along the coastal tracts of the tehsil moderate level of vulnerability was experienced. However, the same region have shifted into very high to high vulnerable zone suggestive of excessive seawater intrusion. A drastic reduction in the area covered by the class very less vulnerability is observed in the central part of the study area from 2022 to 2025. According to saltwater mixing index, 37% wells are facing the problem of saltwater intrusion. Correlation matrix computed to understand the relation among the chemical parameters of groundwater with that of seawater mixing index indicates that EC, TDS, Cl, Na and SO4 are strongly correlated with seawater mixing index. It is concluded that along the coastal area of Alibag tehsil are facing the problem of saltwater intrusion.

Keywords: *Saltwater Intrusion; Coastal Aquifer; GALDIT Method; Seawater Mixing Index; Saltwater Intrusion Vulnerability Zone.*

……..

Hydro-Morphological Degradation and Water Quality Impairment in a Tidal Spill Channel: The Study of the Noai River, West Bengal

Pritam Sarkar[1] and Chandan Surabhi Das[2]
[1.] Research Scholar, Department of Geography, West Bengal state University, Barasat
[2.] Associate Professor, Department of Geography, Darjeeling Govt. College, Darjeeling
Corresponding author's email - Sarkarp031@gmail.com

The Noai River, a tidal spill channel of the Hugli, has shifted from a dynamic, biodiverse fluvial system to a canalised and ecologically degraded channel under intense urban-industrial pressure. This study combines hydro-morphological assessment and water quality analysis to examine how channel geometry, bank stability, and tidal hydraulics influence pollutant transport and retention. Hydro-morphological status was evaluated using the Morphological Quality Index (MQI) based on key indicators including channel planform changes, bank structure alterations, bed condition, flow continuity, sediment transport, riparian zone integrity, artificial structures, encroachments, width-depth ratio, sinuosity, and discharge. The MQI revealed severe mid-reach degradation driven by rapid urbanization and unregulated industrialization, which have caused channel straightening, embankment hardening, and riparian vegetation loss, reducing morphological diversity and stability. These degraded reaches coincided with the lowest WQI (Water Quality Index) values, anoxic conditions, extreme faecal contamination, high biological oxygen demand, and heavy metal enrichment dominated by chromium, mercury and lead. Untreated industrial effluents and domestic sewage further exacerbated WQI decline through nutrient loading, organic enrichment, pathogenic influx, and metal accumulation. In contrast, upstream rural reaches such as Sahapur maintained higher MQI scores and better water quality, while downstream tidal segments displayed moderate morphological resilience but functioned as heavy metal sinks due to reduced flushing and slack-water deposition. Principal Component Analysis showed strong loadings of chromium, mercury and lead indicating common industrial and urban runoff sources, likely linked to small-scale industrial activities along the river banks. The findings indicate that hydro-morphological degradation diminishes the river's capacity for hydraulic dilution and self-purification. The influx of industrial pollutants further accelerates habitat loss and geomorphic disequilibrium. Effective restoration must adopt management strategy, upgraded wastewater treatment infrastructure, re-establishment of native riparian vegetation for bank stabilization, and land-use zoning to limit encroachment on the floodplain.

Keywords*: Hydro-morphological degradation; Morphological Quality Index (MQI); Heavy Metal Pollution Index (HMPI); Riparian buffer loss; Urban-industrial River systems.*

……

Hybrid AHP–Entropy Based Stability Assessment of Channel Bars in the Bhagirathi–Hugli River System, West Bengal

Deeprita Ghosh[1], Sayantan Das[2], and Sunando Bandyopadhyay[3]
[1]Department of Geography, West Bengal State University, Barasat, India
[2]Department of Geography, Dum Dum Motijheel College, Kolkata, India
[3]Department of Geography, University of Calcutta, Kolkata, India
Email: deepritaghosh.dg@gmail.com

Channel bars represent transient yet functionally significant fluvial landforms, exerting strong controls on channel hydraulics, sediment routing, navigability, and floodplain utilization. Assessing their stability is critical for river management in large alluvial systems such as the Bhagirathi–Hugli, where bar dynamics influence both geomorphic processes and socio-economic activities. This study proposes a hybrid multi-criteria evaluation framework integrating the Analytic Hierarchy Process (AHP) with Entropy Weighting to construct a Channel Bar Stability Index (CBSI) for three representative sites: Balagachhi (B7; non-tidal regime), Shantipur (B54; tidal regime), and Mangaldwip (B60; tidal regime). Seven hydro-geomorphological and anthropogenic determinants were incorporated: flow velocity, median grain size (D_{50}), vegetation cover, elevation of channel bars above bankfull condition, submergence frequency, bar area index (BAI), and anthropogenic transformation index (ATI). AHP enabled pairwise prioritization, while entropy weighting introduced data-driven normalization of variability. This hybrid model minimizes subjective bias and enhances stability estimation. Quantitative results reveal strong spatial heterogeneity in bar stability: Mangaldwip (B60) achieved the highest stability index (0.875), supported by elevated bankfull height, dense vegetation and recreational activities. Balagachhi (B7) recorded moderate stability (0.455), reflecting partial geomorphic resilience, through agricultural activities. In contrast, Shantipur (B54) exhibited the lowest stability (0.170), primarily due to high local flow velocity and fine-grained sediment composition. The findings underscore the utility of hybrid AHP–Entropy approaches in systematically quantifying fluvial bar dynamics in a deltaic fluvial regime with objective parameter variability.

Keywords: *Channel Bar Stability; Bhagirathi–Hugli River; AHP–Entropy Hybrid Model; Multi-Criteria Evaluation.*

……

Surface Water Dynamics and Inundation Frequency as Indicators of Hydrological Stress: A Case Study of Birbhum, West Bengal, India

Subham Roy, Rajesh B. Survase and Suchitra Sudhakar Pardeshi
Department of Geography, Prof. R.M. College, Savitribai Phule Pune University, Pune, Maharashtra
Email:subhambobo12@gmail.com

Surface water plays a crucial role in sustaining agriculture and livelihoods in Birbhum district, West Bengal, where farming dominates the local economy. This study analyzes spatio-temporal variations in surface water extent using multi-temporal Landsat Level-2 data (2014–2024) for both pre- and post-monsoon periods. To identify surface water features, spectral indices such as the Normalized Difference Water Index (NDWI), Modified NDWI (MNDWI), and Water Ratio Index (WRI) were computed, followed by raster-based classification in ArcGIS. Water Inundation Frequency (WIF) was generated by integrating seasonal water maps, allowing categorization of permanent, seasonal, and occasional water bodies across administrative blocks.

Findings reveal a notable contraction of waterbodies during the study period, with permanent and stable water features showing consistent decline, and localized expansions insufficient to counterbalance overall reduction. WIF analysis demonstrates dominance of permanent and seasonal water bodies, while occasional inundation remains rare—signifying reduced hydrological resilience in the district. Block-level assessment highlights Dubrajpur and Md. Bazar as comparatively water-rich, though both exhibit a marked decrease in stability between 2014 and 2024. These results indicate increasing hydrological stress, potentially linked to erratic rainfall, unsustainable groundwater withdrawal, and agricultural land-use changes. The observed decline in water stability raises concerns for water security, ecosystem health, and agricultural productivity. Strengthening local water resilience will require integrated management approaches including rainwater harvesting, revitalization of traditional reservoirs, and promotion of sustainable agricultural practices to mitigate climate variability and ensure long-term water sustainability.

Keywords: *Surface Water Dynamics; Normalized Difference Water Index (NDWI); Modified Normalized Difference Water Index (MNDWI); Water Ratio Index (WRI); Water Inundation Frequency WIF).*

……

Evaluation of Groundwater Quality for Irrigation Using IWQI: A Case Study of Purandar Lift Irrigation Scheme

Akshata A. Alhat[1] and Amol Bibe[2]
[1&2] Research Scholar, Prof Ramkrishna More Arts, Commerce and Science Akurdi, Pune
Savitribai Phule Pune University
Email: akshataalhat@gmail.com

Groundwater is critical and irreplaceable resource for drinking, agriculture, and industrial uses, but its quality is increasingly at risk from both human and natural influences. To promote sustainable use of this resource, a comprehensive assessment of groundwater quality is necessary. The major aim of the study is to evaluate groundwater quality for Irrigation using Irrigation Water Quality Index(IWQI). The IWQI serves as an effective tool for assessing overall water quality by converting complex physio-chemical data into a single, easily understandable value. In this research, 30 groundwater samples were collected and tested for key indicators such as electrical conductivity (EC), pH, total dissolved solids (TDS), and major cations (Na^+, Ca^{2+}, Mg^{2+}, K^+), as well as anions (Cl^-, HCO_3^-, SO_4^{2-}). The data were standardized, assigned weights based on their significance, using statistical technique Principle Component Analysis (PCA) method to calculate IWQI scores. The study classifies the Groundwater into categories from Serve restriction zone to No restriction zone. Result of this analysis shows that 23.33% groundwater comes under severe to high water restriction zone and 60% groundwater comes under Moderate to low restriction zone.

Keywords: *Groundwater, IWQI, Lift Irrigation, PCA*

……..

TS-4

Mountain Ecosystems and Environmental Change

Field Study on indoor air quality of households in semi-arid cold region Kargil, India

Hakima Banoo
Department of Geography, School of Liberal & Creative Arts, Lovely Professional University, Phagwara-144411, Punjab
Email: Hakimabanoo818@gmail.com

Indoor Air Pollution is a major health problem, with growing Global attention due to its serious effects and significant concern for human health. Semi-arid cold deserts, such as Kargil and Leh, have distinct climatic and environmental circumstances that enhance pollutant exposure, but they remain underexplored. This study gives a detailed assessment of indoor air quality in Kargil, Ladakh, in 2024 and examine its relationship with Outdoor atmospheric data which include pollutant such as fine particulate matter (PM1, PM2.5, PM10), aerosol optical depths (AOD), for black carbon, organic matter, and dust, and carbon monoxide (CO) concentrations, and carbon dioxide (CO2). Only one prior study from Leh, Ladakh, has examined indoor air quality in high-altitude cold deserts, and it did not integrate indoor and outdoor datasets, leaving a critical gap in understanding pollutant dynamics in such environments. The results show distinct seasonal variations, PM2.5 and PM1 peaked in winter (December), owing to increased use of solid fuels for heating and air inversion, whereas PM10 and dust AOD increased throughout the spring and summer months due to resuspended dust and high winds. CO levels were highest in August, most likely due to increased transportation and tourism activities. Indoor air quality assessment in seven tehsils in November revealed significant diversity, with 17 of 57 houses reporting ‘severe' PM2.5 levels, mostly due to biomass burning. This reflects a combination of persistent interior contaminants, inadequate ventilation, and potential outdoor air penetration. Households with better infrastructure and favorable outdoor conditions showed improved IAQ. The findings emphasize the necessity of conducting integrated indoor-outdoor air evaluations, as well as clean energy access, enhanced ventilation, and targeted community-level interventions to reduce pollution exposure and health concerns in high-altitude cold desert locations.

Keywords: *Particulate Matter; Indoor Air Pollution; Cold Desert; Ladakh; Atmospheric Pollution; PM_{10}, PM_{1}, $PM_{2.5}$.*

……

Influence of Slope Gradient on Land Use and Land Cover in the Bijul River Basin: A GIS-Based Analysis

Ankit Singh and S.P. Singh
Department of Geography, Deen Dayal Upadhyaya Gorakhpur University, Gorakhpur
Email: ankitsingh.student@ddugu.ac.in

Plateau landscapes have distinct geomorphic features, where slope gradients play a major role in shaping land use and land cover (LULC) patterns. The main objective of the study is to examine the influence of slope gradients on LULC changes in the Bijul River Basin. It's a tributary of the Son River and Physiographically situated in the Baghelkhand plateau region. Using multi-temporal Landsat & Sentinel data from 1995, 2005, 2015, and 2025, we applied Geographic Information System (GIS) and Google Earth Engine (GEE) techniques to map and analyze these changes. Slope gradients were derived from a Digital Elevation Model (DEM) and categorized into eight classes: 0–2°, 2–4°, 4–6°, 6–8°, 8–10°, 10–12°, 12–14°, and above 14°. The LULC classification included six categories—forest, vegetation, cropland, waterbody, built-up area, and bare land—mapped using Google Earth Engine and ArcGIS and verified through accuracy assessment. The present paper deals with a study of slope gradient influence on LULC patterns in the Bijul River Basin. An attempt has been made to scientifically and methodologically classify the slope gradient and LULC in the study area. The results reveal clear patterns: gentle slopes (0–4°), usually found on plateau tops and valley floors, are dominated by cropland and built-up areas, with agricultural land expanding steadily over the last 30 years. Moderate slopes (4–10°) are a mix of forest and vegetation, but gradual conversion to cropland and bare land is evident**.** Moderately steep slopes (10–14°) retain substantial forest cover, though localized clearing and bare patches indicate human intervention and land degradation. Steep slopes (>14°) are still largely forested, although recent increases in deforestation and the emergence of bare patches highlight growing risks of soil erosion. Over time, cropland and built-up areas have expanded primarily at the expense of forests and vegetation, particularly in low- to moderate-slope zones. These findings highlight the importance of slope-based LULC assessments in the Bijul River Basin and offer valuable guidance for land management, soil conservation, sustainable watershed management, and mitigating anthropogenic development.

Keywords: *Slope Gradient*; *Land Use Land Cover; River Basin; GIS and Remote Sensing*

……

Assessment of neotectonic signatures using geomorphic indices: A study in the Eastern Himalayan piedmont setting

Deepangshu Chandra[1] and Sayantan Das[2]
[1]Department of Geography, West Bengal State University, West Bengal 700126, India
[2]Department of Geography, Dum Dum Motijheel College, Kolkata 700074, India
Corresponding author: deepangshuc29@gmail.com

The Eastern Himalaya is one of the most tectonically active mountain fronts in the world, accommodating a significant portion of the Indo-Eurasian collision-related crustal shortening. This has been corroborated by frequent high-magnitude earthquakes and evidence of structural control on fluvial morphology. River basins in tectonically active regions exhibit multiple geomorphic signatures attesting the degree of neotectonic perturbations, which can be carefully examined across different physical settings. The Jaldhaka and Torsa are the two major streams draining the Eastern Himalayan piedmont zone in West Bengal, both showing prominent structural imprints in their basins. This study aims to assess the impact of active tectonics on selected river basins within their interfluve, bounded by the Himalayan Fold and Thrust belt folds in the north and intersected by numerous NE-SW trending lineaments.A number of geomorphic indices was derived from freely available DEMs such as Stream Length (SL) Gradient Index, Steepness Index (Ks), Basin Asymmetry (Af), Valley Floor Width to Height Ratio (Vf), Mountain Front Sinuosity (Smf), Hypsometric Integral (HI) and Basin Shape (B_s) Index to infer tectonic imprints in the river basins. The values of these parameters were averaged to obtain the Index of Relative Active Tectonics (IRAT) values, which were categorized into hierarchical impact classes of High (<2.2), Medium (2.2 – 2.5) and Low (>2.5). Results show that the neotectonic impact is more prominent in the western and eastern portions of the interfluve, particularly in rivers flowing through resistant bedrock with higher vertical incision, compared to basins with extensive alluvial cover. Nonetheless, detailed drainage network analysis and field observations reveal observable imprints of neotectonics in the larger basins as well. The result of this study should thus prove insightful for analyzing the neotectonic impacts on mountain front river basins.

Keywords: *Neotectonics; Geomorphic Indices; Index of Relative Active Tectonics; Piedmont; Interfluve.*

……

Geospatial Assessment of Hazard Susceptibility using Topographical Indices in the Upper Beas Basin

Mahjabeen, Brijesh Kumar Mishra, Nisa Suhanee and Aruna Paarcha
Department of Geography, Jamia Millia Islamia, New Delhi
Email: mahik4845@gmail.com

The Upper Beas Basin has unique physiographic, climatic, and hydrological characteristics and is an ecologically sensitive and disaster-prone area. It is located in the fragile ecosystem of the Himalayan ecosystem and is characterized by steep slopes, highly dissected landscapes, and many microclimatic zones. This study provides a detailed multiple criteria terrain hazard susceptibility assessment for the Upper Beas Basin, specifically for landslides, erosion, and floods according to the terrain of the area and hydrological reasons. Topographic indices derived from Digital Elevation Model (DEM) slope, aspect, curvature, Topographical Wetness Index (TWI), Topographical Positional Index (TPI) and Topographical Roughness Index (TRI) were applied within a Geographic Information System (GIS)-mapped system with the Analytical Hierarchy Process (AHP) to produce spatially explicit hazard susceptibility zones. This studies Validation involved mapping 20 randomly-selected villages into hazard zones, which determined that 7 villages are located in Moderate hazard zones, 6 in Very Low hazard zones, 4 in Low hazard zones, 2 in High hazard zones, and 1 in a Very High hazard area. The results illustrate that slope, TWI, and TPI are the three most significant influences on terrain instability. This study provides useful insights for disaster risk reduction and land use planning to facilitate sustainable land use, contributing to long-lasting resilience in sensitive ecological regions such as the Upper Beas Basin.

Keywords*: Analytical Hierarchy Process; Himalayan Ecosystem; Terrain Hazard Susceptibility Assessment; Topographic Indices; Upper Beas Basin.*

…….....

Identification of Ecologically Vulnerable Hotspots under Climate Change: A Geospatial Study in a Part of the Bhutan Himalayan Foothill Region of Assam, India

Nityaranjan Nath [1] and Dhrubajyoti Sahariah [2]*
[1*] PhD Research Scholar, Department of Geography, Gauhati University, Assam, India
[2] Professor, Department of Geography, Gauhati University, Assam, India.
[*]Email: nityarnath@gmail.com

This study focuses on identifying ecologically vulnerable hotspots under climate change in a portion of the Bhutan Himalayan foothill region of Assam, spanning Kokrajhar, Chirang, Baksa, and Udalguri. The area lies within the Eastern Himalayan Biodiversity Hotspot, a globally significant landscape that supports rich biodiversity and vital ecosystem services. It includes two

national parks and several wildlife sanctuaries, forming a connected mosaic of foothill forests, grasslands, river corridors, and human-modified lands. These protected and surrounding areas function as ecological pathways and buffers that sustain wildlife, regulate water and sediment, and underpin local livelihoods. Using a geospatial perspective, the study screens the region to highlight places where climate pressures are most likely to intersect with sensitive ecosystems and human uses. The main focus of the study is to deliver clear, map-based insights that can guide attention, monitoring, and future research across the four districts. By framing vulnerability at a landscape scale within a globally recognized hotspot, the work offers a concise baseline for anticipating ecological stress in the Himalayan foothill setting.

Keywords: *Ecological Vulnerability; Climate Change; Geospatial Assessment; Foothill Ecosystems.*

…….....

Edaphic Controls on Treeline Shift in the Kashmir Himalaya: Linking Soil Ecosystem with Treeline Dynamics

Ikhlaq Majeed [1] and Aabroo Fatima Qazi [2]

[1] Department of Environmental Science, University of Kashmir, Srinagar, J&K, India

[2] Department of Botany, University of Kashmir, Srinagar, J&K, India

The Himalayan treeline ecotone is a climate-sensitive boundary and an important indicator of ecosystem responses to global warming. While temperature has traditionally been considered the main driver of treeline dynamics, the role of edaphic factors remains underexplored, particularly in the Kashmir Himalayas. This study, conducted at the Razdan Pass in Kashmir Himalaya investigates how soil physicochemical properties, microbial biomass (C, N, P), and litter decomposition regulate treeline shifts. Soil samples collected 300 m above, at, and 300 m below the treeline were analysed for organic carbon, nutrients, pH, and moisture, while microbial biomass was estimated using the chloroform fumigation–extraction method and decomposition rates assessed through litterbag experiments. Results show that variations in microbial activity and litter turnover strongly correlate with soil nutrient status and organic matter quality, directly influencing seedling establishment and growth at higher elevations. The findings highlight that treeline advancement in the Kashmir Himalayas is not solely temperature-driven but also governed by belowground processes that regulate nutrient cycling, underscoring the need to incorporate soil–microbe–climate interactions into treeline models to improve predictions of vegetation responses, biodiversity conservation, and ecosystem management under ongoing climate change.

Keywords: *Treeline Ecotone; Kashmir Himalayas; Soil Characteristics; Microbial Biomass; Litter Decomposition; Climate Change*…….....

TS-5

Natural Hazards & Disaster Risk Reduction

Geomorphic Evidence is Persuasive of Landslide-Dammed Formation of Kausar Nag in Kashmir

Akhtar Alam and M. Sultan Bhat*
Department of Geography and Disaster Management, University of Kashmir, Srinagar-190006, India
**Corresponding author: alamakhtar@uok.edu.in*

Geomorphic signatures of earth surface features provide valuable clues about their genesis and also about the role of endogenic and exogenic forces that shape them. Generally, the surface signatures get obscured or distorted over time owing to the action of multiple geomorphic processes, especially in highly dynamic glacial environments. However, geomorphic signatures of past processes and catastrophic events may also remain preserved for long, offering opportunities to unravel their evolution and predict their future behavior. Kausar Nag, an alpine lake, located insouthwestern quadrant of the Kashmir Basin along the Pir Panjal Range, seems to be an ideal example of such preservation. The present morphometry of the lake includes an area of 1.3 km², a maximum length of 2.88 km, a maximum width of 0.88 km, an elevation of 3,500 meters, and a rough center point at 33°30′41″ N, 74°46′12″ E. It is inferred that the lake may have originated because of damming caused by a massive landslide. The inference is made based on three geomorphic attributes of the lake: 1. The morphology of the damming material is typical of a landslide in which features like, crown, main scarp, and radial ridges of deposition are clearly traceable. 2. The damming material, if considered to be a terminal moraine, is disproportionately larger in size, which is indicative of younger material relative to glacial action and less erosion. 3. The linearity of the damming material unlike any other alpine lake of the Kashmir basin is suggestive of its rapid origin. Although the Kausar Nag appears to be stable due to minimal glacial activity and the current damming configuration, the risk of a landslide-triggered outburst flood cannot be ruled out. This is a preliminary assessment and the inferences drawn are to be validated through complementary approaches.

Keywords: *Landslide; Damming; Alpine Lakes; Outburst Floods; Kousar Nag*

……

Taming Natures Fury: Unifying Natural Hazards and Climate Change for Resilient Futures

Sinki Yadav
Research Scholar M.M.P.G College, Kaalakaankar, Pratapgarh (Uttar Pradesh), India
Email address: sinkibetu@gmail.com
Supervised by Prof. Pradeep Kumar Singh

The escalating interplay between natural hazards and climate change poses unprecedented challenges to global sustainability, necessitating integrated approaches for effective risk management. This research explores the synergies and feedback loops between phenomena such as floods, droughts, cyclones, and landslides, exacerbated by anthropogenic climate drivers like rising temperatures and altered precipitation patterns. Drawing on interdisciplinary frame- works, the study aims to develop a holistic integration model that combines hazard vulnerability assessments with climate adaptation strategies, emphasizing vulnerable regions in Uttar Pradesh, India. Employing a mixed-methods approach, including geospatial analysis via GIS tools, statistical modeling of historical hazard data (1980–2023), and qualitative stakeholder interviews with local communities and policymakers, the investigation identifies key integration gaps, such as siloed institutional responses and data inconsistencies. Findings reveal that climate amplified hazards have increased by 35% in frequency over the past decade, with socio-economic disparities amplifying impacts on marginalized populations. The proposed model advocates for multihasard warning system, nature-based solutions, and policy harmonization to enhance resilience. Ultimately, this study underscores the imperative for transdisciplinary collaboration to mitigate compounded risks, offering actionable insights for policy- makers and practitioners to foster adaptive, equitable futures amid accelerating environmental uncertainties.

Keywords: *Natural Hazards; Climate Change; Resilience; Vulnerability Assessment; Interdisciplinary Integration.*

…….....

A Review of Floods in Prayagraj: Causes, Consequences and Community Resilience

Prashant kumar yadav[1] and A. R. Siddiqui[2]
[1] Research scholar [2] Professor and Former Head
Department of Geography, University of Allahabad
Email: prashantky_phd2025@allduniv.ac.in

Flood is a natural disaster event that is extremely threatening and affecting ecosystem as well as human lives all over the world. Prayagraj, situated at the confluence of the Ganga and Yamuna River, faces recurrent floods that effect of urban life, rural livelihoods, and the regional economy. Seasonal monsoonal inflows, river bank erosion, and unregulated urban expansion and human

intervention intensify flood hazards. The consequences include large scale displacement of people, damage of infrastructure, water logging, and instability. Even with these challenges, local communities exhibit resilience through traditional method and adaptive land use practice. This study tries to find the natural and anthropogenic cause of flooding, assesses its social and economic impacts, and investigates community level adaptation strategies. Primary data were collected through household surveys using a structured questionnaire across flood affected wards, and secondary data such as rainfall records and satellite imagery were also analyzed. The information was processed using descriptive statistics and vulnerability indices to assess all consequences. Results show that floods significantly damage housing, land and communities facing the greatest losses. As well as this study emphasizes the need of understanding of flood and advocate for an integrated approach that priorities community engagement and collaborative management.

Keywords: *Floods; Human Intervention; Infrastructure; Consequences; Community Resilience.*

……

PS-InSAR-based Slope Deformation Monitoring in the Main Central Thrust Zones in Bhagirathi Valley, Uttarakhand Himalaya

Anand Kumar Gupta[1,2], Khayingshing Luirei[1,2], Vikram Gupta[3] and Mohd Shawez[1,2]*
[1]Physical Sciences, Academy of Scientific and Innovative Research (AcSIR), Ghaziabad, India
[2] Geomorphology Group, Wadia Institute of Himalayan Geology, Dehradun, India
[3]Department of Geology, Sikkim University, Gangtok, India
*Email:akumargupta272@outllook.com

Satellite-based continuous observation of slow-moving, deep-seated landslides—often referred to as “silent disasters” that pose long-term threats to infrastructure, communities, and landscapes, with the potential to evolve into catastrophic events- provides crucial insights into the evolution of the landslide and also assists in delineating causative factors. In the present study, the PS-InSAR technique has been utilized for assessing the time-series deformation of the slopes housing the villages such as Bhatwari, Raithal, and Barsu in the Bhagirathi Valley, Uttarakhand Himalaya. The area falls into a high to very high landslide susceptible area and has also been declared as an eco-sensitive zone by the Government of India in the year 2012. A total of 129 ascending-pass and 114 descending-pass scenes of Sentinel-1 have been utilized to estimate slope velocities along the radar line-of-sight (LOS) for each pass for a period of more than 4 years (Jan 2021-Mar 2025), using open-source tools such as ISCE and StaMPS. Further, these LOS velocities were decomposed to obtain vertical (up-down) and horizontal (east-west) velocities. The results reveal that Raithal (elevation ~2150 m), in the middle of the slope, is subsiding at ~3 mm/year with an eastward movement of ~5 mm/year. Bhatwari (1650 m), on the lower slope, shows eastward creep at ~4 mm/year and upliftment at ~2 mm/year, suggesting rotational landslide activity. Barsu (2262 m), situated at a slope ~3 km upstream, exhibits eastward movement at ~6 mm/year and subsidence at ~3 mm/year. Field investigations corroborate these findings, revealing features such as scarps,

cracks, tilted structures, disrupted roads, and longitudinal and traverse ponds. The persistent creeping suggests the potential for sudden slope failure during heavy rainfall or earthquakes, which may dam the Bhagirathi River, and the impoundment may further trigger cascading downstream hazards. Therefore, there is a need for a comprehensive investigation integrating the PS results with the slope stability analysis that assesses the role of geology, rainfall, and earthquakes. This integration shall assist in estimating the risk posed by the failure and further help in mitigation planning.

Keywords: *InSAR; Slow-moving landslides; Bhagirathi; Uttarakhand; Himalaya.*

……..

Operational Landslide Early Warning System in the Kashmir Himalayas: Integrating Conditioning Factors and Rainfall Thresholds for Landslide Hazard Zonation

Bilquis Shah
Department of Geography and Disaster Management, University of Kashmir, Srinagar 190006, Jammu and Kashmir, India

The Kashmir Himalayan region has challenging topography and intricate geological formations, resulting in widespread unstable slopes and frequent tectonic activity which creates conditions conducive to the occurrence of landslides. The likelihood of landslides is strongly influenced by precipitation characteristics, for which various studies have developed rainfall threshold-based early warning systems (RLEWS). Despite the region having a notable record of devastating landslides caused by rainfall, no such specific study has been undertaken to explore this connection. This study develops a rainfall threshold-based landslide early warning system (RLEWS) for the Kashmir Himalaya, with a focus on the Kashmir Valley and the NH-44 corridor. A landslide inventory covering 1990–2020 was reconstructed and combined with precipitation records to examine the role of rainfall in slope instability. The Precipitation Concentration Index (PCI) and seasonal rainfall distribution were analyzed, revealing a strong link between landslide occurrence and the magnitude, intensity, and frequency of precipitation. A frequentist statistical approach was then applied to define rainfall thresholds critical for slope failure initiation. The findings show distinct regional variations. Along NH-44, landslides are triggered by a minimum of 21.2 mm/day rainfall at the 5% exceedance probability and 14.35 mm/day at the 1% level. In the Kashmir Valley, the thresholds are relatively lower, at 12.98 mm/day (5%) and 9.4 mm/day (1%). Susceptibility analysis further highlights spatial differences in vulnerability: 10.99% of NH-44 terrain falls under high to very-high susceptibility, while in the Kashmir Valley, 25.5% is classified as high and 6.8% as very-high. By integrating rainfall thresholds with susceptibility maps, multi-hazard zones were delineated, categorizing areas according to potential slope failure severity. This combined framework demonstrates how critical rainfall levels interact with terrain vulnerability, producing dynamic hazard assessments. The developed RLEWS provides a non-

structural, cost-effective approach to monitoring slope stability, issuing timely warnings, and supporting disaster preparedness in the fragile and landslide-prone Kashmir Himalaya.

Keywords: *Frequentist approach; Non-structural; Precipitation Concentration Index; RLEWS; Risk*

……..

Storm surge flood susceptibility analysis in Sundarban Biosphere Reserve, India: A multi-model stacking ensemble approach with SHAP-based interpretability

Daawar Bashir Ganaie, Haroon Sajjad and Md Sahil*
Department of Geography, Faculty of Sciences, Jamia Millia Islamia, New Delhi, India
*Corresponding Author: Daawar Bashir Ganaie
Email: daawarb@gmail.com

Storm surge floods (SSFs) are the devastating coastal hazards that have caused widespread ecological disruptions, human and infrastructural losses. The current study assesses SSF susceptibility in Sundarban Biosphere Reserve (SBR) through multi-model approach using random forest (RF), extreme gradient boosting (XGB), convolutional neural network (CNN) and deep neural network (DNN) as base-learners along their stacking ensembles employing logistic regression (LR) as a meta-learner. A storm surge flood inventory map developed from cyclone Amphan (2020) and past flood reports (1990-2023) was used for training and validation of models. Multicollinearity check among conditioning parameters was carried through Pearson's correlation, variance of inflation and tolerance tests to ensure all 13 parameters are free from serious interdependence. Model performances were evaluated through performance assessors namely mean absolute error, root mean square error and coefficient of correlation. The susceptibility maps were validated through AUC-ROC curve, confusion matrix and a set of classification reports. SHAP-based interpretability analysis was applied on each model to identify the influence of conditioning parameters on model predictions. Among the applied models, LR-XGB emerged as the best fit model with (MAE = 0.094, RMSE = 0.107, R^2 = 0.96, ROC = 0.9714 and accuracy = 0.9047). However, the other applied models have also produced the promising results and can also be applied for susceptibility analysis. SSF susceptibility maps were classified into low, moderate, high and very-high susceptibility zones. Around 55.62-56.46 per cent of the SBR falls under very-high SSF susceptibility zone. These results strongly align with SHAP analysis which revealed that low elevation, distance to coastline and rivers, proximity to cyclone tracks, high intensity rainfall and windspeed as most influential parameters in model predictions. The findings of this paper may provide critical insights to policymakers, stakeholders and local administrators in devising targeted mitigation and adaptation strategies to enhance coastal resilience in SBR.
Keywords: *Storm surge flood; Susceptibility; Stacking; Sundarban Biosphere Reserve; SHAP.*

……..

Multi-Scale Modelling of landslide Vulnerability of Kurseong Subdivision, Darjeeling Himalaya, India

[1]Kapil GHOSH and [2]Sunil Kumar DE
[1]Department of Geography, Diamond Harbour Women's University – 743368, India,
Email: ghoshk.geo@gmail.com
[2]Department of Geography, North Eastern Hill University, Shillong – 793022, India

The Darjeeling region of the Eastern Himalaya, especially the Kurseong subdivision (study area) experiences landslides in every monsoon season. Landslide hazard and vulnerability assessment is considered as an integral part of landslide hazard management strategy. The identification of risk elements provides the basic platform for assessing the landslide risk of a region. The research is focused on the application of a top-down approach to find out the most vulnerable community. Regional scale landslide hazards and vulnerability assessments have been carried out to identify the most exposed communities. The landslide hazard zonation map shows that about 8.300% and 21.68% of the study area are under very high and high hazard zones respectively. The community-level vulnerability has been assessed considering 10 socio-economic indicators. Each indicator is assigned a score and the indicator maps are combined to get the community-level vulnerability index map. Based on the considered indicators, the vulnerability hotspots (villages) have been identified. The total vulnerability score ranges from 2.21 to 5.48. community-level vulnerability assessment shows 19 villages are characterized by relatively hard socio-economic conditions (vulnerability score is > 4.00) among 61 villages. Based on 27 indicators belonging to the three dimensions a composite vulnerability index has been formulated and vulnerability at the household level has been identified. The study reveals that about 5.77% of households belong to the low vulnerable category, 42.31% of households belong to the moderate vulnerable category, 34.61% of households belong to the high, and 17.31% under the very high vulnerable category. For better management and response, a web-based dashboard can be developed which can help to track and keep the records of the affected households and conditions at a single operating display.

Keywords: *Community; Hazard; Vulnerability; Landslide.*

……

Natural Hazard and Unstable Rivers: A GIS-Based Assessment Approach in the Bongaigaon District, Assam

Pranab Dutta[1*]
[1*] Research Scholar, Department of Geography, Gauhati University
Email: pranabdutta867@gmail.com

Natural hazards are primarily triggered by interplay of various geo-environmental factors. Among all, occurrences of floods have been increasingly intensifying in low-lying areas across the world. Predominantly, in the Brahmaputra valley of Assam, in its lower reach, flood imposes tragic fabrics on both socio-economic aspects as well as natural landscape. The Bongaigaon district is being known for a flood prone districts of Assam due to annual hit by major or minor floods, imparting impacts on the human lives and livelihoods. The present study focused on to assess the major flood scenario of 2022, and also to understand the impact of flood on bank lines of the Aie and Manas Rivers within the district. The dynamic characteristics of these rivers were investigated using the Digital Shoreline Analysis System (DSAS) tool in the Geographical Information System (GIS) environment. The bank lines were delineated over visible thalwages after performing NDWI and MNDWI; for the region. Additionally, a comparative analysis for the left bank (LB) and right bank (RB) also analysed along with identifying the critical places alongside of the riverine tracks. It has found that a total of 287.11 sq.km of geographical area were submerged under flood water and 351 no. of villages were affected, during 2022 flood hits. Finding of this work highlights the left bank of the River Aie is most unstable in respect to End-Point (-2795 as erosion) and (+ 1989 as deposition) rate. The results and findings of the study may help in enhancing the database and shall help policy makers to support the sustainable river basin management plan for the region.

Keywords: *Natural Hazard; Digital Shoreline Analysis System; Critical Zones; Lower Brahmaputra Valley.*

…….....

ComprehensiveEmpirical and Numerical Approach for Analyzing Stability and Failures along Bandipora to Gurez highway, J&K, India

Aadil M. Nanda[1] *and Pervez Ahmed*[2]
1. Assistant Prof (C), Department of Geography, Govt. Degree College, Anantnag, J&K HED
2. Prof. & Head Department of Geography & Disaster Management, University of Kashmir, Srinagar

Stability assessment of rock slopes in the tectonically active western Himalayas region is extremely crucial, as this area has undergone multiple deformation phases that have resulted in intricate geological conditions, as observed along the Bandipora to Gurez road in J&K, India. The

region's rugged and treacherous terrain is susceptible to frequent slope failures, which frequently result in disruption of traffic, loss of life, property damage, and environmental degradation. Utilizing field observations and considering variations in geological and geotechnical conditions, we conducted a detailed study of twenty slope facets. This study involved employing the Rock Mass Rating (RMR) and kinematic analysis to classify the causes, types of failure, and potential failure directions. The RMR values derived from the study lie between 89 to 16, reflecting a spectrum of rating from very good to very poor. Higher values suggest the presence of completely stable areas, while lower values suggest the presence of completely unstable areas. The kinematic analysis depicts that the rock slopes are prone to planar and wedge failure. The kinematic analysis further shows that joint planes intersect with each other in different directions resulting in different potential failure modes. The current study is poised to help not only in risk reduction but also in supporting the ongoing civil projects in this area. Our findings indicate that immediate mitigation measures are imperative for the state highway to avert slope failure and ensure its long-term stability.

Keywords: *Slope failures; Kinematic Analysis; Rock Mass Rating, Potential Failure Modes.*

……..

Flan-T5-Based NLP-Driven Geospatial Intelligence for Mortality Risk Mapping and Rainfall-Correlated Micro-Flood Analysis in Assam's 2024 Flood Disaster

Mustaq Ali1 and Dhanjit Deka[2]

[1] PhD Research Scholar, Department of Geography, Gauhati University, Guwahati, Assam

[2] Assistant Professor, Department of Geography, Gauhati University, Guwahati, Assam

Email: dhanjitdeka@gauhati.ac.in

The 2024 Assam flood disaster, marked by successive waves of severe flooding, resulted in significant mortality and widespread damage across the state. This study develops a hybrid geospatial intelligence framework to map flood-induced mortality risks and identify their drivers at a micro-scale, leveraging Google Earth Engine (GEE) for large-scale geospatial processing. The methodology integrates a Flan-T5-based natural language processing pipeline with rule-based regular expressions to standardize archival flood and mortality address datasets. Cleaned addresses are geocoded using the Google Maps Places API and validated against authoritative village boundary datasets, enabling precise village-level mortality hotspot identification through spatial clustering. Flood hazard zonation map is prepared using GEE-processed satellite imagery (e.g., NRSC/ISRO datasets) to map inundation patterns and assess impacts on agriculture and infrastructure. Micro-scale rainfall analysis, utilizing Global Precipitation Measurement (GPM) and India Meteorological Department (IMD) data, correlates flood severity with precipitation anomalies in Assam and neighboring states, elucidating the roles of local rainfall and upstream runoff. The findings demonstrate that the Flan-T5-driven pipeline, combined with GEE and GPM/IMD data, enables accurate geospatial attribution mapping of flood mortality, pinpointing

key drivers such as intense local precipitation and regional runoff. This scalable framework provides actionable insights for disaster preparedness and resilience planning, aligning with the Sendai Framework for Disaster Risk Reduction (2015–2030), and serves as a model for flood-prone regions worldwide.

Keywords: *Flan-T5; NLP; Mortality Hotspot Mapping; Flood Hazard Zonation; Sendai Framework.*

…….....

Indigenous Drought Prediction and Coping Strategies in Jaisalmer District

Nidhi
Doctoral Scholar, Department of Geography, University of Rajasthan, Jaipur, Rajasthan;
Email: nddahiya2013@gmail.com

Droughts represent global endemic natural phenomena with varying intensities across different regions and temporal scales. Western Rajasthan, particularly Jaisalmer district, exemplifies areas of greatest climate sensitivity where these phenomena manifest with acute severity. In the era of climate change, the district faces increasing vulnerability to erratic water supply patterns, making drought management a critical survival imperative for indigenous communities who have normalized drought as part of their socio-ecological existence. The local population has cultivated remarkable expertise in drought and monsoon forecasting through systematic observation of natural indicators including animal behavioral patterns, wind directional changes, and cloud formation dynamics. These indigenous early warning systems represent centuries of accumulated environmental wisdom enabling communities to anticipate climatic variations with considerable accuracy. Community institutions, strengthened through extensive inter-generational experience, have developed comprehensive drought management frameworks addressing multiple intensity levels while minimizing socio-economic impacts through proactive intervention strategies. Drought coping mechanisms reflect sophisticated integration of traditional ecological knowledge with contemporary adaptive practices, encompassing livelihood diversification strategies, indigenous water harvesting structures, and lifestyle modifications enhancing community resilience. This research employs household surveys and in-depth interviews, providing insights into relationships between traditional drought prediction methodologies, community-based water management practices, and social networks. The findings contribute to understanding how indigenous knowledge systems function as critical components of climate adaptation strategies, offering perspectives on need of comprehensive state response for drought management and climate resilience planning.

Keywords: *Traditional Ecological Knowledge; Drought Prediction; Community Resilience; Water Management; Climate Adaptation.*

……..

Increasing Vulnerability to Cloudburst Hazards in Jammu and Kashmir: A Preliminary Analysis (2006–2025)

Suhail Ahmad Dar[1], Rayees Ahmad[2] and Saqiba Hussain[3]
[1]Department of Geography, Lovely Professional University, Phagwara-144411, Punjab, India
[2]Project Scientist at Indian Institute of Science Bangalore, 5600012-Bengaluru, India
[3]Department of Geography and Disaster Management, University of Kashmir, Hazratbal-19006 Srinagar, India
*Corresponding Author: suhaild7@gmail.com

Cloudburst events remain one of the most destructive hydro-meteorological hazards in the Himalayan region, frequently triggering flash floods, debris flows, and extensive damage to life and infrastructure. In this preliminary study, 26 confirmed cloudburst incidents were compiled for Jammu and Kashmir between 2006 and 2025 from authentic sources, including newspapers, official reports, journal articles, and disaster databases. While the actual number is likely higher due to underreporting in remote valleys, the available data indicate that these events have caused at least 396 fatalities. The deadliest single event was the 6 August 2010 Choglamsar disaster in Leh, which claimed 260 lives, followed by the Chashoti village cloudburst which claimed at least 60 lives in Kishtwar district on 14 August 2025 followed by Honzar cloudburst in Kishtwar on 28 July 2021 (26 deaths) and the Amarnath–Baltal incident in Ganderbal on 8 July 2022 (16 deaths). More than 80% of the recorded events occurred during the monsoon months of July and August, with high-altitude districts such as Leh, Ganderbal, and Kargil showing the greatest frequency. Ganderbal recorded the most events, particularly along the Amarnath Yatra route, while Leh accounted for the highest single-event mortality. The analysis reveals a troubling trend: increasing human settlement, tourism, and infrastructure expansion in ecologically fragile mountain areas without adequate checks and balances are amplifying vulnerability to such hazards. This has been exposed repeatedly, including in two recent destructive events in Kishtwar district. The findings call for urgent integration of hazard zonation, land-use regulation, and community-based early warning systems into regional development planning. Given the preliminary nature of this work, a more detailed investigation is warranted to understand the interplay between changing climatic extremes and human-induced exposure, thereby enabling effective risk reduction strategies in Jammu and Kashmir's fragile mountain ecosystems.

Keywords: *Cloudbursts; Flash floods; Natural hazards; Himalayan region; Sustainability.*

……..

General to Specific Landslide Hazard Mapping in the Garhwal Himalayan Region

Sana Rafi
Department of Geography, School of Earth Sciences, Hemvati Nandan Bahuguna Garhwal University, SRT Campus, Tehri (249199), Uttarakhand, India.
Corresponding Author: snrafi18@gmail.com

Garhwal Himalayan Region (GHR) is extremely prone to landslides due to its geological characteristics, climatic changes, and human activities. A GIS-based multicriteria approach is used here by selecting fifteen landslide conditioning factors:1. aspect, 2. geology, 3. slope, 4. geomorphology, 5. elevation, 6. groundwater, 7. road density, 8. lineament density, 9. drainage density, 10. soil, 11. curvature, 12. rainfall, 13. land cover classification, 14. fire-sensitive zones, and 15. seismicity. A theme layer for each factor is constructed and allocated a weight using the AHP-based impact on landslide occurrences. The landslide susceptibility index map is then acquired by integrating each factor layer using the weighted overlay method and classified into 5 classes, from very low to very high. The results revealed that 13.40% of the total area of the GHR is in a very high hazard zone, 26.74% in high risk, 28.76% in moderate, 21.6% in low risk, and 9.5% in very low-risk coverage. Hence, 68.9% of the total geographical area of the GHR lies within a moderate to very high landslide hazard zone. High landslide occurrence is attributed to high drainage, lineament, road density, heavy rainfall, steep slopes, seismic activity, and human activities. The area under the ROC curve (AUC) yielded gratifying results (87.3%). To validate the result of the landslide hazard mapping of GHR, a specific road segment from Shivpuri to Kaudiyala along NH-7 lying in a very high landslide hazard zone is studied in detail. A surge of landslide incidents and the area affected is noticed from 2010 to 2025. This specific analysis revealed that this area falls under moderate to very high landslide hazard zones, while very low to low categories had no area. The GHR landslide hazard map is applicable since it provides useful data on existing and potential landslides. Such a map could be helpful to planners and decision-makers in managing slope stability and planning land uses.

Keywords: *Garhwal Himalayan Region; GIS; Landslide Hazard; NH-7; General to Specific*

……

Why does beat-level wildfire mapping matter for (post)fire management in the dry deciduous forests of southern West Bengal?

Kunal Mallick [1] and Priyank Pravin Patel [1]*
[1]Department of Geography, Presidency University, Kolkata
Institutional address: Department of Geography, Presidency University, 86/1, College Street, Kolkata - 700073, West Bengal, India
Email: kunal.rs@presiuniv.ac.in

Wildfire studies in India generally emphasise on regions having large, contiguous forests. States with fragmented/degraded forests like West Bengal are often ignored, despite experiencing a disproportionately high number of fire events annually relative to their forest coverage. This study examines that oversight by focusing on fire incidents in the dry deciduous forests of southern West Bengal, which despite being an ecologically fragile landscape is rarely featured in national-level assessments. Using Suomi National Polar-orbiting Partnership (SNPP) satellite-based fire products from 2012 to 2023, we conducted Location Quotient (LQ) analysis of fire occurrences at the state and intra-state levels. Results reveal that though West Bengal ranks near the bottom in terms of total fire counts, its southern districts exhibit consistently high fire concentration relative to their limited forest area. This discrepancy is further exemplified through annual forest beat-wise fire event mapping, pinpointing specific locales that experience recurring fires. Therefore, we introduce an operational early-warning framework that uses detailed fire maps to guide on-the-ground action. This includes reducing dry fuel before the fire season, deploying patrols to the most at-risk forest beats to mitigate and suppress fires, and planning effective post-fire restoration. The system is designed so that forest officers, NGOs, and policy makers can easily use the information to act quickly. In doing so, it offers a strong blend of scientific knowledge and practical utility, ensuring that India's most fire-prone forests, experiencing progressive sparsification induced by wildfires yet neglected for a long time, receive the proactive stewardship they critically require.

Keywords: *Recurrent Wildfires; Dry Deciduous Forest; Mapping and Management.*

……

Assessing the Impact of Cyclones on Soil Salinity Dynamics in Sundarban: A Remote Sensing and GIS Approach

Ratna Khoso[1] and Sukla Hazra[2]*
[1]West Bengal State University, Berunanpukuria, Malikapur, Barasat, Kolkata, West Bengal 700126
[2]East Calcutta Girls' College (West Bengal State University), P 237, Lake Town Rd, Block B, Sreebhumi, Lake Town, Kolkata, West Bengal 700089
Email: ratna.khoso2013@gmail.com

Soil salinity is a significant challenge for crop production in the Indian Sundarbans. Embankments play a crucial role in preventing saline water intrusion from creeks. However, extreme climatic events like tropical cyclones often overwhelm these palliative embankments, except for the 'Aila Bandh'. This detailed study examines soil salinity dynamics due to cyclonic interruptions from 2009 to 2024 in the Hingalganj C.D. Block. The study is based on field surveys, authorized secondary reports, and validated maps through a questionnaire survey of 120 local households. Thirty-five soil samples were collected in April and validated using the Normalized Difference Salinity Index with significant positive values in Sentinel-2 ($r^2 = 0.82$) and Landsat-8 ($r^2 = 0.78$) images. The examination of salinity dynamics depended on cyclonic flood duration, particularly saline water inundation, and climatic factors such as temperature, relative humidity, rainfall, and soil moisture. Results indicated that cyclone 'Aila' had a profound impact on soil salinity. The electrical conductivity of affected lands increased from an initial 2 dS/m to over 6 dS/m due to prolonged saline water stagnation (over 161 days) across twenty-seven villages. There were no other significant cyclonic events between 'Aila' in 2009 and 'Amphan' in 2020. The study identified that natural recovery of soil salinity takes approximately eight years. Following cyclones 'Bulbul' (2019), 'Amphan' (2020), and 'Yaas' (2021), affected lands remained above 6 dS/m due to insufficient recovery time, with seasonal salt fluctuations inhibiting crop germination.

Keywords: *Salinity; Cyclone; Electrical Conductivity; Dynamics; Temperature.*

……

Are floods on the Mahi River getting worse and more frequent in Anthropocene?

Pramodkumar Hire[1] and Rajendra Gunjal[2]*
[1] Department of Geography, HPT Arts and RYK Science College, Nashik, Maharashtra (India)
[2] K.R.T. Arts, B.H. Commerce, and A.M. Science, Nashik, Maharashtra (India)
Email:pramodkumarhire@gmail.com

The Mahi River of western India is recognised as one of the most intense flood-prone rivers of India. Flooding during the monsoon season is the most recurring, widespread and disastrous natural hazard in the basin that results in enormous social, economic and environment consequences every year. Several massive floods have occurred in the recent decades causing huge economic losses and human suffering. To answer the question whether floods on the Mahi River are getting worse and more frequent in Anthropocene, all available data were considered: the annual peak discharge data for a downstream gauging site, information on historical floods from the available sources on large floods and palaeoflood records from six locations in the basin. The analyses indicate that the large magnitude floods on this river are direct outcomes of severe tropical cyclones/storms implanted within the Indian summer monsoon. The cluster of extreme floods in the past few decades represents an inconsistent strengthening in both the magnitude and frequency of large floods when compared with the 17 ka record of palaeoflood deposits in the basin. An investigation of relative magnitude for modern, historical and palaeofloods shows that the present and second half of the last century is characterized by very large magnitude floods. The study demonstrates that most historical floods and palaeofloods, for which there is evidence, were smaller in magnitude compared to modern floods. Notwithstanding the limitations of data, there is enough evidence to conclude that (1) incidences of flood-generating extreme rainfall event are rising (2) human interventions have made the recent floods more destructive and (3) floods on the Mahi River are getting worse and more frequent in Anthropocene.

Keywords: *Palaeoflood; Magnitude; Frequency; Mahi River; Anthropocene.*

…….....

Determining Geo-Environmental Parameters Causing Slope Instability in Parts of Western Ghats, Maharashtra, India

Sumant E. Autade[1], Sudhakar D. Pardeshi[2], Suchitra S. Pardeshi[3], and Mahesh Lavate[4]

[1]Department of Geography, Rashtriya Shikshan Sanstha's Swami Vivekanand Night College, Chhatrapati Bhavan, Ayre Road, Dattanagar, Dombivli East, Maharashtra, India

[2]Dept. of Geography, Savitribai Phule Pune University (formerly University of Pune), Pune - 411 007, Maharashtra, India

[3]Post-Graduate Department and Research Center in Geography, Prof. Ramkrishna More College, Akurdi, Pune – 44, Maharashtra, India

[4]Department of Geography, KES's B.K. Shroff College of Arts and M.H. Shroff College of Commerce, Bhulabhai Desai Road, Kandivli (West), Mumbai – 400067.

Corresponding Author's email address: sumantautade@gmail.com

Western Ghtas and undulated terrain of Konkan region are susceptible to slope failures of different types and varying intensities. Distinctive lithological properties, geomorphic characteristics combined with intense monsoonal rainfall are important factors responsible for slope instability in this region. Translational debris slide is the most common type of slope failure on the western slopes of Western Ghats up to the elevation of 350 m. whereas wedge failure and rockslides are common slope failure types at higher elevation (350 to 600 m.). The present paper attempts to determine geo-environmental characteristics of landslide affected areas susceptible to landslides in parts of Western Ghats and Konkan region of Maharashtra State. The study focuses on determining characteristics of slope, slope aspect, elevation, density of natural vegetation, land use and land cover, lithological characteristics, geological formations, structural discontinuity etc. based on landslide susceptibility map using Multi-criteria decision making approach. The parameters including distance from road, proximity to lineaments and proximity to major drainage have not been considered for establishing their relationship with actual slope failures. Since, only major drainage lines have been extracted for the present study and only seven slope failure events are found within the buffer of 100 m. distance from drainage lines. The distance from roads could not be considered for establishing its relationship with slope failure because all the slope failure events recorded during field survey are confined to roads. No major slope failure has been observed with proximity to lineaments. This may be due to the coarse resolution of the data used (SRTM DEM, Google Earthpro and Geological Quadrangles) for extraction of the lineaments. On the basis of the relationships between landslide causative factors and distribution of actual slope failures, it can be inferred that slope gradient, aspect, rainfall, lithology, land use and land cover are important geo-environmental factors in the initiation of slope failures in North Konkan. Since, rainfall is a main landslide triggering factor in the study area the consideration of landslide magnitude at the time of slope failure will be more useful rather than mean annual rainfall. One of the major limitations in calculating rainfall intensity is non-availability of details about exact date and time of slope failure. Therefore, generating complete landslide database with accurate date

and time of slope failure can be more effective in determining the role of rainfall in slope instability.

Keywords: *Landslide Frequency; Landslide Susceptibility Zonation; Western Ghats; Translational Landslides; Rotational Landslides; Landslide Density.*

……

Climatic Drivers for Snow Cover Variability in the Bhaga Basin, Western Himalaya: A Google Earth Engine-Based Analysis

Sonam Chhomo
Centre for the Study of Regional Development, Jawaharlal Nehru University, New Delhi
sonamc24_ssf@jnu.ac.in

Snow is an essential component of cryosphere, sustaining water resources, regulating Earth's energy balance and supporting ecosystems. Snow cover variability monitoring is vital for hydrological and climate studies. This study aims to analyse the snow cover area (SCA) changes from 2000 to 2024 and its association with temperature and precipitation in the Bhaga Basin of the western Himalayas. To detect snow cover area variability, moderate-resolution imaging spectroradiometer (MODIS) daily snow cover products (SCPs, version 6) are used. This data has gap issues due to cloud cover, sensor, and orbital limitations, among others. Therefore, the cloud gap filled (CGF) method, such as cubic spline interpolation and spatio-temporal weighted method, has been applied to fill the data gaps. Temperature and precipitation data are extracted from ERA5. Furthermore, Landsat 8 OLI data is utilised for validation of the cloud gap-filled SCPs. It is found that the Bhaga basin records maximum SCA in February and minimum in August. Mann-Kendal test and Sen's slope estimator show that snow cover area is decreasing at the rate of 0.03 km^2 per year. The multiple linear regression model reveals that SCA tends to decrease significantly with rising temperature and increase slightly with more precipitation, with an R^2 of 0.69. These findings show snow cover variability is highly sensitive to rising temperatures.

Keywords: *Snow Cover Area; MODIS; ERA5*

……

Characteristics of Landslides along the Mandi-Manali National Highway Stretch in Himachal Pradesh

Indora Suraj Rajkumar and Anju Gupta
Research Scholar Department of Geography, Kurukshetra University
Assistant Professor, Department of Geography, Kurukshetra University
Email: suraj0111@gmail.com

Road network plays an important role in socio-economic development of the Himalayan regions. The roads of the Himalayan region are generally subjected to heavy slope failure events. Slope failure along highways is a crucial problem. The objective of this research paper is to analyze the spatial pattern and characteristics of landslide in the study area. The landslide inventory includes 302 landslides in the study area. In total, the mapped landslides occupy about 1.5 million square meter area which is 1.533 km². The smallest landslide area is 30 m² and the largest is 350000 m². The average is 5112.3 m², with a standard deviation of 27745.66 m², collectively the 302 landslides in the study area of around 1000 km² displaced 8.3 million cubic meters of slop material. According to the volume of the landslides 53% landslides are fairly large which have the debris 1000 to 9999 m³. The attribute data reveals that 81% landslides are still in active mode which is quite alarming and only 18% landslide sites have the mitigation measures which means still 82% landslide location need the mitigation measure to reduce the risk.

Keywords: *Landslide; Inventory; Mitigation.*

……..

GIS-Based Assessment of Anthropogenic Influence on Forest Fires: Integrating Settlements, Road and Agricultural Proximity Data on Raigad District, Maharashtra, India

Sabale S. B.[1], and Doke A. B.[2]
Departmentof Geography, Prof. R. M. College, Savitribai Phule Pune University, Pune, Maharashtra
Departmentof Geography, Prof. R. M. College, Savitribai Phule Pune University, Pune, Maharashtra
Email*:sivasabale1997@gmail.com

Forest fires represent a major global concern, with nearly 95% linked to human-induced factors such as tourism, transportation, and agriculture. In the Raigad district, frequent incidents require specific measures to protect the environment and surrounding communities. For this study, MODIS active fire data from NASA FIRMS (1 km spatial resolution) were used for the period 2001 to 2024 to understand the trend of forest fires in Raigad district. Forest fire data 2024 was used to develop a forest fire zonation map, incorporating proximity to roads, settlements, and

agricultural areas as key influencing factors. Only type 0 detections (presumed vegetation fires) were considered. To ensure data reliability, records with a confidence level below 30% were excluded, retaining only those with nominal to high confidence. The forest fire zonation map was divided into five categories: very high, high, moderate, low, and very low. The analysis indicates that approximately 4.14%of the study area falls under the very high-risk zone, while about 21.53% lies within the high-risk zone. The analysis shows that most forest fires in Raigad district are closely linked to human proximity: 85.66% occurred within 1 km of roads, 43% within 5 km of settlements, and 88.23% within 2.5 km of agricultural land**,** indicating the strong influence of roads, settlements, and cropland on fire incidents. The analysis reveals a strong link between forest fires and human activities in Raigad district, showing that about 292 km² area of very high fire risk zones lie within proximity to roads, settlements, and agricultural lands. This concentration highlights the significant influence of anthropogenic factors in driving fire occurrences.

Keywords: *Forest Fires Zone; GIS &Remote Sensing; MODIS Active Fire; Anthropogenic Activity; Raigad District.*

…….....

Mapping Landslide Susceptibility Zones in the Coastal Districts of Maharashtra

Sai Tushar Shelar and Sudhakar Pardeshi*
Department of Geography, Savitribai Phule Pune University, Pune
*Corresponding author: saitusharshelar@gmail.com

Climate change has increased the frequency and magnitude of hazardous events across India, and the Western Ghats of Maharashtra represent one of the most vulnerable regions. The Konkan region is a narrow coastal belt situated at the interface of the Western Ghats and the Arabian Sea. It comprises a few coastal districts of Maharashtra, such as Palghar, Thane, Mumbai, Mumbai Suburban, Raigad, Ratnagiri, and Sindhudurg. The presence of rugged topography, heavy monsoon rainfall, and high anthropogenic pressure makes this region highly prone to slope failure. Such events pose a significant threat to human life, infrastructure, and ecosystems, emphasizing the need for scientific hazard assessments. The present study focuses on identifying landslide susceptible areas and assessing vulnerability and risk using a combination of machine learning and multi-criteria decision analysis. Random Forest Model (RFM) and Analytical Hierarchy Process were integrated with GIS and remote sensing techniques to study landslide susceptibility and risk. The variability of conditioning factors can impact the accuracy of identifying landslide susceptible areas. The present investigation incorporates sixteen environmental landslide conditioning parameters and five socio-economic parameters along with landslide inventory data for further analysis. The results are presented in a susceptibility map, which categorizes the region into different hazard zones ranging from very low to very high susceptibility. The efficiency of the landslide susceptibility map was validated by a high area under the curve (AUC) value (0.94) and an overall accuracy of 86%. The derived landslide risk zones can provide a scientific basis for

disaster management and urban development. This study will help policymakers, organizations to make further decisions in disaster management.

***Keywords**: Landslide Susceptibility; Risk; Machine Learning; Hazard; Random Forest Model*

……

Spatio-Temporal Dynamics of Drought Hazard in Ruparail River Basin of Rajasthan: A Multi-Index Assessment

Shubham Soni[1] and Sudhakar D. Pardeshi[2]*
Department of Geography, Faculty of Science and Technology, Savitribai Phule Pune University, Maharashtra, India – 411007
Email: sksoni01@outlook.com

This study presents a multi-index assessment of drought hazard and its spatiotemporal dynamics in the Ruparail River Basin of Rajasthan. The aim is to characterize meteorological, agricultural, and hydrological droughts through climate data and satellite remote sensing observations. Meteorological drought was evaluated using the Standardized Precipitation Index (SPI) and Rainfall Anomaly Index (RAI) for 1981-2024. Agricultural drought was assessed using the Vegetation Condition Index (VCI) and satellite-derived soil moisture data from 2017 to 2024. Hydrological droughts were assessed by examining variations in pre and post-monsoon surface water areas from 2000 to 2024 using Landsat imagery. The findings reveal a causal relationship between drought types in the region. Long-term meteorological data indicate increasing drought frequency. These rainfall deficits have direct agricultural impacts, evidenced by low Vegetation Condition Index (VCI) values and critically low pre-monsoon soil moisture levels, recorded as low as 0.157. Hydrological droughts manifest as significant reduction in post-monsoon surface water storage. The post-monsoon water area decreased to 2.36 square kilometers in the drought year of 2001 and 2.50 square kilometers in 2002, compared to 45.82 square kilometers in the high-rainfall year of 2003. This study provides a comprehensive characterization of drought hazards in the Ruparail Basin, underscoring the region's vulnerability from its agricultural dependence, and offers a foundation for developing integrated water resource management and drought mitigation strategies.

***Keywords:** Drought Hazard Assessment; Ruparail River Basin; Remote Sensing; Vegetation Condition Index (VCI); Water Resource Management*

……

Application of Remotely Sensed Data for Flood Mapping: A Case Study of the Tangan Valley in Malda District, West Bengal, India

Lopamudra Roy[1] and Sayantan Das[2]
[1] Pakuahat Degree College, Malda, India
[2] Dum Dum Motijheel College, Kolkata, India
*Corresponding Email: roylopamudra26@gmail.com

Floods are among the most frequent natural hazards in India, often intensified by climate change, deforestation, and unplanned settlement growth. River basins in the alluvial tracts of eastern India are especially vulnerable due to their low-lying nature. This study explores the recurrent flood situation in the Tangan River catchment within Malda District of West Bengal since 1998, by assessing the damming effect of the Barind Tract (an upland unit formed 2.6-0.01 Ma BP), which is the largest Pleistocene era physiographic unit in the Bengal Basin. Satellite-based mapping was carried out using cloud-free Landsat, and Sentinel-1 Radar imageries, which are highly effective for monitoring floods. Using Landsat data, the submerged area for major flood years was extracted by using Modified Normalized Difference Water Index (MNDWI) and Normalised Difference Vegetation Index (NDVI). Whereas, recent Sentinel-1 SAR data were chosen for the application of a thresholding technique to classify flooded and non-flooded areas. The results showed that more than 60% of the study area was inundated during the largest flood in recent times that occurred in 2017. During every monsoon, the floodwater spread widely over the Pleistocene valley, following the natural low-lying tracts and depressions of the landscape, with the heaviest impact falls on settlements close to the Tangan River. In regular monsoons, the extent of waterlogging in the catchment varies between 15-20% of the total area. This study highlights the importance of understanding the geomorphology of river catchments for effective flood risk management. It also demonstrates how satellite data can be combined with knowledge of landforms to identify flood-prone areas. Such approaches can help reduce future losses and improve resilience for communities living in similar regions.

Keywords: *Flood Mapping; Remote Sensing; Disaster Risk Reduction.*

…….....

TS-6

Social Vulnerability and Resilience Building

A Systematic Review on Climate Change Induced Flood Susceptibility, Vulnerability and Risk: Future Research Perspective

Rayees Ali and Haroon Sajjad*
Department of Geography, Faculty of Sciences, Jamia Millia Islamia, New Delhi, India
*Corresponding Author: Rayees Ali
Email: rayeesalidar@gmail.com

Climate change has emerged as one of the most pressing issues of the 21st century. Its induced disasters have posed significant threats to social, economic and environmental systems on the planet earth. Thus, the understanding of implications of climate change is crucial for developing effective mitigation and adaptation strategies. Floods occur due to anthropogenic activities and disasters causing significant economic and environmental losses. This review paper synthesizes the state of knowledge on flood susceptibility, vulnerability and risk for identifying research gaps and recommending future research. We collected the articles on the research domains through Web of Science and Scopus search engines to create a coherent database for analysis. A total of 156 research articles were analysed after the exclusion criteria for the state of research. A bibliometric and systematic analyses were carried out for examining the trend in the publication, frequency of keywords, scale and distribution of studies during 1990-2023. The major emphasis of the review was on conceptualization, approaches and methods used for analysing flood susceptibility, vulnerability and risk. Our analysis revealed that most of the reviewed research papers were focused on flood susceptibility, risk and vulnerability while less attempts have been made on flood perception, flood resilience and flood management. The effectiveness of flood resilience, community based initiatives and policy frameworks for sustainable flood management have been explored for the holistic and interdisciplinary approach. This paper emphasizes the necessity of collaboration between policymakers, scientists and local communities to develop adaptive and resilient flood management strategies for future research direction. The insights of this study may help to build more resilient communities in the face of increasing flood related challenges.

Keywords: *Flood Susceptibility; Flood Vulnerability; Flood Risk; Research Gap; Future Research*

……..

Intersecting Inequalities: Power, Representation, and Survival in Rural India: A Multidimensional Study Using IHDS-II Data

Ajit Prasad and Suchitra Pardeshi
Department of Geography, Prof. R.M. College, Akurdi, Pune- 411044, Maharashtra, India
Corresponding author: ajit1997in@gmail.com

This study examines how caste dominance intersects with landholding, leadership, public services, and environmental vulnerability in rural India. Drawing on IHDS-II data, the analysis finds that Scheduled Castes (SCs) and Scheduled Tribes (STs) remain structurally marginalized despite their demographic presence. Landholding among these communities is disproportionately low, and what land they possess is more likely to be exposed to floods and droughts. Leadership is unevenly distributed: while General-, OBC-, and ST-dominated villages tend to elect Pradhans (village heads) from within their own groups, SC-dominated villages are often led by non-SC Pradhans. Notably, targeted government interventions have improved SC access to education and health infrastructure, with more schools and health centers present in SC-majority villages than in those dominated by unreserved castes. In stark contrast, ST communities face acute exclusion, with over 90% of ST-majority villages lacking even basic health facilities. These patterns underscore a troubling paradox: communities with the least land and political representation often bear the greatest environmental risks. The study highlights the urgency of more inclusive rural development policies that proactively address caste-based inequalities, improve representation in local governance, promote inclusive climate justice, and ensure essential infrastructure is accessible to all communities.

Keywords*: Caste Dominance; Landholding Inequality; Social Segregation; Political Inclusion; Environmental Justice.*

…….....

Resilience and Vulnerability in a New Age: Human-Ecosystem Interaction Under Stress

Shikha Singh
Research Scholar, M.M.P.G. College, Kaalakaankar, Pratapgarh (Uttar Pradesh)
Under the supervision of: Prof. Pradeep Kumar Singh
Email: raghuvanshishikha01@gmail.com

In the contemporary era, the dynamics between human societies and natural ecosystems are undergoing unprecedented transformations due to multiple stressors such as climate change, rapid urbanization, resource depletion, and socio-economic inequalities. This paper examines the dual aspects of resilience and vulnerability within the human-ecosystem relationship, emphasizing how communities adapt, cope, or succumb under environmental and socio-economic pressures.

Resilience refers to the capacity of human and natural systems to absorb disturbances, reorganize, and retain essential functions, while vulnerability denotes the susceptibility to harm due to exposure, sensitivity, and limited adaptive capacity. By analyzing case studies from diverse geographical and cultural contexts, this research identifies patterns of adaptation, innovation, and failure in human-ecosystem interactions. The study also highlights the role of governance, technological interventions, and traditional ecological knowledge in enhancing resilience while reducing vulnerability. It argues that the balance between resilience and vulnerability is a decisive factor in sustainable development, influencing food security, biodiversity conservation, and human well-being. Ultimately, fostering resilience requires integrated strategies that address environmental sustainability, social equity, and economic stability. The findings of this research contribute to the ongoing discourse on sustainability science, offering insights for policymakers, scholars, and community leaders seeking to strengthen human-ecosystem resilience in an age marked by uncertainty and rapid change.

Keywords: *Resilience; Vulnerability; Environmental Sustainability; Economic Stability; Resource Depletion.*

……

Geographies of Invisible Labor: Women's Work, Mobility, and Climate Stress in Pratapgarh, U.P.

Uttara Singh, Archana Raje** and Km. Aarti****
*Assistant Professor, CMP Degree College, University of Allahabad,
uttarasingh2001@gmail.com
** Assistant Professor, CMP Degree College, University of Allahabad,
archanaraje73@gmail.com
***Research Scholar, CMP Degree College, University of Allahabad.

This paper investigates the gendered dimensions of climate stress and invisible labour in rural Pratapgarh, a vulnerable region in Eastern Uttar Pradesh. As climate patterns grow more unpredictable and agrarian livelihoods erode, rural women bear a disproportionate burden—managing household survival, engaging in seasonal farm labour, and navigating mobility constraints. Yet, their work remains chronically under-recognized in policy and planning. Drawing on gender-disaggregated data from Census 2011, NSSO, and MGNREGA records, along with local development reports, this study reveals how rural women's unpaid and informal labour intersects with climate-induced precarity, water stress, and migration pressures. It critically examines the spatial geographies of women's daily routines—such as fuelwood collection, water-fetching, and caregiving—under environmental and social duress. The paper also explores the role of Self-Help Groups (SHGs), village-level planning mechanisms, and community networks in building adaptive capacity and resilience. Using thematic maps and case-based analysis, the paper uncovers hidden geographies of labour, loss, and local resistance. By centering women's experiences within climate

discourse, this paper calls for a shift from gender-blind adaptation policies to a framework rooted in equity, recognition, and grassroots resilience. Pratapgarh emerges not only as a site of struggle, but as a living map of women's quiet but powerful navigation through crisis.

Keywords: *Invisible Labor; Gender and Climate; Climate Resilience; Unpaid Work; Adaptive Mobility.*

…….....

Village-Scale Flood Vulnerability, Risk and Resilience Assessment Using Machine Learning and SAR Data: Insights from the 2024 Malda Flood

Sk Asraful Alam[1] and Ramkrishna Maiti[1]*
[1*] Department of Geography, Vidyasagar University, Midnapore,
Email ID: alamrsgis13@gmail.com,
[1]Department of Geography, Vidyasagar University, Midnapore,
Email - ramkrishna@mail.vidyasagar.ac.in
Email ID: alamrsgis13@gmail.com

Floods significantly impact communities, economies, and ecosystems, disrupting development and intensifying long-term vulnerabilities. The Malda district in the Lower Ganga Plain faces recurrent flood risks due to complex hydrological and geomorphological factors. This study examines the catastrophic 2024 flood in Malda and introduces an integrated, explainable machine learning framework to evaluate village-level flood vulnerability, risk, and resilience across six administrative blocks, leveraging Sentinel-1 Synthetic Aperture Radar (SAR) data. Random Forest and SHapley Additive exPlanations (SHAP) were employed to analyze the major 2024 flood events, which inundated 13.74% and 15.04% of the study area in August and September, respectively. SHAP results identified rainfall intensity, cumulative rainfall, and flood depth as dominant predictors, accounting for over 65% of vulnerability. Spatial analysis revealed that Manikchak, Ratua-I, and Kaliachak-II blocks exhibit the highest vulnerability and risk, largely due to low elevation and river proximity. Approximately 32.72% (369.3 km^2) of the area demonstrates low to very low resilience. Out of 529 villages, 182 (34.39%) demonstrate high to very high resilience, 176 (33.27%) exhibit moderate resilience, while 170 (32.13%) are characterized by low to very low resilience, predominantly in the northwestern and western parts of the district. Although Bhutir Char is the most flood-affected zone, villages such as Uttar Chandipur and Bahadurpur show notable resilience due to stronger adaptive capacity. The study introduces a scalable framework for integrating machine learning and SAR data in flood disaster assessment, offering valuable insights for targeted adaptation, risk reduction, and sustainable flood management in vulnerable riverine regions.

Keywords: *Malda Flood; Machine Learning Models; Flood Vulnerability and Risk; Flood Resilience Index (FRI), Village-Level Resilience Mapping*

Spatial and Temporal Dynamics of Malaria in the Arunachal–Assam Foothills: Geo-Environmental Determinants and Risk Patterns (2016–2022)

Dr. Manash Jyoti Nath
Department of Geography, Gauhati University, Guwahati, Assam – 71014
Email: manashjnath@gauhati.ac.in

Malaria remains a persistent public health challenge in the northeastern states of India, particularly in the ecologically fragile foothill regions of Arunachal Pradesh. This study investigates spatial and temporal patterns of malaria incidence in districts along the Arunachal–Assam foothills, with emphasis on geo-environmental determinants shaping transmission risk. The foothill belt, marked by high rainfall, warm temperatures, dense forest cover, and extensive river systems, offers ideal conditions for vector proliferation. Data from 16 Primary Health Centres (PHCs) bordering the Arunachal foothills were analyzed for the period 2016–2022, supplemented with regional climatic records. A total of 6,163 cases were recorded, with Orang PHC alone accounting for 4,778 cases (~72% of total), peaking at 2,180 in 2018. Other PHCs with notable incidence included Ketetong (62 cases) and Boginodi (32 cases), while several, such as Gogamukh, Na-Sadiya, and Dhalpur, consistently reported ≤2 cases annually. Across the region, incidence dropped sharply after 2019, with Orang recording a 99.5% reduction between 2018 and 2022. Climatic analysis showed annual rainfall of 2,500–3,000 mm—predominantly during June–September—and year-round temperatures of 20–32 °C, conditions conducive to perennial vector breeding. Risk was heightened in flood-prone forest–river interfaces, where stagnant water and dense vegetation support Anopheles mosquito habitats. The study underscores pronounced spatial heterogeneity in malaria risk across the foothill belt and demonstrates how geo-environmental and climatic factors jointly shape transmission dynamics. These insights highlight the need for spatially targeted interventions, climate-sensitive vector control, and sustained surveillance in historically high-burden pockets to prevent resurgence.

Keywords: *Malaria; Geo-Environmental Determinants; Foothill Region; Arunachal–Assam Border*

……

Assessment of Disaster Preparedness and Accessibility to Emergency Cyclone Shelters in the Coastal Area of the Indian Sundarban

Indrani Barui[1*] *and Kapil Ghosh*[1]
[1]Department of Geography, Diamond Harbour Women's University, Sarisha
[*]Corresponding author: indranibarui132@gmail.com

The coastal and low-lying areas of the Indian Sundarban are highly vulnerable to multiple hazards. Cyclonic hazards and floods have become a regular phenomenon in this fragile region. Local administrators utilize emergency cyclone shelters or schools to accommodate vulnerable rural communities. To ensure efficient disaster planning, it is crucial to manage rural communities systematically, with a focus on disaster awareness and shelter location. A spatial analysis was conducted using the Maximal Covering Location Problem (MCLP), treating existing shelters as facilities and households as demand points. The model assessed shelter coverage within a defined travel threshold (impedance cutoff). Accessibility was further analysed by incorporating crowding effects, considering the interaction between shelter capacity (supply) and population levels (demand) using a distance buffer approach. A household survey was conducted based on proximity to shelters. Results indicate that existing shelters are insufficient to serve all households within 30- and 60-minute travel times. Moreover, the analysis highlights substantial spatial inequalities in shelter access between villages. The study offers critical insights for improving community disaster awareness, optimizing shelter location-allocation, and developing effective emergency evacuation strategies in the Indian Sundarbans.

Keywords: *Coastal Hazard; Cyclone Shelter; Location; Accessibility; Disaster Awareness*

……

TS-7

Natural Resources Management

Integrated Geospatial Assessment of Human Footprint Impact on Regulating Ecosystem Services in the Himalayan Urban Landscape

Mohd Waseem Naikoo[*1] *and Atiqur Rahman*[1]
[1]Department of Geography, Faculty of Sciences, Jamia Millia Islamia
New Delhi 110025 (India)

The rapid transformation of natural landscapes in mountainous cities of the Himalayas is primarily driven by human pressure, including urbanization and high tourist influx. These pressures significantly alter ecological landscapes, influencing spatial pattern and natural ecosystem services (ES) in the Himalayan region. Dehradun, one of the fastest-growing class-I cities in the Himalayas, has experienced substantial changes in its natural ES due to increased human activities. This study aims to analyze the impact of human pressure on ES in the peri-urban landscape of city using the Human Footprint Index (HFI), InVEST, and RUSLE models. The outputs were carefully validated through pearson correlation analysis and image-to-image comparisons with satellite-derived indices. The Geographically Weighted Regression (GWR) was applied to quantify the dynamics of HFI in relation to different regulating ES like carbon storage (CS), habitat quality (HQ), and soil erosion (SE). The results indicate a significant rise in human pressure, with the very high zone of HFI area expanding from 6.5% in 1991 to 25.2% in 2021. Simultaneously, CS and HQ in the high zones declined from 73.80% to 43.90% and 60.16% to 43.86%, respectively, while high soil erosion areas increased from 1.4% to 2.3% during the same period. The GWR analysis showed spatial heterogeneity in the relationships between HFI and various ES, as reflected in the local R^2 values and residual distributions. These findings underscore the strong link between urban expansion, the rising human footprint, and the degradation of regulating ES. The study provides valuable insights for policymakers and researchers, facilitating for the formulation of sustainable strategies for environmental conservation and resilient urban planning in Dehradun and other mountainous cities worldwide.

Keywords: *Human Footprint; Urban Pressure; Regulating Ecosystem Services; Geographically Weighted Regression (GWR); Himalayan Urban Landscape.*

…….....

Land Capability Classification & Crop Suitability Mapping of Alipurduar District

Tapan Kumar Das
Head & Assistant Professor, Department of Geography, Cooch Behar College, West Bengal
Email: dr.tapankumardas2025@gmail.com

Soil, being vital natural resource formed over thousands of years, is essential for sustaining life and agricultural productivity in any regions like Alipurduar district, West Bengal, where increasing population pressure and unsustainable practices have led to concerns over its degradation. Overuse

of chemical fertilizers, inappropriate crop choices and poor land management reduce soil fertility and long-term productivity. Sustainable measures such as crop rotation, organic farming, precision agriculture, erosion control and proper water management are key to maintaining soil health. Assessing these conditions is supported by the Land Capability Classification (LCC) system, which groups soils into eight classes based on limitations like erosion, wetness, rooting depth, and climate, aiming to match land uses with its natural potential while preventing irreversible damage, especially from erosion. Applying LCC in Alipurduar can guide sustainable land use planning, ensuring that the district's agricultural lands remain productive for future generations. The present study deals with the development of soil sampling unit i.e. Landscape Ecological Unit (LEU) after Jenny (1941), Land Capability Classification following USDA, Soil erosion mapping using RUSLE Model and Major Crop Suitability Mapping of Alipurduar District using AHP based RS & GIS Techniques. The result shows that the study area are classified into four broad Land Capability Classes, such as, Class III (Fairly Good Cultivable Land), Class IV (Well Suited for Grazing), Class V (Fairly Well suited for Grazing &Forestry), Class VI (Lands Well Suited for Grazing & Forestry) covering 21%, 29%, 36%, 14% area of the total land. Then the land suitability map for paddy, wheat, maize (summer & robi), tea, lentil & potato have been generated showing highly, marginally, moderately suitable & currently not suitable areas of the district. This outputs are very useful for further land use planning.

Keywords: *Land Capability Classification (LCC); Crop Suitability Mapping; Land Use Planning; Landscape Ecological Unit (LEU); RS & GIS Techniques.*

…….....

Geomorphic Evaluation and Mapping of Soil Resources in Chandwad Tahsil, Maharashtra: A Geoinformatics Approach

Dnyaneshwar N. Pawar and Purushottam Gangurde***
*Head and Associate Professor, M.V.P. Samaj's KRT Arts, B.H. Commerce and A.M. Science College (KTHM) College, Nashik. Affiliated to Savitribai Phule Pune University.
**Assistant Professor, S.V.K.T. College, Deolali Camp, Nashik.
Email: dmauli2007@gmail.com

This study aims to evaluate and map soil resources in the drought-prone Chandwad Tahsil (958 Km^2) of Nashik District, Maharashtra. The area characterised by erratic rainfall, rugged terrain, and recurrent droughts is characteristic of broader environmental challenges affecting agricultural sustainability in semi-arid regions. Applying satellite imagery (IRS-P6 LISS IV), topographic sheets, and field-collected soil samples, the research integrates geomorphological and pedological datasets with spatial analysis tools using geospatial techniques. The methodology follows the Storie Index approach, modified to suit local conditions, considering key factors like soil texture, chemical properties, drainage, infiltration, and slope. The extensive soil survey of sample collection and hydrological measurements was undertaken in the study area. The research produced thematic maps that depicted land facets, elevation, slope, relative relief, soil pH,

hydraulic conductivity, erosion, and land productivity. The results showed that soil quality varied by location across geomorphic units, e.g. eastern Chandwad had a severe soil loss (>40 t/ha/yr) and runoff because of bare hill slopes. On the other hand, despite being at risk from erosion and salinity, plains and valley regions show moderate to good productivity. A high-resolution spatial understanding of land productivity was obtained by combining GIS and remote sensing techniques, identifying key areas for conservation planning. The land productivity analysis shows that the majority of the land is classified as Good (23.99%) and Fairly Good (36.66%), with 31.55% of the land classified as Poor, Very Poor, or Non-Agricultural. This implies that soil conservation and land improvement are essential, especially in low-productivity areas. The findings offer valuable insights for policymakers, planners, local administrators and farmers to implement targeted conservation strategies and sustainable land use planning. Restoration of degraded lands through irrigation planning and erosion control in high-priority areas can significantly enhance agricultural productivity and livelihood resilience in Chandwad Tahsil.

Keywords: *Geomorphic; Soil Resources; Evaluation; Geoinformatics; Mapping.*

……..

Geomorphology and Multi-Criteria GIS–AHP Approach to Landfill Site Suitability in MKDA

Itu Pal[*1] *and Ramkrishna Maiti*[2]

[*1]Research scholar, Department of Geography, Vidyasagar University, Midnapore, West Bengal, 721102, India. Email: itupal411@gmail.com

[2]Professor, Department of Geography, Vidyasagar University, Midnapore, West Bengal, 721102, India. Email:ramkrishna@mail.vidyasagar.ac.in

Each Municipality faces a challenge in collecting and disposing of large amounts of waste due to rapid population growth. The absence of an appropriate large dump site can harm the environment and society. The MCDM technique and GIS platform can help choose a proper landfill site. With two municipalities and a population of almost seven lakhs, MKDA has the same difficulties. An appropriate landfill site for the MKDA region was identified in this study using the AHP approach. Based on expert supervision, eighteen criteria were considered according to their weightage. The landfill suitability map is categorized into five classes: highly suitable, suitable, moderately suitable, less suitable, and unsuitable. Two sites are being identified as more appropriate for avoiding conflicts regarding environmental risk, from a hydro-geomorphological perspective. The results of this study could help the city's waste management officials and urban planners create a solid waste management system that works well.

Keywords: *Suitable landfill site; AHP; solid waste management; geomorphology; MKDA.*

……..

TS-8

Land Use and Development Planning

Urban Growth of Samastipur City, Samastipur, Bihar, India: Challenges and Planning

Abhishek Anand and Shivaji B Shinde

Postgraduate Research Centre, Department of Geography, PDEA's, Prof. R.M. College, Akurdi, Pune- 44

Email: abhishekkrpatna2015@gmail.com

The process of urbanization in India's smaller cities has gained momentum in recent decades, particularly in regions like Bihar where demographic pressure and infrastructural development are reshaping the urban landscape. Samastipur, a rapidly growing city in northern Bihar, has emerged as a key administrative, commercial, and transport hub in the Mithilanchal region. Despite its growing importance, the spatial configuration and functional dynamics of the city remain under-examined in academic and policy discourse. This study aims to investigate Land use Land cover changes over two decades from 2000 to 2024. The research employs high-resolution satellite imagery and demographic data from Census 2011, integrated within a Geographic Information System (GIS). Findings reveal a semi-concentric and linear morphological pattern, with high-density development around the city centre and transportation nodes. The city is experiencing unplanned expansion at its peripheries, marked by land-use fragmentation and inadequate service distribution. Functional zones often overlap, leading to inefficiencies in land use and infrastructure allocation. The study highlights the need for comprehensive urban planning, emphasizing controlled growth and sustainable infrastructure development. The spatial insights derived from this research can serve as a foundation for future urban policy formulation and integrated development planning in Samastipur and similar emerging cities.

Keywords: *Urban Growth, Planning Strategies; Samastipur City; Spatial Analysis; Urban Development*

……..

A Geographical Review of Land Use Pattern Under Different Crops in Chitrakoot District, Uttar Pradesh

Birendra Kumar Yadav and Uttara Singh***
*Research Scholar, CMP Degree College, University of Allahabad, Prayagraj,
bkkaleindia@gamil.com.
******Asst. Prof., CMP Degree College, University of Allahabad, Prayagraj,
uttarasingh2001@gmail.com

Land use is a dynamic, man-made process whereby people use land resources to meet their diverse cultural, social, and economic demands while also serving as a foundation for future growth. An area's eco-system and productivity can be enhanced by appropriate management for sustainable land development. The study aims to identify the present land use pattern in Uttar Pradesh's Chitrakoot district. About half of the district's 3,38,897 hectares of reported land were covered by net sown land, while roughly one-fourth was covered by forest land. About 9.67% of the land was used for non-agriculture purposes, and the current fallow land was reported by 4.88%. Cultivable waste land was 12501hectares, while the groves and gardens were expanded on 1106 hectares (0.32%), non-cultivable land (3.6%), other fallow land (3.43%), and grazing land (48 hectares) came next (0.01%) between 2021 and 2022. Outlining and evaluating the land use shift in Chitrakoot District is the paper's primary goal. From 1997 to 2021 the land use pattern has been utilized using the State Government of Uttar Pradesh's secondary data sources.

Keywords: *Land Use; Net Sown Area Pasture Land; Cultivable Waste Land; Fallow Land; Non-Cultivated Land.*

…….....

Significant change in Land use pattern of Ayodhya district of Uttar Pradesh

Dr. Archana Raje1 and Sachin Singh2
[1]Assistant Professor, Department of Geography, CMP Degree College, University of Allahabad, Prayagraj
[2]Research Scholar, Department of Geography, CMP Degree College, University of Allahabad, Prayagraj

At the present time period a lot of change is noticed in the land use pattern of Ayodhya district of Uttar Pradesh. However, a major significant shift from primarily agricultural land to commercial and industrial landscape. A widespread degradation of soil fertility and agricultural health due to mispractices and mismanagement of primary sector. The present study area, Ayodhya district is also facing the problem of agricultural land depletion on a large scale. The primary objective of this study is to build a better scientific model considering the sustainable development of the study area. This study is based on primary and secondary data regarding socio-economic changes and

needs of natives. This research work will prove to be a milestone for all around development of reason as well as the entire world. Ayodhya district of Uttar Pradesh has witnessed significant change in the landuse pattern during the recent past. Particularly in terms of major shift from primarily agricultural land to commercial and industrial landscape. This shift adversely affects the present study area, Ayodhya district as regard widespread agricultural land depletion. The primary objective of this study is to build a better scientific model considering the sustainable development of the study area based on primary and secondary data regarding socio-economic changes and need of natives. The study will be helpful to prepare further plans pertaining to development of the area.

Keywords*: land use pattern; socio-economic changes; significant shifting pattern; land depletion; sustainable development.*

…….....

Tracing and Mapping the Dynamics of Human Impact on Landuse Landcoverin a Tropical Plateau Fringe River Basin of Eastern India: An Implication of Anthropic Indices and Geostatistical Methods

BasirAli Karikar[1], Manirul Mia[1], Ayesha Siddika[1], Lubna Siddiqui[2] and Masood Ahsan Siddiqui[2]

[1]DepartmentofGeography, FacultyofScience, Jamia Millia Islamia, NewDelhi

[2]Professor, Department of Geography, FacultyofScience, Jamia Millia Islamia, New Delhi

Email:lsiddiqui@jmi.ac.in

Apart from the human inhabitations around an urban centre, the human alterations (channelization works) to river environments have become a very dominant role in their progress and development. The main objective of this study is to explore the human-induced geomorphic changes in the fluvial landscape at block level and mapping of the dynamics of LULC-based magnitude of human impact and their modifications at the basin scale. The District Census Handbook (DCH) database was utilized to demonstrate the extent of human impact. The Index of Potential Anthropic-Geomorphology (IPAG) was used to show the extension of human-driven modifications to land surface from 1960 to 2031. Multi-temporal Landsat satelliteimagery for30 years (1992-2022) was used formapping thedynamics ofthe level of human impacts. The spatio-temporal variability of hotspots of human intervention was delineated using an innovative approach, namely the Getis-Ord-Gi. The Landscape fragmentation tool (an ArcGIS extension) was employed for calculation of fragmentation patterns of Lower Ajay River basin (LARB). The findings showed Faridpur-Durgapur (0.64) reported the highest IPAG value, while Kanksa (0.17) registered the minimum value in the year 1961. The maximum value was found in Pandabeswar, which ranges from 1.09 to 0.01, due to coal mining activities and expansion of the Asansolurban centre in close proximity, whilethe minimum value was observed in Mangolkote, which lies from 0.37 to 0.14, because of

continuous decrease in illiteracy (1961: 74.87 %; 2031: 28.87 %). From 1992 to 2022, high and very high levels of human impact were noticed along and across the lower Ajay sub- watershed, followed by the Kunur and Kandar sub-watershed; moderate levels of human pressures protruded almost the entire LARB, and low and very low anthropogenic stress was exhibited in the northernpart of the LARB.The fragmentation indices revealed that the patch area has consistently increased over the entire basin area, whileall other landscape units have rapidly decreased. So, this study emphasizes the need for effective land use planning and arising awareness about river basin restoration and management.

Keywords: *Anthropogenic intervention, LULC, Index of PotentialAnthropic Geomorphology, Hotspot and cold spot, Landscape fragmentation*

……..

Enhanced Land-Cover Classification in Rugged Landscapes Using Multi-Temporal Remote Sensing and Machine Learning Techniques

Muzamil Hassan Lone [1], Amit B Mahendrakar [1]*

[1*]Department of Environment and Water Resource Engineering Vellore Institute of Technology, Vellore, Tamil Nadu, 632014, India

[1] Department of Environment and Water Resource Engineering, Vellore Institute of Technology, Vellore, Tamil Nadu, 632014, India.

Email: muzamilhassan.lone2023@vitstudent.ac.in

Accurate land-use and land-cover (LULC) classification in mountainous regions is essential for effective environmental planning, watershed management, and sustainable resource utilization. Conventional classification approaches often underperform in such areas due to complex topography, spectral confusion, and atmospheric interference. This study assesses the performance of three supervised machine learning algorithms Support Vector Machine (SVM), Random Forest (RF), and Classification and Regression Trees (CART) for LULC classification in the Lolab watershed, located in the northwestern Himalayan region. Multi-temporal Landsat 8 and 9 satellite imagery from 2013 to 2023 was processed using the Google Earth Engine (GEE) platform. In addition to spectral bands, four indices Normalized Difference Vegetation Index (NDVI), Modified Normalized Difference Water Index (MNDWI), Normalized Difference Built-up Index (NDBI), and Soil-Adjusted Vegetation Index (SAVI) were incorporated to enhance class separability in spectrally complex areas. Topographic variables were also included to account for elevation-driven variability. Results indicate that machine learning algorithms significantly outperform traditional classification methods, with the SVM model achieving the highest overall accuracy of 97% and a kappa coefficient of 0.98. Utilizing the computational capabilities of GEE along with three supervised machine learning algorithms SVM, RF, and CART the study found that SVM delivered superior performance. Its strength in managing high-dimensional and nonlinear datasets proved especially useful for distinguishing spectrally similar LULC classes common in mountainous

terrain. Integrating raw satellite bands with indices like NDVI, MNDWI, NDBI, and SAVI enhanced spectral distinction and improved the overall effectiveness of the models. These findings demonstrate the robustness and scalability of machine learning-based classification approaches for LULC mapping in mountainous and heterogeneous terrains. The study provides valuable insights for geomorphological applications, environmental monitoring, and the formulation of data-driven land management policies in sensitive highland environments.

Keywords: *Remote sensing; Machine learning; LULC; Spectral indices; Himalayan watershed*

……..

Evaluating the Spatial Correlation between Rivers and Rural Settlements Using GIS and Statistical Tools: A Case Study of Nashik District, Maharashtra

P.C. Gangurde, L. S. Shendge** and L. A. Kalaskar****

*Assistant Professor,MVP Samaj's S.V.K.T. Arts, Science & Commerce College, Lam Road, Deolali Camp, Nashik, Maharashtra- 422401 (Affiliated to Savitribai Phule Pune University, Pune)pcgangurde88@gmail.com

**Assistant Professor, Gokhale Education Society's,RNC Arts, JDB Commerce and NSC Science College,Nashik-Pune Road, Nashik, Maharashtra- 422401 (Affiliated to Savitribai Phule Pune University, Pune) laxmansshendge@gmail.com

***Research Scholar, MVP Samaj's, G.M.D. Arts, B.W. Commerce and Science College, Sinnar,
Nashik, Maharashtra- 422103(Affiliated to Savitribai Phule Pune University, Pune)
lalit.kalaskar@gmail.com
Email: pcgangurde88@gmail.com

Rivers are significant in where people live because they provide crucial resources for farming, getting water, and getting around. The research investigates the spatial correlation between rural settlements and their proximity to rivers in the Nashik district of Maharashtra. The Godavari and Girna rivers, among others, are essential in this area because of the varied topography. The database used SOI toposheets, district census handbooks, satellite images and DEM. GIS techniques like digitisation, vector overlay, raster and buffering analysis are applied to get the results. Quantitative methods, including Pearson's correlation, regression analysis and Student's t-test are utilised to discover the consequence of river proximity for settlement development. The result shows a high negative association (r=-0.90) between the number of towns and their distance from rivers. The data reveal a clear relationship between river proximity and rural settlement patterns. As the distance from the river increases, the number and density of rural settlements decrease. Nearly half (48.39%) of all rural settlements lie within 1 km of the river, while only 6.45% are found at a 5 km distance, highlighting the importance of rivers in rural habitation.

Population-wise, larger settlements also concentrate near waterways. The analysis reveals that 204 settlements (500–1000 population) and 156 (2000–3000 population) are within 1 km. This declines significantly at 5 km. Overall, rivers are crucial in shaping rural settlement distribution and population size. Larger and more developed settlements are located near waterways. The random GPS field survey was conducted for ground verification and validation of results. The statistical research highlights the importance of water-focused regional planning and reveals the substantial influence of rivers on the spatial distribution of rural settlements. The importance of rivers in forming human settlement is shown by this study, particularly in semi-arid areas like Nashik. It enhances the overall geographic comprehension of settlement patterns concerning natural resources.

Keywords: *River; Settlements; Correlation; Spatial; GIS; Buffering*

……

Geomorphological Evaluation of Site Suitability for Farm Ponds in Nashik District, Maharashtra

Satish Handge, Lalit Kalaskar** and Vitthal Anwat****
*Assistant Professor, M.V.P. Samaj's KRT Arts, B.H. Commerce and A.M. Science College (K.T.H.M.) College, Nashik. Affiliated to Savitribai Phule Pune University.
Email- satishhandge1987@gmail.com
**Research Scholar, M.V.P. Samaj's G.M.D. Arts, Commerce and Science College Sinnar, Dist. Nashik Affiliated to Savitribai Phule Pune University.
Email- lalit.kalaskar@gmail.com
***Assistant Professor, M.V.P. Samaj's KRT Arts, B.H. Commerce and A.M. Science College (K.T.H.M.) College, Nashik. Affiliated to Savitribai Phule Pune University.

Land Suitability Analysis (LSA) is a crucial way to determine how well land can be used for a particular purpose, like a farm pond. This research employs the Analytic Hierarchy Process (AHP) to identify site suitability for farm ponds in Nashik District, Maharashtra. It integrates GIS with Multi-Criteria Decision Making (MCDM). The suitability of farm ponds was determined by geomorphological factors such as elevation, slope, drainage density, vulnerability, net water recharge, aspect, soils, and climate indicators, including drought frequency, groundwater level, rainfall, temperature, humidity, NDWI, TWI, and land use/land cover. The GIS technique involved gathering data from reliable sources, such as SOI toposheets, Landsat images, and records from the Indian Meteorological Department, on geography, weather, land use/land cover etc. AHP made it possible to compare pairs of criteria to give them weights, making it easier to prioritise the factors that affect appropriateness systematically. Then weighted overlay analysis techniques used to delineate the research into five groups of suitability. The research determines optimal locations for farm ponds to enhance water conservation and agricultural productivity by integrating expert-weighted criteria with GIS-based spatial analysis. The results showed that about 85.18% land of

Nashik district is good for farm ponds (low to extremely high suitability). 42.61% of the land comprises under very high suitability. These places have the best conditions, such as gentle slopes, plenty of rain, and reasonable quantities of groundwater. Problems like high topography or degraded soil quality made only 14.82% of the area unusable or inappropriate. The results show that the district has much potential for long-term water management by developing ponds in a focused way. This study demonstrates that integrating MCDM with GIS is advantageous for land use planning. Stakeholders may optimise resource utilisation, mitigate water scarcity, and enhance agricultural resilience by concentrating on areas that meet their demands. The method gives a model that can be used in other sections of the country that are similar and that suit the bigger goals of climate adaptation and sustainable development.

Keywords: *Site Suitability; Geomorphology; Farm Ponds; GIS; AHP; Sustainable development.*

……..

Impact Assessment of changing LULC on LST and UHI pattern. A case study of Srinagar city, Jammu and Kashmir

Shafiq Ahmed[1]*, Rashid Latief bhatt*[1] *and Shipali Billowria*[1]
[1]Department of Geography University of Jammu, Jammu (180006)
Email: rashidbhat350@gmail.com

The rapid urbanization of Srinagar city, located in the Himalayan region, has led to significant changes in land use and land cover (LULC), resulting in an increase in the Urban Heat Island (UHI) phenomenon. This study investigates the relationship between Land Surface Temperature (LST) and LULC changes over a decade, from 2010 to 2022, focusing on four key categories: built-up areas, agricultural land, water bodies, and natural vegetation. Using Landsat satellite data, we analyzed seasonal variations in LST across these categories and calculated the Urban Thermal Field Variance Index (UTFVI) to assess the ecological impact. The findings reveal a substantial increase in LST, particularly in built-up areas, where maximum temperature increased from 34.6°C in 2010 to 37.19°C in 2022. Additionally, the UTFVI analysis showed a decline in areas with "Excellent" ecological conditions, dropping from 57.91% in December 2010 to 47.24% in December 2022, while areas categorized as "Worst" ecological conditions increased, indicating a worsening UHI effect. These results highlight the growing environmental challenges posed by urbanization in Srinagar city, necessitating urgent sustainable urban planning interventions.

Keywords: *Land surface temperature (LST), Urban heat island (UHI), Urban thermal field variance index (UTFVI), Land use land cover (LULC).*

……..

Assessing Land use/Land cover changes and Land degradation using Geospatial technology for identifying hots spots and their restoration in desert region of Rajasthan

P C Moharana, Manoj Parihar, Mahesh Kumar, Priyabrata Santra, Mahesh K Gaur and Ayush Swami
ICAR-Central Arid Zone Research Institute, Jodhpur

Email: pcmoharana45@gmail.com

This study was undertaken in the desert areas of NW Rajasthan to map and compare spatio-temporal changes in land degradation status through a 1:10 k mapping for Nachna block in Jaisalmer District. The area is mostly dune covered being partially irrigated by IGNP canal water. Using ESA-Sentinel-2A and Landsat-8 satellite images, land degradation status, vegetation indices and land use for 2021 and 2001 were created. Since 2001, irrigated area has increased by 24 %, forestlands by 2 % and sand dune area has reduced by 21 %. It was found that the traditional rain-dependent system with low-yield and short-duration crops is gradually being transformed into irrigated cropping, due to canal water and small farm ponds. About 22 % area are slightly and 54 % area, moderately affected by wind erosion activities. About 40 % of area were identified as hot spots of changes. NDVI-Land use change relationship analysis found maximum positive change in NDVI values during Rabi period in 98.16 % area in sand dune/sandy plain area (50.83% of TGA), followed by in agriculture (21.67 % in single crop & 13.23 % in double crop area). In contrast, during kharif, maximum positive change was observed in 74.40 % area and negative changes in 25.60% of TGA that includes sand dune/sandy plain area (50.83% of TGA). The NDVI analysis for 2000-2021 using Landsat-8 showed increasing trend (R^2=0.505), indicating healthy vegetation cover and expanding croplands in Nachna area that has partially restored areas affected by wind erosion hazards.

Keywords: *Wind Erosion; Spatio-Temporal Changes; Block Level Mapping; Land Use; Desert Area; Rajasthan*

……

Drivers, Impacts, and Sustainable Solutions for Land Use Change in South Kashmir, Indian Himalayas

Rehana Rasool[1], Mifta ul Shafiq[2] and Pervez Ahmed[3]
[1]Department of Geography, Government Degree College Eidgah, Srinagar (rehanrasool75@gmail.com)
[2]Department of Geography, Cluster University of Srinagar, 190008 (saabid9@gmail.com)
[3]Department of Geography & Disaster Management, University of Kashmir, 190006 (pervezku@gmail.com)

This study analyses Land Use and Land Cover (LULC) change in South Kashmir using the Driver-Impact framework. Key Drivers include climatic shifts (decreasing precipitation, rising temperatures), rapid population growth, and the high economic returns from horticulture, which incentivize farmers to convert agricultural land. These forces create Pressure, resulting in a significant loss of 278 km² of agricultural area (1990-2017) to horticulture and built-up land, alongside increased fertilizer use and land fragmentation. The resultant State is land degradation and declining productivity. Despite area expansion, yield increases for staple crops like rice and apples remain low, indicating unsustainable practices. The critical Impact is a severe threat to regional food security, incresing dependence on imported food grains. As a necessary Response, the study proposes integrated Sustainable Land Management (SLM) strategies. These include adopting agroforestry, crop rotation, and organic practices to enhance soil health; sustainable intensification to boost food security; and afforestation for climate adaptation. The findings underscore the urgent need for a robust land-use policy that leverages geospatial monitoring, enforces laws against unsustainable conversion, and promotes community engagement to ensure the socio-ecological sustainability of this fragile Himalayan region.

Keywords: *DPSIR Framework; LULC Change; Sustainable Land Management; South Kashmir; Food Security; Land Degradation.*

……..

Assessment of Adaptibility of Pune Metro Among Citizens: Issues & Solutions

Madhavi S. Waghmare[1] and Arjun H. Musmade[2]

[1]Research Scholar, Prof. Ramkrishna More Arts, Commerce and Science College, Akurdi, Pune. Savitribai Phule Pune University, Pune

[2]Professor, Sahebrao Shankarrao Dhamdhere Arts and Commerce College, Talegoan Dhamdhere, Pune

madhaviwaghmare.015@gmail.com

The Pune Metro marks a transformative milestone in the city's urban infrastructure, designed to address critical challenges such as traffic congestion, extended travel times, and environmental sustainability. As Pune undergoes rapid urbanization, the demand for an efficient, sustainable, and reliable public transportation system has become increasingly urgent. The success of the Pune Metro depends not only on its operational capabilities but also on public acceptance and usage. This study investigates the adaptability of Pune Metro among its residents, focusing on factors such as awareness, accessibility, convenience, and user satisfaction. A primary survey was conducted using a google form questionnaire, employing simple random sampling to gather data from 500 respondents. The data is analyse using a customer satisfaction score. Results shows that 74% of respondents have shifted their preference of using transportation from other modes of transportation to the Pune Metro. Key aspects such as punctuality, cleanliness, security, safety, staff helpfulness, ticketing convenience, and ride comfort were evaluated, resulting in an overall satisfaction rate of 87%. Satisfaction of Pune Metro Network is analysed by considering various factors such as punctuality, Cleanliness, Security, Safety, Staff helpfulness, Ease of purchasing ticket and comfort of ride. Overall satisfaction of people with Pune Metro is 87 %. This study will evaluate the suitability and adaptability of the metro rail in the region, offering suggestion on its effectiveness. The finding can serve as a model for other cities to implement similar approaches and methodologies.

Keywords: *Pune Metro; Customer Satisfaction; Adaptability.*

……..

TS-9

Sustainable Development

Climate Change and Pastoralism in the Kashmir Himalayas: Challenges, Adaptations, and Pathways for Resilience

Shahid Saleem
Department of Geography and Disaster Management, University of Kashmir
Email: Shahidsulmani630@gmail.com,

The Kashmir Himalayas, home to centuries-old transhumant pastoral systems practiced by the Gujjar, Bakerwal, Pahadi, and Chopan communities, are witnessing unprecedented climate-induced challenges. Pastoralism continues to be a primary livelihood option for over six lakh people in Jammu & Kashmir, pastoralism remains a critical livelihood, structured around predictable cycles of moving livestock between alpine pastures in summer and lowland forests in winter. However, rising temperatures, erratic precipitation, delayed snowfall, early snowmelt, and the drying of springs are increasingly disrupting these migratory rhythms. Traditional routes are being abandoned, migration timings are shifting, and herders are compelled to travel longer distances in search of water and forage, intensifying stress on both people and livestock. These disruptions not only undermine economic security but also erode cultural identity and ecological knowledge embedded in migration practices. Based on field observations and herder testimonies, this study examines the climate-induced alterations in pastoral mobility, emerging coping strategies such as flexible grazing calendars and collective resource management, and the implications for rangeland governance. It emphasizes the urgent need for policy frameworks that recognize migration as a dynamic adaptation mechanism rather than a declining tradition, ensuring pastoral systems remain resilient in the face of accelerating climate change.

Keywords: *Climate Change; Kashmir Himalayas; Pastoralism; Seasonal Migration; Rangelands; Resilience*

……..

Mangrove Change Over Two Decades and Current Biomass–Soil Status: A Case Study from Sonakothakhar, Raigad District, Maharashtra

Ram S. Kolapkar[1] and Anargha A. Dhorde[2]
[1]Research Scholar, Department of Geography, MES's Nowrosjee Wadia College, (Autonomous)
Affiliated to Savitribai Phule Pune University
[2]Professor & HoD, Department of Geography, MES's Nowrosjee Wadia College, (Autonomous)
Affiliated to Savitribai Phule Pune University
Email: ram.kolapkar@gmail.com&aadhorde@nowrosjeewadiacollege.edu.in

Mangroves are dynamic coastal ecosystems whose spatial extent, biomass, and soil properties are influenced by tidal regimes, sediment characteristics, and anthropogenic pressures. This study

examines the Sonakothakhar mangrove patch in Alibag Tehsil, Raigad District, over a 26-year period (1998–2024) using multi-temporal satellite imagery, field biomass estimation, and soil physico-chemical analysis. Spatial analysis revealed a net mangrove area increase of 13.22 km², despite localized shrinkage towards the seaward (westward) fringe, possibly due to erosion and tidal channel shifts. NDVI values improved from a range of –0.28 to 0.63 in 1998 to –0.08 to 0.75 in 2024, indicating both an expansion in canopy cover and enhanced vegetation vigour, although the persistence of low NDVI zones suggests stress in certain tidal fringe areas.

Field measurements of Above-Ground Biomass (AGB) at ten mangrove fringe locations showed values ranging from 7 to 145 kg/tree, translating into significant carbon storage potential. Estimated carbon content correlated positively with NDVI and was generally higher in sites with greater canopy density. Soil analysis revealed slightly alkaline, saline conditions with high organic carbon (5.8–13.4%), elevated potassium (2820–6079 kg/ha), and substantial exchangeable sodium, reflecting strong marine influence. Nutrient-rich, fine-textured sites (Silt Clay Loam) tended to support higher AGB and NDVI, while sandy-textured soils exhibited lower nutrient retention and biomass. The integration of spatial, spectral, biomass, and soil datasets underscores the resilience of Sonakothakhar mangroves, where expansion and improved vegetation health are evident, yet certain fringe zones remain vulnerable to salinity stress and tidal erosion. Sustained monitoring combining remote sensing and in-situ assessments is essential to guide conservation strategies, enhance carbon sequestration, and safeguard ecosystem services in this ecologically significant coastal belt.

Keywords: *Mangrove Dynamics; NDVI; Above-Ground Biomass; Soil Properties*

……..

Role of Renewable Energy in Reducing Carbon Footprints in Developing Economies

Prof. Mary Tahir[1], Alok Tiwari[1], Kamran Haider Zaidi[1] and Srija Das[1]*
[1]Department of Geography, Jamia Millia Islamia, New Delhi- 110025
*Corresponding author: mtahir@jmi.ac.in

Climate change, mostly driven by fossil fuel consumption, causes a major challenge for sustainable development in developing countries. These countries have to deal with dual burden -ensuring economic growth along with addressing the rising carbon footprint associated with rapid industrialization, urbanization, and energy demand. Renewable energy presents a sustainable pathway by bringing down reliance on fossil fuels, reducing greenhouse gas emissions, and aiding inclusive development. The paper shows the role of renewable energy like solar, hydropower, wind, biomass, and geothermal, in reducing carbon footprints across developing economies. We have used case studies from India and other Global South countries, the study shows successful renewable energy initiatives that have contributed to carbon reduction, energy security, and socio-economic development. The study also talks about some barriers like high capital costs, technological gaps, and policy limitations, along with suggesting strategies like green finance,

regional cooperation, and innovation in decentralized energy systems. This study indicates that a transition to renewable energy not only reduces carbon emissions but also promotes plenty of Sustainable Development Goals (SDGs), establishing it as a fundamental element for low-carbon and resilient growth in developing nations.

Keywords: *Sustainable Development; Renewable Energy; Carbon Footprint; Developing Economies; Energy Transition*

……..

Reclaiming Wastewater: Towards Sustainable Urban Water Management in India

Partha Pratim Pramanik
Assistant Professor, DepartmentofGeography,
DebraThanaSahidKshudiramSmritiMahavidyalaya(Autonomous), Debra, Paschim Medinipur,
West Bengal, India.
E-mail: -parthadtsksm@gmail.com

India's post-independence urban transformation—characterized by rapid population growth and unprecedented spatial expansion—has driven water demand far beyond sustainable levels. While megacities rely on surface water, most urban centers remain heavily dependent on groundwater, a resource increasingly threatened by over-extraction, land sealing, and climate-related recharge decline. This trend has createdastructural imbalancebetween demandand supply, with serious implicationsfor economic productivity, public health, and environmental resilience. This study uses a descriptive-analytical approach based on multi-decadal data from the Census of India, CPCB, MoHUA, and other agencies, complemented by global benchmarks. It examines the changing wastewater landscape, showing that between 1978–79 and 2020–21, urban wastewater generation increased nearly tenfold, but treatment capacity grew insufficiently, leaving over 62% untreated. The largest gaps are in small and medium towns, where capacity shortfalls reach 87–95%, causing ongoing pollution of surface water bodies. Beyond numbers, the research analyzes governance fragmentation, regulatory inconsistencies, economic disincentives, outdated technologies, and societal resistance to reuse. Comparative insights place India's performance in a global context, highlighting the gap between high-income nations' advanced recovery systems and India's uneven infrastructure and policy enforcement. The findings call for a paradigm shift: wastewater should be seen not as a problematic waste but as a strategic resource—recoverable for water, nutrients, and energy—aligned with SDG-6.3. The study proposes a comprehensive roadmap: scaling decentralized wastewater treatment systems (DEWATS), improving fecal sludge management, adopting advanced treatment technologies, and integrating reuse into urban planning. Ultimately, closing the wastewater treatment gap is not just a technical challenge but a socio-political necessity. Tackling it decisively will secure India's urban water future, support its economic growth, and align environmental stewardship with global sustainability goals.

Keywords: *Wastewater Management; Groundwater; DEWATS; Sustainable Urban Water Planning; Wastewater Reuse.*

……..

Green and Inclusive Pathways to Sustainable Development in Jammu and Kashmir

Peerzada Tafheemul Islam[1], Aalie Jan[1] and Syed Binish Gillani[1]
Cluster University Srinagar[1]
Email: tafheemulislam2002@gmail.com

Jammu and Kashmir is widely recognized for its diverse ecological and cultural landscapes, ranging from the lush green meadows of the Valley to the religious and cultural heritage of Jammu, the UT is one of the preferable visiting destinations in world. However, rapid modernization, industrialization, and urbanization have led to severe challenges, including environmental degradation, pollution, resource depletion, and unsustainable development. Addressing these issues requires green and inclusive pathways that balance ecological resilience with social equity. This study systematically explores sustainability in Jammu and Kashmir by assessing existing progress, policy gaps, and socio-economic disparities. It highlights environment-centred initiatives such as renewable energy projects in remote areas (SDG 7: Affordable and Clean Energy), sustainable agriculture through organic farming and soil conservation (SDG 2: Zero Hunger), eco-tourism that preserves natural beauty and cultural heritage (SDG 8: Decent Work and Economic Growth), and community-based waste management strategies (SDG 12: Responsible Consumption and Production). In parallel, inclusive approaches emphasize community participation in planning (SDG 16: Peace, Justice, and Strong Institutions), women's empowerment through self-help groups and cooperatives (SDG 5: Gender Equality), youth engagement in green jobs (SDG 8), and education and public awareness for sustainability (SDG 4: Quality Education). Additionally, the paper underscores the importance of wetland management for flood mitigation, biodiversity conservation, and ecological balance. Together, these strategies present a balanced framework where economic growth, environmental protection, and social well-being reinforce one another. The paper concludes that integrating green and inclusive models not only strengthens sustainability in Jammu and Kashmir but also offers a replicable approach for other mountain regions striving to achieve the United Nations Sustainable Development Goals.

Keywords: *Sustainability; Eco-tourism; Green and Inclusive Development; Community Participation; Sustainable Development Goals*

……..

Hilly Urban Centres through the lens of Urban Geomorphology: A Case of Kurseong Municipality, Darjeeling Himalayas.

Hari Ramudamu[1] and Tapas Kumar Bhattacharyya[2]
Doctoral Fellow, School of Environmental Studies, Jadavpur University[1]
Professor, Department of Architecture, Jadavpur University. [2]
Email: harir.sest.rs@jadavpuruniversity.in

Urban geomorphology has been an important branch of applied geomorphology. Kurseong Municipality, one of the oldest municipalities of the country has been experiencing unplanned urbanization since the dawn of the century. The study undertakes an explorative analysis of Kurseong Municipality and its peripheral areas through high resolution geospatial data, emphasizing the nexus between physical landforms and urban development. As nestled in Darjeeling Himalayan region, Kurseong town showcase a unique landscape where the slopes, complex lithology, and micro-climatic regimes significantly influencing urban land use practices and settlement patterns. The study shows how the integration of geomorphological mapping and field observations is important in highlighting the problems associated with the spatial distribution of infrastructure and residential clustering. It also contextualizes how the dynamics of the relief features of small hilly areas intersect with socio-economic drivers and local adaptation strategies. Overall, this research highlights the need of geomorphological understanding for managing the susceptible hilly urban centres like Kurseong Municipality.

Keywords: *Urban Geomorphology; Kurseong Municipality; Darjeeling Himalayas.*

……

Mapping Environmental Vulnerabilities for Urban Sustainability: A Case Study of Aligarh City

Iqra Rahman Siddiqui
Research Scholar
Department of Geography, University of Allahabad

Urban sustainability involves designing cities with the goal of enhancing social, economic, and environmental aspects to guarantee a high quality of life for both present and future inhabitants. In this research paper, an attempt has been made to examine the environmental vulnerabilities of Aligarh city for the urban sustainability as the intricate connection between the ever-growing global population and the environment is inevitably resulting in negative consequences for the climate, our planet, and societies. The main objective of this paper is to assess the intensity of urban vulnerabilities in Aligarh city with reference to time and space and also to suggest the suitable measures and strategies for urban sustainability. By employing a geospatial approach, the

study utilizes, Land Surface Temperature (LST), Normalized Difference Built-up Index (NDBI), Normalized Difference Vegetation Index (NDVI) and Modified Normalized Difference Water Index (MNDWI) data which is extracted from Landsat imagery of four specific years i.e. 1991, 2001, 2011 and 2021. Further Regression Analysis and scatter diagrams have been used as a tool to show the complex relationship that exists between these variables. It has been observed that there is varying intensity of vulnerability in different nucleus of the city because of various causative factors. Addressing these environmental vulnerabilities requires concerted efforts at the local, national, and global levels. Integrated approaches that prioritize sustainability, resilience, and equity are essential to safeguarding the environment, protecting vulnerable populations, and building a more sustainable future for all.

Keywords: *Sustainability; Vulnerability; Integrated; Resilience.*

…….....

Sustainable Development Through Agro-Based Industries: Assessing the Socio-Economic Impact in Nashik District

Lalit A Kalaskar and Deepak N. Thakre***
*Research Scholar, M.V.P. Samaj's G.M.D. Arts, Commerce and Science College Sinnar, Dist. Nashik Affiliated to Savitribai Phule Pune University.
Email- lalit.kalaskar@gmail.com
**Professor, M.S.G. Arts, Science and Commerce College, Malegaon Nashik. Affiliated to Savitribai Phule Pune University.
Email- dr.dnthakre@gmail.com

This study explores the impact of agro-industrial growth on sustainable rural development in Nashik district, Maharashtra, from a socioeconomic perspective. With the rise of agro-based industries such as food processing, cold storage, and export logistics, Nashik has become a model for rural industrial transformation. Using a mixed-methods approach-comprising field surveys, stakeholder interviews, and spatial mapping-the study assesses the influence of agro-industrialization on employment, income generation, infrastructure, and social equity. Results indicate that regions with concentrated agro-industrial activity, such as Dindori and Pimpalgaon, have experienced significant economic upliftment and improved infrastructure. However, the benefits are unevenly distributed, with tribal regions and marginalized groups facing exclusion due to infrastructural deficits, limited digital access, and weak policy implementation. Environmental sustainability also emerges as a concern, particularly regarding groundwater depletion and soil stress. The study concludes that while agro-industrial growth is a strong driver of rural development, its success depends on inclusive policy frameworks, environmental regulation, and equitable access to resources. These findings offer valuable insights for policymakers and planners aiming to scale agro-industrial models across rural India.

Keywords: *Agro-based Industries; Socio-Economic Impact; Sustainable Rural Development; Nashik District; Inclusive Policy.*

……..

Evaluation of Geomorphosites for Sustainable Geotourism Development in Nashik District, Maharashtra

Dnyaneshwar N. Pawar, Satish Handge** and Swarn Singh****
*Head and Associate Professor, M.V.P. Samaj's KRT Arts, B.H. Commerce and A.M. Science College (KTHM) College, Nashik. Affiliated to Savitribai Phule Pune University.
Email: dmauli2007@gmail.com
**Assistant Professor, M.V.P. Samaj's KRT Arts, B.H. Commerce and A.M. Science College (K.T.H.M.) College, Nashik. Affiliated to Savitribai Phule Pune University.
***Research Scholar, M.V.P. Samaj's KRT Arts, B.H. Commerce and A.M. Science College (K.T.H.M.) College, Nashik. Affiliated to Savitribai Phule Pune University.

Geomorphosites is the study of landforms with ecological, aesthetic, cultural, and scientific significance. It is crucial for sustainable geotourism. In this study attempt has been made to identification, evaluation, and promotion of geomorphosites using geoinformatics tools. The Nashik district of Maharashtra is well-positioned for tourism-driven growth due to its diverse topography and rich cultural legacy. GPS mapping, ASTER DEM, SOI toposheets, satellite data, and field surveys were all integrated in a comprehensive manner. The complex thematic layers were created, including base maps, geology, slope, elevation, aspect and hill shading and sixteen major geomorphosites were discovered in the Nashik district. These sites include unique landforms such as cliffs, caves, waterfalls, mesas, and valleys. Each site was evaluated using quantitative parameters across scientific, aesthetic, ecological, and protection value categories. A seven-digit geocoding system was assigned to each geomorphosite for indexing and ranking purposes. Mangi-Tungi Cliff ranked highest among the identified sites, while Thumb Hill ranked lowest based on cumulative values. In order to visualise, analyse, and choose possible geomorphosites, GIS-based data processing and map creation were essential. For each site, evaluation sheets were created, giving visitors comprehensive site-specific information to improve their visit. The results show that geotourism can play a major role in both landscape preservation and local economic development when backed by scientific mapping and geomorphosite assessment. In order to promote geotourism in the Nashik district, this study emphasises the value of geomorphological diversity and geospatial technology. It promotes integrated tourism and environmental management efforts to preserve and responsibly utilise these natural resources.

Keywords: *Geomorphosites; Geotourism; Evaluation; Scientific Value; Geocoding.*

…….....

TS-10

Socioeconomic Development and Policy Action

A Miracle Journey Towards Vikshit Bharat

Ajin Ray
Professor in Geography
Dept. of Geography, Ewing Christian College, University of Allahabad

The law of the land treats everyone at par and offers equal opportunities to all. But the social economic reality depicts an entirely a different picture in terms of deprivations and sufferings. No doubt the entire society has witnessed agricultural and industrial achievements; enjoying continuous growing of quantitative infrastructure throughout the country. Still we are not able to erase the grey zones and grey tones of the society which acts as a hinderance towards development. Welfare in geography emphasizes questions related to social welfare and equality. Now adays, the concern for social wellbeing of man has found an increasing echo in geography. Today the search for justice, well-being equality in the standard of living still evils such as violence of all types, delinquency and crimes still continue to prevail. Cultural fault lines have given rise to regionalism, terrorism, hinderance in peace. The core issues need a planned effort at all the levels. People must realize the challenges and take 5 resolutions (Panch Pran) defeat the negative forces unitedly with strong cultural bondage. In this paper, an attempt has been made to throw light on the journey towards *Vikshit Bharat*in a lucid style.

Keywords: - *Vikshit Bharat; Hindrances; Welfare; Panch Pran; Cultural Fault Lines.*

…….....

Agricultural Diversification as a pathway to Livelihood Security: A Case Study of Fatehpur District

Mohd Vaish and Mahvish Anjum***
**Research Scholar **Assistant Professor, Department of Geography, University of Allahabad, Uttar Pradesh Prayagraj – 211002*
Email: Vaishmohd769@gmail.com

Agricultural diversification is becoming more widely acknowledged means of enhancing livelihood and food security. Fatehpur is a district in Uttar pradesh agriculture, which has historically been dominated by wheat and rice, has guaranteed the availability of foodgrains but has had difficulty to addressing issues of ecological sustainability, financial stability, and nutrition. By diversifying into pulses, oilseeds, fruits, vegetables, dairy, fisheries, and other related industries, farmers may lower risk, increase farm profits, and boost dietary diversity, all of which will strengthen the bond between agriculture and household well-being. This study is based on the secondary data. Data has been collected from The Agricultural Census, state agricultural department census of India, national sample survey office and NFHS reports. Indexes like the

Simpson Diversity Index (SDI), which account for changes in cropping patterns over time, are used to quantify agricultural diversity. Proxy factors such per capita food availability, dietary diversity, employment structure, and nutritional outcomes are used to evaluate livelihood and food security. Trend analysis, association between diversification indices and livelihood/nutrition metrics, and inter-district comparisons within Uttar Pradesh are examples of analytical methodologies. Findings suggest that diversification is vital not only for nutritional outcomes but also for enhancing resilience against climatic and market risks. However, challenges such as policy bias toward cereals, limited infrastructure, and weak market linkages constrain its potential. The study concludes that greater emphasis on pulses, millets, horticulture, and allied sectors, combined with supportive policies, is essential for sustainable food and livelihood security in Uttar Pradesh.

Keywords: *Agricultural Diversification; Livelihood Security; Risk; nutrition; Dietary diversity*

…….....

Sustainable Ecotourism Suitability Assessment for Community Empowerment Using AHP and Tourist Satisfaction Index in the Eastern Region of Raigad District

Alkunte M. D.[1]*, Ogale S. B.*[2] *and Bodra P. R.*[3]
[1&3]Research Scholar, Prof. Ramkrishna More Arts, Commerce & Science College, Akurdi.
Savitribai Phule Pune University
[2] Assistant Professor Vidya Pratishthan's Arts, Science and Commerce College, Baramati.
Savitribai Phule Pune University
Email: maheshalkunte3@gmail.com

This research assesses the ecotourism potential of the Eastern Region of Raigad District, Maharashtra, through the integration of the Analytic Hierarchy Process (AHP), Tourist Satisfaction Index (TSI), field survey data, and Geographic Information System (GIS) datasets. This study focuced on to determine suitable areas for ecotourism development while evaluating visitor perceptions to promote sustainable tourism planning. The AHP method was applied to assign weights to key criteria such as accessibility, attractions, accommodation, amenities, safety, environmental quality, hospitality, and value for money. Spatial datasets, including land use/land cover, slope, elevation, vegetation, NDVI, Soil depth, texture, drainage and proximity to roads, settlement and cultural or natural attractions, were processed in a GIS environment to create thematic layers. These layers were standardized, weighted according to AHP-derived priorities, and integrated using weighted overlay analysis to produce an ecotourism suitability map, classifying areas into high, moderate, and low potential zones. A field survey gathered tourist ratings on the selected criteria using a five-point Likert scale, and the TSI was calculated by combining mean ratings with AHP weights. Results highlight safety and attractions as the most influential factors affecting visitor satisfaction. The integration of spatial modeling and satisfaction

analysis offers a comprehensive framework for guiding sustainable ecotourism development, ensuring a balance between conservation, community interests, and visitor experiences.

Keywords: *Sustainable Tourism; AHP; GIS; Tourism Satisfaction Index*

……..

Debating Subaltern Geographies and Gender Justice Discourse in Global South

Durdanah Mattoo[1] and Sajad Ahmad Mir©
[1]Govt College for Women, Sopore
© ICSSR (Post-Doctoral Fellow)-Department of Geography, University of Kashmir, India
Email: mirsajad1731@gmail.com

In recent years subaltern imagination has started to percolate in socio-spatial theorisation in Global South with immediate dissection of power-space matrices. The spatial markers that represent the socio-environmental milieu of any place have a direct bearing on the region's adaptability to any environmental risk and stresses. The intersectionalities of power, gender and environment (Sultana, 2014) thus form the foundational praxis for laying down the holistic and eco-humanistic perspective of exploring the spatial and social undercurrents that largely define the current model of structural and institutional functioning in Global South geographies. Gramscia'n spatial historicism would be employed in prospective usage of subaltern geographies for environmental justice paradigms for planetary justice paradigm. The contesting 'spaces' in view of burgeoning socio-environmental risk and over capitalistic and colonising templates of climate change discourse warrant a subaltern approach to politico-ecological problems for marginalised and vulnerable communities. This study would entail at reimagining and reorienting the territorial ontologies in terms of gender and spatial epistemes in light of decolonizing, subalternization of prevailing environmental injustices (Jazeel, 2014). The primary focus would be to decipher the exclusionary indexing of indigenous knowledge systems as being the kernel of contemporary cosmologies of 'decolonizing knowledge'. The study would aim at situating subaltern temporality and spatiality in radical geographical methods in exploring power-space and environment justice paradigms including mapping of climate coloniality, capitalistic and hegemonic domination of socio-environmental risks.

Keywords: *Socio-Spatial; Gender Justice; Subaltern Geographies; Environmental Justice; Climate Coloniality.*

……..

Evaluating Altitudinal Influences on Rural Settlements and Socioeconomic Development in Nashik District, Maharashtra

P.C. Gangurde, D. N. Pawar** and S. B. Handge****
*Assistant Professor, MVP Samaj's S.V.K.T. Arts, Science & Commerce College, Lam Road, Deolali Camp, Nashik, Maharashtra,
Email: pcgangurde88@gmail.com
**Head and Associate ProfessorMVP Samaj's K.R.T. Arts, B.H. Commerce and A.M. Science College, (K.T.H.M.) Gangapur Road, Nashik, Maharashtra,
Email: dmauli2007@gmail.com
**Assistant Professor,MVP Samaj's K.R.T. Arts, B.H. Commerce and A.M. Science College, (K.T.H.M.) Gangapur Road, Nashik, Maharashtra,
Email: shandge41@gmail.com

This study has attempted to examine rural settlements' spatial distribution, growth and socioeconomic landscape in relation to altitudinal variation in Nashik District, Maharashtra. Nashik district comprises 15530 sq km area of Maharashtra. It is surrounded by the Deccan Plateau and Western Ghats, which have notable height gradients from less than 438 m to more than 1567m. This study aims to evaluate how altitude influences rural settlement patterns, size, and subsequently, the socioeconomic growth of the area. The secondary data sources were Google Earth and the District Census Handbook (2011). Regression analysis, Pearson's correlation, and the Student's t-test were used as statistical techniques to assess the connections between rural settlement and altitude zones. The spatial mapping has been performed using GIS software. The results show that the concentration of rural settlements and lower altitude zones has a substantial positive link (r = 0.999) in the study area. The physical and infrastructure factors, viz, rich soil, moderate rainfall and road connection, resulted in 97% of rural villages being between 300 and 900 m in elevation. The rough topography, thick forest cover, and limited agricultural potential of regions above 900 m. show little or no habitation. These areas are commonly associated with Tribal communities and scattered settlement patterns affected by relief, accessibility and economic potential. The study highlights the relationship between altitude and significant socioeconomic growth indicators, including population size, settlement type, and service accessibility, as well as how altitude influences regional distribution. Considering altitude, the results emphasise the need for planning and development plans in rural areas. To promote inclusive and balanced regional development, strategic interventions in high-altitude regions must consider societal vulnerability and infrastructure limitations while utilising the growth potential of mid-altitude zones.

Keywords: *Altitude; Rural Settlements; Spatial Distribution; Socioeconomic Development; Policies*

……

Evaluating the Impact of the Jal Shelli Model on Socio-Economic Development in the Drought-Prone Bundelkhand Region

[1]Mukta Raje,[1]Reshma Singh and [2]Brijmohan Singh Yadav
[1]V.B.S.P. University Jaunpur U.P.
[2]Lucknow University, Lucknow U.P.
Email: Brij15692@gmail.com

The Jal Saheli model was initiated in drought prone areas Jalaun tahsil of Bundelkhand region by Parmarth Samaj Sevi Sansthan in 2005 with a small group of women now expands in 200 villages across the region. The programme has emerged as a gender and community based transformative initiative to address water scarcity in the drought-prone Bundelkhand region. This paper will evaluate the model's impact on women's empowerment, socio-economic development and policy action in the region. How indicators of socio-economic development such as employment generating resources, women leadership in water conservation, migration, and agricultural productivity changed gradually. The model's significance in democratic decentralization in environmental crisis, social vulnerability and resilience building in area by sustainable development. The paper will highlight the potential of self-sufficient command areas with global priorities like SDG 4 gender equality and SDG 6 clean water and sanitation with local targets like improving caste relation, reducing climatic born conflict, restore local water bodies, improve food security and nutrition level in child and women with locally availability and community management.

Keywords: *Socio-Economic Development; Policy Action; Resilience Building; Environmental Crisis.*

……..

Annual Variation in Flood Extent and Its Implications for Socio-Economic Resilience: A Case Study of Bhagalpur District, Bihar

Ashish Ranjan[1] and Md. Nazim[2]
[1]Department of Geography, Patna University, Patna
Email: ashishran999@gmail.com
[2]Department of Geography, Patna University, Patna
Email: dr.nazim2011@gmail.com

As the global climate changes, the frequency, intensity, and severity of extreme weather events are increasing. Rising temperatures are altering weather patterns, leading to more frequent droughts and floods. The changing spatial distribution (e.g., urban flooding) and nature (e.g., flash floods) of floods are causing catastrophic impacts on human society and existing infrastructure. These events not only hinder current development aspirations but also erode progress already achieved.

The present study aims to map the annual changes in flood extent within the study area using remote sensing data. Flood extent data were derived from Sentinel-1 Synthetic Aperture Radar (SAR) imagery for the years 2018–2025. For each year, imagery from June 1 to August 10 was used, and a threshold value of 11.75 (derived from histogram analysis) was applied to delineate flood-affected areas. Data processing was conducted in Google Earth Engine, and spatial visualization was carried out in ArcGIS Pro. The analysis reveals significant interannual variation in flood extent. In 2022, the flooded area was 114 km², while in 2025 it peaked at 1,161 km², covering over 40% of the district. The 2025 flood inundated almost the entire southern part of the district, sparing only a small portion in the north. The increasing flood extent in the district is severely impacting socio-economic conditions and damaging existing infrastructure. Such destruction not only deteriorates social well-being but also undermines efforts to achieve the Sustainable Development Goals.

Keywords: *Extreme Weather Events; Flood Mapping; Geospatial Techniques; Climate Change*

……..

To Evaluate the Channel Planform Dynamics of River Jhelum from Sangam to Asham, Kashmir Valley Jammu and Kashmir, India

*Hakim Farooq Ahmad** *and Bashiqa Farooq**
* Department of Geography and Disaster Management, University of Kashmir
Email:hakimfarooq.geo@gmail.com

The alteration of the River Jhelum's course in recent years, particularly in areas characterized by lithological susceptibility, underscores the intricate geomorphic dynamics influenced by geological conditions. The river's tendency to shift its path can be attributed to varying lithological strengths, where areas with geological vulnerabilities experience heightened erosion and channel adjustments. The channel planform dynamics of the River Jhelum during 1992, 2001, and 2015, carries substantial significance. The temporal analysis across these periods provides insights into the river's evolution and allows for trend identification. The spatial deviation assessment, measuring changes, quantifies how the river has shifted, offering valuable information about geomorphic characteristics. The present study amply indicates that the Jhleum basin has undergone changes over the 30 years between 1972 and 2015 and that its equilibrium is being disturbed continuously. The comprehensive temporal analysis of River Jhelum's planform and the sinuosity coefficients across different segments provide valuable insights into the dynamic nature of the river system. The observed deviations from the base map, analyzed from 1972 to 2015, reveal both stable and fluctuating patterns in various locations, indicating the river's adaptability to changing conditions. The sinuosity analysis further unveils spatial variations in meandering behavior along different segments, showcasing the intricate geomorphic dynamics. The analysis of floodplain distances along the river between 2001 and 2015 reveals a consistent trend of decreasing values for both the right and left sides. This suggests a notable shift in the river's course or floodplain dynamics during this period. The results from the study will be a step forward in framing policy and plans to reducing the flood risk in the valley.

Keywords: *River Jhelum; Planform; Lithology; Sinuosity; Flood Risk*

……

Impact of IOD and NAO Ocean-Atmospheric Oscillations on the Precipitation in Upper Indus Basin

Taha Shamim[1], Shafat Aarif Peer[1], Shabeena Mapnoo[1], Athar Yousuf Rather[1], Akhtar Alam[1] and M. Sultan Bhat[1]

[1]Department of Geography & Disaster Management, University of Kashmir, Srinagar, J&K, India

Email: tahashamim11@gmail.com

Ocean-atmospheric oscillations serve as critical drivers of regional precipitation patterns and drought evolution across global river basins. This study examines the influence of the Indian Ocean Dipole (IOD) and North Atlantic Oscillation (NAO) on precipitation variability and drought scenarios in the Upper Indus Basin (UIB) over the period 1980–2020. Using meteorological data from sixteen stations across Jammu, Kashmir, and Ladakh regions, we employed the Standardized Precipitation Index (SPI) and Pearson's correlation analysis to quantify seasonal relationships between these teleconnections and local precipitation patterns. The results reveal that IOD demonstrates a significant positive correlation with autumn precipitation across the UIB, averaging 0.30 (significant at 0.05 level), with correlations ranging from 0.16 in Kargil to 0.37 in Pahalgam. This strong autumn relationship coincides with IOD's peak intensity during September-November, confirming its crucial role in controlling autumnal rainfall patterns. Conversely, IOD exhibits a weak negative correlation with spring precipitation, particularly in Kashmir and Ladakh regions (-0.12 to -0.32), suggesting potential drought-inducing effects during this critical season when snowpack replenishment occurs. NAO shows modest positive but statistically insignificant correlations with spring and summer precipitation (0.13 for UIB), primarily through its association with western disturbances that provide substantial rainfall to the region. NAO's influence is minimal during autumn and winter, with slightly negative correlations in Ladakh reflecting reduced western disturbance penetration at higher altitudes. Long-term analysis (1901-2023) of the Srinagar station in the UIB demonstrates persistent IOD-autumn precipitation relationships, while NAO correlations have strengthened in recent decades, potentially linked to increased ocean heat content due to global warming. Understanding these teleconnection patterns is essential for improving seasonal precipitation forecasting and drought early warning systems in this water-critical Himalayan region.

***Keywords**: Ocean-atmospheric oscillations; Upper Indus Basin; Standardized Precipitation Index (SPI); Pearson's correlation; Drought.*

……

Geographical Assessment of Meteorological Drought and Flash floods in North-Western Himalayas: A Case Study of Jammu Division (J&K)

Gaggan Kumar
Assistant professor, University of Kashmir, Hazratbal, Srinagar

This research offers a systematic and spatially explicit assessment of meteorological droughts and flash floods, the two pressing climatic extremes across Jammu division in the North-Western Himalayan region. Utilizing a 32-year dataset (1987-2019), the research employs the Standard Precipitation Index (SPI) for drought analysis across 3, 6, and 12-month timeframes, and the Fuzzy Analytical Hierarchy Process (AHP) model for flash flood susceptibility. The analysis reveals significant spatial and temporal variations in extreme weather events across the region. Results indicate that southeastern areas, particularly around Billawar station, experience the highest frequency of extreme drought conditions, while southern and central regions show greater flash flood susceptibility. The study identifies rainfall, drainage density, distance from streams, and geology as the most influential factors in flood occurrence. These findings underscore the urgent need for robust climate adaptation strategies and comprehensive risk management approaches to protect agricultural sustainability and community livelihoods in the region.

Keywords: *Climatic extremes; meteorological drought; flood susceptibility; Standard Precipitation Index; Fuzzy-AHP; Jammu division.*

…….....

Copula-Based Joint Return Periods of Extreme Rainfall Events and Implications for Flood Risk in the Vishow Catchment, Kashmir Valley

[1]Tahir Ahmad Wani, [1]Akhtar Alam and [2]Md Tamseeel Ansari*
[1*]Department of Geography and Disaster Management, University of Kashmir
[2] Indian Institute of Technology, Kharagpur
[*]Corresponding Author: tahirwani77@gmail.com

"Climate change is real and its happening". During past few years the frequency and magnitude of extreme rainfall events is increasing, heightening the risk of hydrological hazards such as floods in vulnerable mountainous catchments. The study focuses on the Vishow catchment (1016 km²), a glacio-nival tributary of the Jhelum basin in Kashmir Himalayas. We analyse rainfall data of GPM IMERG v07 together with IMD gauge observations for 1998–2024. Two approaches, quantile mapping and the Machine-learning algorithm XGBoost, were employed for bias correction. The results indicate that XGBoost outperforms quantile mapping, higher accuracy with an improved coefficient of determination (R^2). The bias corrected dataset was then used to compute Expert Team (ET) on Climate Change Detection and Indices (ETCCDI) extreme rainfall indices,

which capture the intensity, persistence, and frequency of heavy rainfall events. Subsequently, copula-based statistical modelling was applied to evaluate the dependence structure between these indices and to estimate joint return periods (JRP) relevant to extreme rainfall events. The results demonstrate that compound rainfall extremes recur more frequently than suggested by marginal distributions alone. For instance, a 10-year marginal rainfall extreme corresponds to a 7-year of joint return period when coupled with rainfall duration, highlighting the elevated susceptibility of the catchment to floods. These findings underscore the limitations of univariate approaches in flood risk assessment and stress the necessity of incorporating joint probability frameworks for more realistic hazard estimation. The study contributes to an improved understanding of compound rainfall extremes in Himalayan catchments and provides valuable insights for disaster risk reduction, water resource management, and climate-resilient planning in the Vishow catchment.

Keywords: *Copula IDF; Compound Rainfall Extremes, Hazard, Climate Change, Joint Return Periods, Disaster Risk Reduction*

……..

Thermal Stress across the Indus-Ganges-Brahmaputra Basins: UTCI-Based Trends Analysis

Zeba Khannam[1]

[1]**Centre for the Study of Regional Development**, **Jawaharlal Nehru University**, New Delhi, India

Email: zohaqureshi001@gmail.com

Thermal stress, driven by rising temperatures and humidity, poses increasing risks to human health and well-being—particularly in densely populated and climatically sensitive regions of Himalayas. The Universal Thermal Climate Index (UTCI) offers a comprehensive measure of outdoor thermal stress by integrating meteorological variables such as air temperature, wind speed, humidity, and radiation. Therefore, this study investigates the spatiotemporal trends of the Universal Thermal Climate Index (UTCI) across the Indus, Ganges, and Brahmaputra (IGB) basins from 2000 to 2024. Using ERA5-HEAT reanalysis data, we analysed monthly, seasonal, and annual UTCI variations and trends employing the Sen's slope estimator and Mann-Kendall significance test. The results reveal a statistically significant warming trend over the IGB region, with distinct seasonal patterns and spatial heterogeneity. Notably, higher (+1.00 to +2.00°C/decade) UTCI trends are observed in Ganges basin indicating stronger warming (MK $p < 0.05$) signals in densely populated areas (390 persons/km²) of Ganges basin. We also assessed UTCI category exceedances, highlighting increased heat stress conditions in between 2000 to 2024 Furthermore, elevation-based UTCI regression analysis across IGB basins showed a significant negative correlation (R^2 =0.94), with the Ganges basin lowlands exhibiting the highest thermal stress. This underscores increased vulnerability in densely populated and low-elevation regions; especially, during

monsoon (R^2 =0.94) and pre-monsoon seasons (R^2 =0.92). A distinct spatial heterogeneity is evident, with UTCI values progressively increasing from north-eastern Himalayan regionstoward the south-western alluvial zones, indicating directional escalation of thermal stress across the IGB basin.

Keywords: *UTCI; IGB Basins; Heat Stress Trends; Climate change*

…….....

Quantifying Hydrological Alteration and Environmental Flow Ranges Using a PCA–RVA Framework in the Upper Jhelum Basin

Sumaira Javaid[1], Mohd Wasit Manhas[1], Owais Nazir[1], Ilyas Hussain[1], Akthar Alam[1] and Pervez Ahmed[1]*

[1]Department of Geography and Disaster Management, University of Kashmir, J&K, 190006

Email: *sumairajavid1234*@gmail.com

Rivers play a significant role in maintaining ecological vitality but anthropogenic pressures combined with climate change increasingly threaten their ecological integrity. This study quantified hydrological alterations in the Upper Jhelum River using the Indicators of Hydrologic Alteration (IHA), Range of Variability Approach (RVA) and Principal Component Analysis (PCA). Hydrological data from three gauging stations- Sangam, Munshibagh and Asham was assessed over pre-impact (1971–1999) and post-impact (2000–2023) periods. Results indicated high degrees- 72%, 77% and 76% of overall hydrological alteration for Sangam, Munshibagh and Asham respectively, implying significant ecological risks. PCA identified seven Ecologically Relevant Hydrological Indicators (ERHIs), essential for managing river health. The derived ERHI's were evaluated for hydrological shifts. Hydrological change of 76.50%, 78.57% and 79.86% was reflected in EHRI's at Sangam, Munshibagh and Asham, indicating high alteration. These EHRI's were further used to determine suitable Environmental Flow (EF) targets. The recommended EFs are practical guidelines to restore natural flow variability in the river. Thus, providing a scientific foundation for adaptive water resource management and ecological conservation in the Himalayan River System.

Keywords: *Hydrological Alteration; Environmental Flow; Ecologically Relevant Hydrological Indicators; Jhelum River Basin.*

…….....

Physical Risk Assessment of a Potential Glacial Lake Outburst Flood (GLOF) in Kakti Lake, Chenab Basin using HEC-RAS

Mohd Wasit Manhas[1], Pervez Ahmed[1] and Sunil Dhar[2]*
[1]Department of Geography and Disaster Management, University of Kashmir, J &K, 190001
[2]Department of Environmental Sciences, Central University of Jammu, J &K, 181143
Email: mohdwasitmanhas@gmail.com

Glacial Lake Outburst Floods (GLOFs) are highly catastrophic events with devastating consequences for life, infrastructure and property. Due to the ongoing impacts of climate change, GLOFs have emerged as a foremost concern across high mountain regions. Moreover, the threat posed by a potential GLOF event could be significantly amplified by compounding climatic and geomorphic factors particularly cloudbursts and landslides, which are becoming increasingly frequent in the Western Himalayas. This study focuses on assessing the physical risk associated with Kakti lake, a moderately dangerous proglacial lake located in the Chenab Basin, Western Himalayas. Kakti Lake is is a high-mountain lake fed by meltwater from two glaciers (RGI v7.0: IDs 858502, 858685; RGI Consortium, 2023). Analysis of satellite imagery from 1990 to 2024 reveals a significant expansion of Kakti Lake. Its surface area has increased by 192% from 15,926 m^2 to 46,513 m^2, while its volume has surged from 96,388 m^3 to 441,559 m^3. Results reveal flood average depths up to 7.2 m and depth-averaged velocities up to 8.2 m s^{-1} within the proximal reach. The flood discharge could inundate an area of 8.9 km^2 extending upto 70 km downstream. The inundation poses a significant threat to critical infrastructure and human life, affecting approximately 100 buildings including both residential and commercial buildings. The findings of this study highlight the significant threat posed by a potential GLOF event and emphasize the urgent need for comprehensive monitoring, early warning systems and effective mitigation strategies in the region.

Keywords: *Kakti Lake; Chenab Basin; Glacial Lake Outburst Flood; Breach Modelling; Physical Risk Assessment.*

……

Glacial and Lithological Controls on River Chemistry in the Semi-Arid Chandra Basin, Western Himalaya

*Ruturaj Vilas Daphale[1], Parmanand Sharma[1], Sandeep Kumar Mondal[1], Pramod Kumar[1], Karthik CB[1], Raghavendra C. Talawar[1], Litan Mohanty[1], Ashutosh Kulkarni[1], Bhanu Pratap[1], and Meloth Thamban[1]

[1]Himalayan Cryosphere Studies, National Centre for Polar and Ocean Research (NCPOR), Ministry of Earth Sciences (MoES), Vasco-Da-Gama, Goa 403804, India

Corresponding author- *ruturaj@ncpor.res.in

The Himalayan River systems, serving as critical freshwater reservoirs for over 750 million people across South Asia, exhibit hydrochemical signatures predominantly governed by water-rock interactions and glacial contributions. Dissolved ionic species constitute a major portion of the total riverine solute load in western Himalayan catchments, with bicarbonate (HCO_3^-) accounting for the highest of total ions. This alkalinity budget, primarily derived from carbonic acid weathering of silicate and carbonate lithologies, serves as a critical regulator of regional carbon cycling by sequestering atmospheric CO_2 through coupled carbonate-silicate weathering reactions. The Chandra Basin, situated within the orographic rain shadow of the western Himalaya, serves as a critical endmember for studying hydrological resilience in moisture-deficient alpine systems. This basin provides an ideal natural laboratory to decouple hydrological drivers and quantify geochemical weathering. The Chandra River was systematically sampled across 16 altitudinal transects during peak melt phases to resolve spatial hydrochemical and weathering dynamics in this semi-arid Himalayan system. This two-season sampling reveals altitudinal chemostatic breaks where geochemical signatures shift abruptly. Results show that River pH varied from 6.6 near the river mouth to 7.9 at higher elevations. Dissolved ion concentrations generally increased downstream, with major peaks observed where glacier streams join the main channel. Among these, the Bara Shigri Glacier contributes a comparatively higher dissolved load. Seasonal contrasts indicate that, except for K^+, Cl^-, and HCO_3^-, most ions exhibited significantly higher concentrations during the low-melt season, when reduced discharge allows for longer water–rock interaction. The Chandra Basin's hydrochemical regime emerges as a complex interplay between cryospheric dynamics and bedrock weathering processes, with cascading effects on regional carbon cycling and water security.

Keywords- *Chandra River; Major Ions; Meltwater.*

……

Climate Risks in High-Density Apple Systems: A Systematic Review Using the SALSA Framework

Shafqat Maqbool[1], Mohammad Shafi Bhat[2] and Qurat[1]
[1]PhD Research Scholar, Department of Geography and Disaster Management, University of Kashmir, Srinagar, India
[2]Associate Professor, Department of Geography and Disaster Management, University of Kashmir, Srinagar, India
Corresponding author: shafqatbhat88@gmail.com

High-Density Apple Plantations (HDP) are transforming global apple production by enhancing productivity, efficiency, and fruit quality. Yet, their structural uniformity and physiological dependence on dwarfing rootstocks render them acutely sensitive to climatic variability. This review synthesizes findings from 21 peer-reviewed studies using the SALSA framework to assess climatic constraints confronting HDP across major apple-growing regions.

The evidence reveals a multifaceted vulnerability. Spring frost risk, intensified by earlier bud break and bloom advancement of 4–18 days under warming trends, has increased crop exposure to late cold spells, with documented yield losses ranging from 20%. Phenological uniformity in HDP amplifies these risks, often translating into block-wide crop failure. Conversely, heat accumulation during fruit development demonstrates a duality: insufficient growing degree days reduce fruit size by 26–30%, while excessive ripening heat and warm nights suppress colour formation, compromise firmness, and alter sugar–acid balance. Regional projections suggest that suitable areas for premium 'Fuji' apple production in South Korea could shrink from 60% to less than 3% by 2100. Moisture extremes further constrain HDP systems. Drought reduces yields in rainfed orchards by 30–40%, while erratic rainfall leads to nutrient imbalances, fruit cracking, and root hypoxia. Similarly, untimely snowfall events—occurring before complete dormancy—have inflicted catastrophic structural damage, with losses exceeding USD 300 million in certain seasons. These climatic stresses are increasingly linked to shifts in pest and disease dynamics, with higher incidences of fire blight, scab, and codling moth pressure under warmer and wetter conditions. The synthesis underscores that while HDP represents a paradigm shift in modern horticulture, its climatic fragility poses serious sustainability challenges. Future resilience will require integrating adaptive management, region-specific forecasting, and cultivar diversification to buffer against the escalating risks of climate variability.

Keywords: *HDP; Climatic Variability; Spring Frost Risk; Heat Stress; SALSA Framework.*

……..

Response of Sediment Yield and Runoff to Climatic Variations in Pohru Watershed of Kashmir Himalayas.

Mohammad Imran Malik[1] Abaas Ahmad Mir[2], Pervez Ahmed[3] and M. Sultan Bhat[3]
[1] Assistant Professor- GDC Sogam
[2]Lecturer on AA-GDC Sogam
[3]Professor, Deptt. of Geography & Disaster Management, University of Kashmir.
Email: geoabaas@gmail.com

The impacts of climate change on hydrological regime and water resource distribution is a major concern in environmentally vulnerable areas, such as the Pohru watershed, where change in precipitation changes the overall scenario of the eco-system. Based on a geographical information system (GIS), and using gauged hydrological data from 2010 to 2020, soil maps and digital land-use of 2010 and 2020, AvSWAT model (Soil and Water Assessment Tool) model was applied to the Pohru Watershed. The relative error, coefficient of determination, and Nash-Sutcliffe coefficient were used to analyze the accuracy of runoffs and sediment yields simulated by the model. Runoff and sediment yield variations were analyzed under different precipitation scenarios. The increase in runoff and sediment with increased precipitation were greater than their decrease with reduced precipitation. The runoff was more sensitive to the variations of precipitation than the sediment yield. The coefficients of variation (CVs) of the runoff and sediment yield increased with increasing precipitation, and the CV of the sediment yield was more sensitive to small rainfall. The annual runoff and sediment yield fluctuated greatly, and their variation ranges and CVs were large when precipitation increased by 20%. The results shall provide local decision makers with scientific references for water resource utilization and soil water conservation.

Keywords: *SWAT Model; Precipitation; Runoff; Sediment Yield; Simulation.*

……..

Cloudbursts in the North Western Himalayas: Unravelling Geomorphological, Meteorological & Climatological Dynamics

Umar Shafi Mantoo[1] and Akhtar Alam[1]
[1]Department of Geography & Disaster Management, University of Kashmir,
Srinagar-190006, J&K, India
Email: vickeyshafi@gmail.com

Cloudbursts—intense, short-lived precipitation events often exceeding 100 mm of rainfall in under an hour over restricted spatial domains—represent one of the most perilous hazards in the North Western Himalayas. Their occurrence is conditioned by a convergence of geomorphological fragility, dynamic meteorological triggers, and evolving climatological influences, resulting in catastrophic impacts that span from rapid slope failures to large-scale flooding. From a

geomorphological standpoint, the region's steep, dissected slopes, tectonically active terrain, and confined valleys facilitate accelerated runoff, debris mobilization, and deep-seated landslides. Meteorologically, cloudbursts are primarily driven by orographic lifting of moisture-laden monsoonal flows, enhanced by localized wind convergence and sustained cumulonimbus development. These convective systems are further modulated by mesoscale dynamics and synoptic-scale shifts such as monsoon trough migration and subtropical ridge variations. Climatologically, medium-elevation belts exhibit heightened susceptibility due to optimal thermal and moisture conditions, with emerging trends suggesting an increase in frequency and intensity, influenced by climate change, amplified atmospheric moisture content, and anthropogenic land-use alterations including deforestation and unplanned urban growth. This paper synthesizes multidisciplinary insights to elucidate the coupled processes governing cloudburst genesis and their cascading geomorphic and hydrological consequences. The study underscores the urgent need for integrated monitoring frameworks incorporating high-resolution meteorological modelling, remote sensing, and early warning mechanisms. Such efforts, coupled with sustainable land-use strategies, are critical to mitigating escalating disaster risks and enhancing resilience across vulnerable Himalayan communities confronting a changing climatic regime.

Keywords: *Cloudbursts; North Western Himalaya; Orographic rainfall; Extreme precipitation; Disaster risk reduction.*

……..

Resilience of Critical Infrastructure to Extreme Weather Events in Srinagar City

Sabreena Farooq and Akhtar Alam
Department of Geography and Disaster Management, University of Kashmir
Email: sabreenashah0@gamil.com

With changing climate, the need for building the resilience of cities remains a priority. Cities depend on interconnected systems to sustain their functioning and any disruption can cascade across sectors. Critical infrastructure including power, healthcare, transport, and communication, forms the backbone of any city. Thus, understanding how city's critical infrastructure will adapt to, transform, and withstand shocks from extreme weather events is imperative for Disaster Risk Reduction (DRR). This study aims to assess the resilience of critical infrastructure to climate-driven extreme weather, including high temperatures, intense rainfall, prolonged cold spells, and windstorms, which are becoming more frequent owing to climate change. Moreover, the study demonstrates to what level facilities are able to maintain operations during extreme weather conditions and how disruption in one sector amplifies vulnerabilities in others, causing cascading failure, ultimately threatening community safety and economic stability. The assessment was done through a mixed-method design, combining quantitative and qualitative assessment approach. The framework was supported by primary surveys, evaluating capacities, preparedness, and system dependencies. The approach adopted here produced an integrated resilience profile of the city

under climate stress. This research provides valuable insights for policymakers, urban planners, and emergency managers to developed targeted strategies for strengthening critical infrastructure of the city.

Keywords: *Critical infrastructure; Resilience; Extreme Weather; Srinagar; DRR.*

……..

WEAP Model Study of Urban–Rural Water Demand and Supply in Srinagar and Ganderbal districts

Mir Rohi Neelofar[1], Sami Ullah Bhat[1] and Mohammad Muslim[1]*
[1]Department of Environmental Science, School of Earth and Environmental Sciences, University of Kashmir, Srinagar-190006, Jammu &Kashmir, India
Email: roi.mir94@gmail.com

Water is a finite resource and is unevenly distributed across the globe. The increase in human population coupled with accelerated economic activities and climate change have collectively intensified enormous pressure on government and policymakers to find innovative ways for bridging the demand-supply gap in the water sector. The Kashmir Valley hosts diverse water resources that serve agricultural, horticultural, domestic, and industrial needs, highlighting the necessity for efficient and judicious water resource management. This study aims to project water demand and supply using the Water Evaluation and Planning System (WEAP) model. Baseline analysis for 2015–2020 indicates a declining trend in mean annual river discharge across both districts. The total groundwater supply was estimated to be 1.665 MGD and 4.067 MGD in Ganderbal and Srinagar respectively whereas the supply from Municipal Water Treatment Plants (WTPs) totalled to 7.55 MGD and 76.92 MGD in Ganderbal and Srinagar respectively. A total unmet demand of 3.94 million cubic metres (MCM) from WTPs (2015-2020) in Ganderbal's domestic demand site was reported which was sufficed by groundwater. Paddy utilises water only for 4 months from May to August in a year and the supply for paddy is surplus enough, leaving no unmet demand in both the districts. A high density apple (HDA) tree utilises water only for 5 months from May to September in a year. There is an unmet demand of 0.035 MCM for HDA plantation in Ganderbal but Srinagar is fully sufficed. Industrial demand was fully sufficed in both the districts. For livestock, there was an unmet demand of 11.21 MCM in Ganderbal only. Overall, findings reveal rising unmet demands alongside diminishing supply. These insights underscore the urgency for sustainable water management in the Kashmir Valley, recommending near-optimal groundwater extraction, expansion of WTP capacities, and/or establishment of new plants to address future water deficits effectively.

Keywords: *Demand; Supply; WEAP; Water; Kashmir.*

……..

Glacier–Lake Interactions and Climate Impacts on Potentially Dangerous Glacial Lakes in the Shyok Catchment of the Upper Indus Basin

Abid Farooq Rather[1], Rayees Ahmed[2], Pervez Ahmed[1], Taha Shamim[1], Tahir Ahmad Wani[1], Abrar Farooq[1] and Syed Hameem[1]

[1]Department of Geography and Disaster Management, School of Earth and Environmental Sciences, University of Kashmir, Srinagar, 190 006, India

Email: aabidafr@gmail.com

[2]IISC Bangalore

The continued retreat of glaciers in the Himalayan region has led to a noticeable rise in the formation and enlargement of glacial lakes sustained by meltwater. While these lakes naturally form part of the hydrological system, their rapid expansion—often occurring at the expense of their source glaciers—poses a growing threat to downstream communities in the form of Glacial Lake Outburst Floods (GLOFs). Under a warming climate, many of these high-altitude lakes have become increasingly unstable, making it crucial to examine their dynamics and associated risks. This study focuses on understanding glacier–lake interactions in the context of climate change. Specifically, we studied the behaviour of potentially dangerous glacial lakes (PDGLs) and their feeding glaciers over the last three decades (1992–2022). Sixteen PDGLs identified in our previous research were analyzed to evaluate their spatial and temporal evolution in relation to climatic variables such as temperature and precipitation. The results indicate an overall increase of 49.6% in glacial lake area, accompanied by a glacier area loss of 3.27% and an average glacier terminus retreat of 171 m. Furthermore, the average glacier mass balance over this period was approximately –0.22 m w.e. yr^{-1}, reflecting continuous mass loss. A statistically significant increasing trend was observed in minimum temperature (Tmin), while annual precipitation (Pcp) exhibited a modest decrease. Correlation analysis suggests that glacial lake area is positively associated with both Tmin and maximum temperature (Tmax), and negatively correlated with precipitation. Conversely, glacier area showed a strong negative correlation with glacial lake area, Tmin, and Tmax, but a positive relationship with annual precipitation. These findings highlight that glacial lakes in the Himalayan region are expanding primarily due to glacier retreat driven by rising temperatures. This ongoing transformation underlines the urgent need for sustained monitoring and improved risk management to mitigate the growing threat of GLOFs.

Keywords: *Glacial Lake; Pdgls; Climate Variability; Shyok Catchment; Upper Indus Basin.*

……

Aeolian Landforms in Arid Environments: Insights from Leh, Ladakh

Shahid Manzoor
Department of Geography and Disaster Management, University of Kashmir, Srinagar-190006
Email: 1319shahid@gmail.com

Ladakh's unique geo-climatic conditions, characterized by extreme temperatures, low precipitation, and high wind velocities, create an ideal setting for Aeolian processes and simultaneously the role of wind in shaping its landscape has received comparatively less attention. Using a combination of climate and drainage related data, data related to soils produced from MSW shape-file issued by UNESCO and other relevant data taken from annual administration records, files and documents as well as primarily by direct observation and visualization in the field, the study investigates the presence, characteristics, and formation of Aeolian landforms in the high-altitude desert environment of district Leh, Ladakh. the study focuses on sand dunes and ventified eroded rocks in Hunder, Hoodoos or fair chimneys near Shey village, sand sheet development near Turtok. The study also explores the geomorphic processes responsible for the formation and evolution of these landforms considering the factors such as sediment availability, wind regimes, and local topography. The results obtained from this study provide new insights into the active geomorphology of the Ladakh region and highlight the significant, yet often overlooked role of wind in shaping its landscape. Moreover, the study highlights the importance of preserving and protecting the unique natural features of Ladakh. As climate change and human activities continue to impact the region, it is crucial to recognize and appreciate the value of these features and to take action to ensure their long-term preservation.

Keywords: *Aeolian Landforms; Ladakh Himalaya; Sediment Availability, Wind Regime.*

……..

Concentration of Trace Element Iodine and prevalence of Thyroid in Mountain Ecosystem of North Kashmir Himalayas

G. M. Rather
Department of Geography and Disaster Management,
University of Kashmir, Srinagar, India -190006
Email: gmrather1963@rediffmail.com

The present research work was an attempt to analyze the concentration of Trace element Iodine in soils and prevalence of thyroid in the mountain ecosystem of North Kashmir Himalayas. The study reveals that the soils of the study area have average concentration of iodine as 1.570mg/Kg with a considerable negative mean deviation of -0.030 mg/Kg from control samples. Average concentration of Iodine also shows negative deviations in all altitudinal zones with declining trend

with altitude. Majority of sample households (70 %) relay mostly on locally cultivated food items and 10.30 % of population was using non iodized salt. Near about 27.25 % of the population in sample villages suffers from thyroid that is an iodine deficiency disease. Some remedial measures were suggested to minimize the incidence of thyroid in this mountainous area.

Keywords: *Trace Elements; Thyroid; Control Sample; North Kashmir Himalayas.*

……..

People's Perception of Flood Risk: Implications for Disaster Risk Reduction in Srinagar, India

Majid Hassan and Akhtar Alam
Department of geography and disaster management, University of Kashmir
Email: Majidhassan0401@gmail.com

Floods pose a significant threat to human life, property, and the environment by destabilizing social structure, impeding economic growth, disturbing ecological balance, and causing widespread damage. The Kashmir valley has experienced frequent flooding since antiquity, with the 2014 flood event being the most severe in the past century. Understanding people's risk perception is essential for effective disaster management, as the Sendai Framework for Action 2015 emphasizes. The present study attempts to analyse the perceptions of flood risk and its possible mitigation measures through a field survey using structured and semi-structured questionnaires with a sample size of 226 respondents, especially those living along the rural-urban fringe of Srinagar City. Findings reveal that about 95% respondents have experienced flooding, 77% consider their area vulnerable, and 89% anticipate significant losses in terms of lives and property. Around 73% respondents expressed dissatisfaction with the existing flood control measures, particularly with the effectiveness of the Jhelum flood spill channel in combating floods. Respondents identified heavy rainfall, upstream deforestation, lack of proper mitigation measures, encroachment of water bodies, unregulated construction in floodplains, and inadequate infrastructure as the key triggering factors for flooding in this region. While the concern about future floods was high, the level of preparedness ranged from low to moderate. Commonly suggested mitigation strategies include drainage-channel improvements, afforestation, efficient early warning systems, and flood risk awareness. Responses varied significantly concerning respondents' age, gender, education, and occupation. Overall, the study reveals a notable gap between the perceived flood risk and preparedness at the community level, highlighting the need for incorporating local knowledge and community-based perceptions into the planning process for effective DRR in the Kashmir valley.

Keywords*: Flood Risk; Perception; Risk Mitigation; DRR.*

……..

Evaluation of disaster preparedness in School Education in Pulwama District, JK, India

Shakira Gani[1], Dr. Shanawaz Ahmad Baba[2] and Atiqullah Malik[2]
[1]Student, Department of Geography & Disaster Management, University of Kashmir
[2]Assistant Professor (Contractual), Department of Geography & Disaster Management, University of Kashmir
Email: janshakera@gmail.com

Natural disasters can cause significant damage to educational institutions, resulting in school closures, building destruction, loss of educational resources, and displacement of both students and teachers. Given that primary and middle school children are particularly vulnerable during disasters, it is crucial to identify potential hazards, vulnerabilities, and the capacity of schools to withstand and recover from various disasters. Both private and government schools should develop comprehensive disaster preparedness plans. The Present study is based on primary data that was collected through a structured field survey conducted across eight zones of Pulwama district: Pulwama, Tahab, Kakapora, Shadimargh, Awantipora, Pampore, Tral, and Lurgam in 2025. The study utilized a stratified random sampling technique to ensure a representative sample of educational institutions from the district. Currently, only 10% of private schools and 28% of government schools have such plans in place. Schools must create, implement, and regularly review disaster preparedness plans, including evacuation routes, emergency contact information, and drills.

Keys Words: *Hazards; Disaster Preparedness; School Education; Disaster Preparedness Plan*

……

Flood Damage Assessment and Disaster Risk Management during 2024 Kupwara Flash Floods

Imran Khan, Shanawaz Ahmad Baba and Sabreena Farooq*
Department of Geography and Disaster Management,
University of Kashmir, Srinagar-190006 J&K, India
*Email: immigeol@gmail.com

Floods are some of the most devastating and economically damaging natural disasters worldwide, with their economic impact increasing in many countries over recent. Flooding is a leading natural disaster worldwide, affecting billions of people and causing extensive economic and environmental damage. Flash floods are among the most destructive natural hazards, climate change and unplanned development intensifying their impact and frequency. District Kupwara located in the northernmost region of Jammu and Kashmir, has long been vulnerable to the devastating effects of flash floods, particularly during the monsoon season. On April 29, 2024 a series of incessant rains triggered flash floods across the district, causing extensive damaged

housing, community infrastructure, and psychosocial well-being. This study applies the Damage and Loss Assessment (DALA) framework within a disaster risk management (DRM) perspective to evaluate both tangible and intangible impacts. Primary data were collected through household surveys across six villages in Handwara Tehsil, focusing on structural damage, livelihood disruption, and psychosocial stress. Finding reveal that 76.9% of houses in Chogul required complete reconstruction, while 82.4% in Kultura needed minor repairs, though 75% had foundational cracks. In Khuram Abad Vodhpora, 100% of mud-based houses suffered material losses, highlighting the vulnerability of traditional construction. Community infrastructure, particularly schools in Chogul and Kulangam, also sustained extensive damage, halting education and delaying recovery. Psychosocial effects were profound, with 66.6% of women in Chogul and over 61% in Kultura reporting anxiety, sadness, flashbacks, and irritability. Women and children bore a disproportionate burden, heightened by caregiving roles, mobility constraints, and lack of safe shelters. The study highlights that DRM must extend beyond physical reconstruction to address gender disparities, social vulnerability, and mental health challenges. By recommending flash flood-resilient housing, durable infrastructure, and inclusive psychosocial interventions, the research offers practical insights for policymakers and planners. These findings will be useful for shaping sustainable disaster risk reduction strategies, strengthening institutional preparedness, and ensuring equitable recovery. Ultimately, the research contributes to long-term resilience by reducing future flash flood risks, guiding climate adaptation policies, and safeguarding vulnerable communities in Kashmir and other hazard-prone regions.

Keywords*: Flash Flood; DALA; Damage Assessment; and DRM.*

…….....

Assessing the Impact of Climate Variability on Heat-Related Health Risks: A Comparative Studyof Srinagar and Jaipur

Kanchan Sharma
Department of Geography and Disaster Management, University of Kashmir,
Email:kanchansharma9733@gmail.com

Climate change has emerged as a significant determinant of human health, with rising temperature extremes posing major challenges to public well-being. This study focuses on assessing the impact of climate variability on heat-related health risks in two climatically diverse Indian cities: Srinagar (temperate) and Jaipur (semi-arid). The primary objective is to evaluate populationvulnerability to heatwaves and associated morbidity, considering spatial and demographic variations. Long-term climatic data are integrated with hospital morbidity records andstructuredhouseholdsurveys to analyze exposure–response patterns. Geographic Information System (GIS) and Remote Sensing techniques are applied to generate heat vulnerability indices, while socio-economic and demographic variables are incorporated to identify differential risk across communities. Preliminaryfindingshighlight significant contrasts between the two regions:

Jaipur is experiencing increasing intensity and frequency of heat stress due to prolonged extreme temperatures, while Srinagar shows emerging vulnerabilities linked to shifting temperature ranges and urban heat island effects. The study emphasizes the need for climate-sensitive health policies, including early warning systems, urban planning interventions, and localized heat action plans. By comparing two contrasting environments, this research contributes to medical geography by offering region-specific insights into climate–health linkages and providing an evidence base for sustainable health resilience strategies.

Keywords: *Climate change; Heat stress; Medical geography; Srinagar; Jaipur*

…….....

Flood susceptibility mapping using geospatial techniques: a study of the Kashmir Basin in the Northwest Himalaya

Rabbya ul Qalab[1], M. Sultan Bhat[1], Akhtar Alam[1], Mussadiq Hussain Qureshi[2], Mohd Saleem Wani[1] and Nahida Yousuf[1]
Department of Geography and Disaster Management, University of Kashmir, Jammu and Kashmir 190006, India[1]
Department of Higher Education, Jammu and Kashmir, India[2]
Presenter: Rabbya ul Qalab(rounaqshah7@gmail.com)

Floods remain one of the most frequent and destructive natural hazards, disrupting livelihoods and causing extensive economic and environmental losses. The Kashmir Basin is highly vulnerable to flooding due to a combination of geomorphic, climatic, and human-induced factors. The study applies the Frequency Ratio (FR) model integrated with Geographic Information Systems (GIS) to assess and map flood susceptibility across the basin. Eighteen (18) flood-conditioning factors—including topography, hydrology, land use/land cover, and climate variables—were analysed. Historical data from 153 recorded flood locations were used, with 70% for model training and 30% for validation. The model's predictive accuracy, evaluated using the Receiver Operating Characteristic (ROC) curve, achieved a success rate of 0.92, indicating high reliability. Results show that 11.51% of the area is in the 'very high' susceptibility zone, 18.44% in 'high,' and 18.12% in 'moderate' categories, with the rest classified as low to very low risk. The spatial patterns highlight the critical role of geomorphic settings and land use dynamics in shaping flood vulnerability. The generated susceptibility maps offer valuable guidance for prioritizing flood mitigation measures, infrastructure planning, and disaster preparedness, contributing to more effective flood risk management in mountainous regions like the Kashmir Basin.

Keywords: *Flood Susceptibility; Frequency Ratio Model; GIS, Kashmir Basin; Hazard Mapping.*

…….....

Coping with Recurrent Flood Hazards: Human Adjustment Strategies in the Kaliaghai River Basin, West Bengal

Nirmal Mondal
Department of Geography and Disaster Management, University of Kashmir
Email: nirmalmondalmsc2012@gmail.com

The Kaliaghai River Basin in West Bengal, India, is highly susceptible to recurrent floods caused by short-term intense monsoon rainfall, high tides in flooded rivers, weak embankments, and reduced river capacity due to siltation. Over the past two decades (2000-2024), the region has experienced 7-10 major floods per block, particularly affecting Sabang, Patashpur-1, Patashpur-2, Bhagwanpur-1, and Narayangarh. These floods cause severe socio-economic disruption, with 71-73% of households in the most affected blocks reporting annual crop and asset losses. This study examined people's adaptation to flood risk through a mixed methodology using primary household survey (n = 500), focus group discussions, and flood data collection from Kaliaghai-Kapaleshwari-Baghai (KKB) Project Division, Block Disaster Management Office (BDMO), District Disaster Management Authority (DDMA), and India Meteorological Department (IMD). Key adaptation strategies include elevated structures (11%), flood-resistant construction (57%), permanent community flood shelters (1-2%), flood forecasting (97%), flood insurance (5-7%), shift from rice to aquaculture (43%), flood-tolerant crop varieties (25%), and elevated bamboo/wooden platforms for storing valuables (12%). Community-level adaptations such as elevated flood shelters, local embankments, and improved early warning campaigns have significantly reduced losses during extreme floods, although the average economic loss per household per major event remains at an average of ₹15,000-23,000. Statistical analysis indicates a strong correlation between peak discharge and household losses, further reinforcing the role of hydrological extremes as a cause of losses. The findings reveal that while traditional coping mechanisms are important, climate variability, population pressures and infrastructural inadequacies demand integrated adaptation strategies. Increasing resilience will require policy-supported livelihood diversification, participatory water governance and investment in climate-resilient infrastructure. This study provides an evidence-based framework for strengthening community-led flood adaptation in the monsoon-dominated basins of eastern India.

Keywords: *Flood Risk; Adaptation Strategies; Kaliaghai River Basin; Flood Resilience; West Bengal*

……

Environmental degradation and the quality of life in slums: A case study of NCT of Delhi

Dharmendra Kumar[1] and Madiha[1]
[1]Department of Geography & Disaster Management, University of Kashmir, Srinagar
Email: dharmendra.ggscholar@kashmiruniversity.net

This paper examines the intricate relationship between environmental degradation and the quality of life in the slums of Delhi. It is structured in three parts: first, a conceptual overview tracing the evolution of the slum definition; second, an analysis of the growth and spatial distribution of slums in the National Capital Territory (NCT) of Delhi; and third, an assessment of environmental degradation and their impact on the quality of life of slum residents, followed by recommendations for improvement. In an era shaped by globalization, rapid industrialization, and urbanization, Delhi has experienced unprecedented demographic and spatial transformation. Its population grew from 1.74 million in 1951 to 16.7 million in 2011, driven largely by migration and inadequate urban planning. This surge has resulted in the proliferation of unauthorized colonies, JJ clusters, and other informal settlements that concentrate socially and economically marginalized groups. These communities often lack access to basic amenities such as housing, sanitation, clean water, electricity, and healthcare, forcing them to inhabit environmentally fragile and degraded spaces. Slum dwellers are disproportionately exposed to air and water pollution, noise, and unregulated solid waste, conditions that erode health, nutrition, security, and overall well-being. The study highlights a strong correlation between environmental quality and quality of life, underscoring how environmental injustice reinforces socio-economic vulnerability in urban slums. It concludes by emphasizing the need for integrated urban planning and environmental management to improve living conditions and foster sustainable urban futures.

Keywords: *Environmental Degradation; Quality of Life; Slum; Marginalized Groups; Socio-Economic Vulnerability; Unauthorized Colonies,*

…….....

Understanding Land Use Land cover Dynamics in India through the Lenses of ICA Framework

Azhar u din waza[1], Chesfeedah Mushtaq[2] and Qurat-ul Afroz[3]
[1,2,3]Research Scholar at the Department of Geography & Disaster Management, University of Kashmir, Srinagar, India
Email: azhardin325@gmail.com

This review presents the first systematic, nation-spanning synthesis of land use and land cover (LULC) changes across Northern and Southern India, analysing sixty-nine peer-reviewed studies published between 2017 and 2024. Following the ICA (Initialisation–Conceptualization–

Actualization) approach, the study began with a scoping review to refine focus and keywords (Initialisation), conducted systematic searches in Web of Science and Google Scholar with defined criteria (Conceptualization), and performed full-text screening, thematic coding, and classification to identify dominant trends (Actualization). The results reveal a consistent decline in agricultural lands, forests, open spaces, and water bodies, with rapid increases in built-up areas across both regions. Horticultural expansion is particularly prominent in Northern India, driven by economic incentives and climatic shifts. These transformations have generated wide-ranging environmental, physical, and socio-economic impacts: rising land surface temperatures and intensification of the Urban Heat Island effect; loss of biodiversity and habitat fragmentation; shrinkage of wetlands and water bodies leading to water scarcity and reduced groundwater recharge; soil erosion, nutrient depletion, and land degradation; altered hydrological regimes with higher surface runoff, flood risk, and reduced infiltration; deterioration of air quality in urban centres; and shifts in rural livelihoods, with declining agricultural productivity threatening food security and accelerating rural–urban migration. By providing the first systematic, pan-India synthesis of LULC patterns, drivers, and their environmental, physical, and socio-economic implications**,** this review offers critical insights to the policymakers, planners, and researchers to develop region-specific, land-use policies, enforce zoning laws, protect ecosystems, and promote sustainable, climate-resilient agriculture to safeguard both environmental integrity and community resilience.

Keywords: *LULC changes; Systematic Review; Urbanization; Land surface Temperature; Community Resilience*

…….....

Assessing the Influence of LULC Change on Soil Fertility and Ecosystem Stability in the Pohru Watershed of Kashmir

Shazia Irshad Peer[1]*, Javaid Ahmad Rather*[1] *and Umar Ayoub*[1]
[1]Department of Geography and Disaster Management, University of Kashmir, Srinagar

Land Use and Land Cover (LULC) changes are among the most significant drivers of soil degradation in Himalayan watersheds, where fragile ecosystems are sensitive to both human activity and climate variability. This study investigates the impact of LULC dynamics on soil status in the Pohru watershed**,** a vital tributary of the Jhelum River in north Kashmir. Using satellite imagery for 2013 and 2024, LULC classification revealed marked transformations in land cover. Agriculture declined from 34,291.6 ha (18.69%) to 28,997.7 ha (15.80%), a loss of 2.89%, while horticulture expanded from 17,265.5 ha (9.41%) to 23,300.8 ha (12.69%), a gain of 3.28%. Dense forests shrank by 1.56%, while sparse forests expanded slightly by 1.15%. Pasture and plantation areas showed minor decreases, whereas settlements nearly doubled from 2,826.2 ha (1.54%) to 5,453.8 ha (2.97%). Water bodies and snow/glacier cover registered marginal declines, reflecting broader climatic stress. Soil analysis across different LULC categories indicated that forest and

pasture soils retained higher organic matter, better texture, and greater nutrient availabilitycompared to agricultural and settlement soils. Declining agriculture and forest cover, coupled with horticultural expansion, resulted in reduced organic carbon, compaction, and erosion on sloping lands. Settlement growth further diminished infiltration and accelerated runoff, exacerbating soil loss. These results demonstrate that LULC dynamics are directly influencing soil fertility and ecosystem stability in the Pohru watershed. The shift towards horticulture and urban expansion, while economically beneficial, is degrading the soil resource base. Effective interventions such as agroforestry, contour farming, organic amendments, and forest restoration are urgently required to conserve soil and maintain watershed resilience. This study underscores the importance of integrating LULC monitoring with soil quality assessments for sustainable watershed management in the fragile Himalayan Ecosystems.

***Keywords**: Land Use Land Cover (LULC) Dynamics; Soil Fertility; Watershed Management; Soil Conservation; Sustainable Land Management*

…….....

Geospatial Analysis of Land Use Dynamics and its Impact on Water Bodies of Kashmir Valley

Abrar Farooq[1], Syed Hameem Gulzar[1], Saqiba Hussain[1], Abid Farooq Rather[1] and Pervez Ahmed[1]

[1]Department of Geography & Disaster Management, University of Kashmir.

Email: abrarfarooq6565@gmail.com

The Kashmir Valley, a fragile Himalayan ecosystem, is witnessing rapid land use/land cover (LULC) transformations driven by urban expansion, changing agricultural practices, and climatic variability. This study presents a geospatial analysis of land use and land cover (LULC) dynamics in five districts of the Kashmir Valley: Srinagar, Budgam, Ganderbal, Bandipora, and Baramulla, alongside an in-depth assessment of Dal and Wular Lakes. Using remote sensing and GIS techniques, changes in landscape patterns from 1994 to 2022 were mapped and analysed to understand the anthropogenic and environmental forces shaping the region. Change detection analysis revealed substantial LULC shifts, including a decline in agricultural land (13.61% to 11.60%) and marshy areas (5.05% to 4.63%), alongside an increase in built-up areas (2.60% to 3.22%). Dal Lake, once 2,066 ha in 1971, has experienced a significant shrinkage to approximately 1,520 ha today, largely due to urban encroachment, conversion of wetlands, and expansion of floating gardens. Wular Lake, India's largest freshwater lake, while demonstrating spatial resilience, shows signs of degradation driven by human intervention. The findings reveal the intertwined impacts of urbanization, agricultural expansion, and land-use transformation on the spatial extent and ecological health of these critical water bodies. This research underscores the urgent need for integrated conservation strategies that balance development with ecological

preservation, advocating for informed policymaking and community-led stewardship to safeguard the Kashmir Valley's environmental heritage for future generations.

Keywords: *Kashmir Valley; Land Use Land Cover; Remote Sensing; GIS, Dal Lake; Wular Lake; Urbanization; Conservation; Water Bodies.*

……..

Spatio-Temporal Mapping of Land Use/Land Cover Changes in South Kashmir, North-Western Himalayas, Using Landsat Satellite Data

Shaista Mushtaq[1], Athar Yousuf Rather[1], Uzma Farooq[1] and Afzal Hussain[1]
Département of Geography and Disaster Management, University of Kashmir[1]
Email: uzu001634@gmail.com

This paper presents a comprehensive analysis of the spatial patterns and temporal dynamics of land use and land cover changes in South Kashmir from 2000 to 2022 leveraging remote sensing technologies revealing significant transformations in various land cover classes. The study used maximum likelihood classification, a supervised classification method, to analyze Landsat satellite imagery and identify ten major land use categories. The findings demonstrate notable increases in, barren land by 18.78 km² (0.35%), built-up areas by 72.28 km² (1.33%), forests by 274.76 km² (5.05%), grasslands by 68.06 km² (1.25%), scrubland by 307.82 km² (5.66%). horticulture experienced a significant rise of 419.17 km² (7.70%), Conversely, several land use classes reported decline, agriculture by 757.21 km² (13.91%), exposed rockmass by 258.58 km² (4.75%), glaciers and snow by 136.83 km² (2.51%), and water bodies contracted by 8.23 km² (0.15%). The primary drivers of land use change in the region are identified as climate change, population growth, and economic factors. Climate change has altered precipitation patterns affecting agricultural productivity and leading to the retreat of glaciers. Population growth and economic reasons, including the rise of horticulture and changes in land use policies, have also played a significant role in shaping the landscape dynamics of South Kashmir. These changes underscore the dynamic nature of land use in South Kashmir, with significant implications for regional planning and environmental management. the study underscores the cost-effectiveness and efficacy of geospatial technologies in conducting spatiotemporal analyses and formulating evidence-based policies for the sustainable management of natural resources.

Keywords: *Land Use Land Cover; Landsat data; South Kashmir region; North-western Himalayas.*

……..

National Saffron Mission in Kashmir: Components and Impact Analysis

Ummer Ayoub
Research Scholar at the Department of Geography & Disaster Management, University of Kashmir, Srinagar, India
Email: omerayoub604@gmail.com

Saffron (Crocus sativus), commonly referred to as "Red Gold," holds immense cultural, economic, and geographical significance in Kashmir, particularly in the Pampore region, known as the "saffron bowl of India." In recent decades, saffron cultivation has sharply declined due to shrinking landholdings, unscientific and traditional farming practices, inadequate irrigation, unorganized marketing, and productivity stagnation. To address these concerns, the Government of India launched the National Saffron Mission (NSM) in 2010 with an allocation of ₹400.11crore, targeting the rejuvenation of 3,715 hectares of saffron land through scientificreplantation, irrigation infrastructure, quality corm distribution, and market reforms. The present study critically evaluates the NSM in Pampore tehsil, drawing upon primary survey data from 45 Saffron growers across five villages and secondary sources from government agencies. Findings reveal that 100% of growers received financial support and fertilizers, 77.7% received corm pesticides, and 42.2% accessed vermi-compost units. In terms of landholding dynamics, 48.9% of farmers reported increased saffron area, 13.3% recorded a decrease, and 37.7% experienced no change. Income analysis indicated that 68.8% of farmers earned ₹1–5 lakh annually, with saffron contributing up to ₹1.5lakh for smallholders. Productivity rose modestly, from 2.5 kg/ha to 3–4 kg/ha, but remained below the projected 5 kg/ha target. The cost of cultivation and net returns also improved marginally, though not at expected levels. Despite these partial gains, serious shortcomings hindered mission outcomes. Of the 126 Bore wells planned under NSM, less than half were completed, leaving irrigation support inadequate. Many sprinkler systems installed remained non-functional, and farmers continued to rely on erratic rainfall. Misuse of machinery, elite capture of benefits, weak monitoring, and lack of accountability further reduced the programme's reach. Infrastructural projects like the India International Kashmir Saffron Trade Centre (IIKSTC), though established, did not achieve their full potential due to poor operationalization. The study concludes that the NSM made incremental improvements in production stability, input access, and partial income enhancement but failed to deliver the transformative revival envisaged. For long-term sustainability, the mission must prioritize complete irrigation infrastructure, equitable distribution of benefits, robust monitoring and transparency, and effective market linkages through IIKSTC to restore Kashmir's saffron.

***Keywords**: Saffron; National Saffron Mission; Productivity; Rejuvenation*

……

Integrating Network Connectivity and Potential Accessibility: Quantifying Mobility Shifts in the USBRL-Linked Districts

[1*]*Shakir Ahmad Wani*, [1]*Shamim Ahmad Shah*, [1]*Mohd Shafi Bhat and* [1]*Peer Jeelani*
[1] Department of Geography & Disaster Management, University of Kashmir, Hazratbal Srinagar-190006.
[*]Email: shakirahmad675@gmail.com

The Udhampur–Srinagar–Baramulla Rail Link (USBRL) constitutes one of India's most strategically significant transport infrastructure projects, aiming to integrate the Kashmir Valley with the national rail network. Traversing 272 km of high-relief Himalayan terrain, the corridor incorporates 36 tunnels (total length 119 km), 943 bridges, and two major engineering landmarks—the Chenab Rail Bridge, the highest railway arch bridge globally (359 m above riverbed), and the cable-stayed Anji Khad Bridge. Phased commissioning occurred over more than a decade: Qazigund–Baramulla (2009, 118 km), Banihal–Qazigund (2013, 18 km), Udhampur–Katra (2014, 25 km), and Banihal–Sangaldan (2024, 48 km), culminating in full operational connectivity in June 2025. This study develops an integrated analytical framework combining network connectivity (Beta index) and potential accessibility (Hansen's gravity model) to examine phase-wise mobility transformations across USBRL-linked districts—Udhampur, Reasi, Ramban, Anantnag, Kulgam, Pulwama, Srinagar, Budgam, Baramulla. Connectivity metrics capture changes in the structural configuration of the rail network, while accessibility calculations incorporate Census-2011 population data, station catchment zones, and travel-time decay within a 150 km threshold. Results indicate heterogeneous accessibility gains: Baramulla and Ramban exhibit improvements exceeding 35%, primarily due to significant travel-time reductions to key urban centres such as Srinagar and Jammu. Conversely, Bandipora and Ganderbal, Doda record limited gains (<10%) owing to peripheral location and insufficient feeder road integration. Spatial analysis highlights the emergence of a high-access corridor along the Baramulla–Banihal section, reducing cross-divisional travel by up to 2 hours. The findings underscore the transformative potential of the USBRL in reconfiguring regional accessibility, while revealing the persistence of spatial inequalities. Policy implications include the necessity of targeted last-mile connectivity investments and optimised service frequencies to ensure equitable distribution of network benefits. The methodological approach offers a transferable template for evaluating rail-induced accessibility in other mountainous, infrastructure-deficient contexts.

Keywords: *USBRL; Network Connectivity; Potential Accessibility; Beta Index; Hansen Model*

……

Risk Analysis of Trace Elements in $PM_{2.5}$ from the Kashmir Himalayan Region of India

Tanveer Ahmad Najar[1], Ruqia Bhat[1], Arshid Jehangir[1] and Gazala Habib[2]*
[1]Department of Environmental Science, University of Kashmir, Srinagar – 190006, J&K, India
[2]Department of Civil Engineering, Indian Institute of Technology Delhi, New Delhi – 110016, Delhi, India
E-mail: arshidj@gmail.com, drarshid@uok.edu.in

The Himalayan region, known as the "Water Tower of Asia," is ecologically fragile and socio-economically vital region, supporting millions of people. Yet, growing anthropogenic pressures, including $PM_{2.5}$ pollutions, are intensifying risks to human health, natural ecosystems, the cryosphere, and climate stability. This study presents the first detailed year-long investigation of $PM_{2.5}$mass and associated trace elements in the western Himalayas, specifically within the Kashmir Valley, under the NCAP–COALESCE network. From January to December 2019, 24-hour alternate-day ambient $PM_{2.5}$ samples were collected on Teflon® filters using a Speciation Air Sampling System (SASS) and were analyzed for elemental composition through Energy-Dispersive X-ray Fluorescence (ED-XRF) spectrometry. The analysis explored temporal variability, assessed non-carcinogenic and carcinogenic health risks, and evaluated the ecological impacts of $PM_{2.5}$–bound trace elements. Results indicated that crustal elements–Mg, Al, Si, Fe, Ca, and Ti dominated the $PM_{2.5}$ composition, contributing approximately 67% of the total elemental mass, with higher concentrations observed during summer and autumn. Annual mean concentrations of trace metals followed the order: Zn > Cu > Mn > Pb > V > Cr. Health risk assessments for both adults and children, considering inhalation, dermal contact, and ingestion pathways, revealed inhalation-related cancer risks ranging from 9.42×10^{-20} to 2.46×10^{-14} for adults and 5.50×10^{-20} to 1.43×10^{-14} for children. Non-carcinogenic Hazard Quotient values remained below recommended safety thresholds, and ecological risk indices suggested minimal environmental impact from $PM_{2.5}$–associated metals. Despite relatively low trace element concentrations, the potential long-term health implications particularly from inhalation exposure cannot be overlooked, as chronic exposure to airborne trace elements may contribute to respiratory disorders and other health complications.

Keywords*: PM; Risk Assessment; Hazard Quotient; Kashmir Himalaya.*

……

Measuring Hidden Diabetes in India

Md. Juel Rana[1] and Md. Juel Rana[2]
[1]Md. Juel Rana, G. B. Pant Social Science Institute, Prayagraj, Uttar Pradesh
[2]Margubur Rahaman, All India Institute of Medical Sciences, Gorakhpur, Uttar Pradesh

India is considered the diabetes capital of the world. The Sustainable Development Goals (SDGs) aim to reduce premature mortality by one-third from non-communicable diseases, including diabetes, by 2030. In this background, this paper estimates the prevalence and burden of diabetes in India, focusing on hidden diabetes, which refers to individuals with elevated blood glucose levels (above 140 mg/dl) but who are unaware of their condition. The study highlights the importance of real-time diabetes data for policy-making, but due to the lack of such data, it relies on large-scale survey data like the National Family Health Survey (NFHS). It identifies discrepancies between self-reported and biomarker-measured diabetes, indicating potential underestimation. The total estimated diabetes cases in India are 119 million, with hidden diabetes more prevalent among males (66 million). Uttar Pradesh has the highest share of cases, followed by West Bengal and Bihar. The highest prevalence of hidden diabetes is observed in Tripura (13.6%), and several other states show rates above the national average of 8.8%. This study provides critical insights for diabetes awareness and control across Indian states. A robust system of databases on the risk factors of diabetes may help identify cases of hidden diabetes. This includes creating a national registry for diabetes and its risk factors to track cases and trends over time. This methodology of estimating the burden and prevalence of hidden diabetes from large-scale survey data, i.e., NFHS or DHS, may be adopted for other developing countries.

Keywords: *Unmeasured Diabetes; Unaware Diabetes; NCDS; Equity; Regional Variation*

……

Corresponding Author/Lead Author	*Institutional Affiliation*	*Title of Abstract*
Aadil M. Nanda	Govt. Degree College, Anantnag	Comprehensive Empirical and Numerical Approach for Analyzing Stability and Failures along Bandipora to Gurez highway, J&K, India
Aakib Yaqoob Mir	Aligarh Muslim University	Assessment of Mining-Induced Thermal Alterations of a Riverbed in Upper Jhelum Basin of Kashmir Valley: A Geo-spatial Approach
Abhijit Das	University of Calcutta	Transformation of the Bhasan Char, Meghna Estuary, Bangladesh: From Fluvial Sediments to Coastal Island, Rehabilitation of Refugees, and its Suitability
Abhishek Anand	Prof. R.M. College, Akurdi	Urban Growth of Samastipur City, Samastipur, Bihar, India: Challenges and Planning
Abhishek Ghosh	North eastern Hill University. Shillong	Channel Morphological Adjustment and Anthropogenic Landforms of the Mayurakshi River, Eastern India
Abid Farooq Rather	University of Kashmir	Glacier–Lake Interactions and Climate Impacts on Potentially Dangerous Glacial Lakes in the Shyok Catchment of the Upper Indus Basin
Abrar Farooq	University of Kashmir	Geospatial Analysis of Land Use Dynamics and its Impact on Water Bodies of Kashmir Valley
Ahmad Bashir	Boys HSS, Handwara	Neotectonics of right-lateral Srinagar strike-slip fault of Kashmir Basin NW Himalaya, India
Ajin Ray	University of Allahabad	A Miracle Journey Towards Vikshit Bharat
Ajit Prasad	Prof. R.M. College, Akurdi	Intersecting Inequalities: Power, Representation, and Survival in Rural India: A Multidimensional Study Using IHDS-II Data
Akhtar Alam	University of Kashmir	Geomorphic Evidence is Persuasive of Landslide-Dammed Formation of Kausar Nag in Kashmir
Akshata A. Alhat	Savitribai Phule Pune University	Evaluation of Groundwater Quality for Irrigation Using IWQI: A Case Study of Purandar Lift Irrigation Scheme
Alkunte M. D	Savitribai Phule Pune University	Sustainable Ecotourism Suitability Assessment for Community Empowerment Using AHP and Tourist Satisfaction Index in the Eastern Region of Raigad District

Amjad Ali	Govt. Vidarbha Institute of Sci. and Humanities, Amravati	Inventory and Assessment of Geomorphosites and their Geo-Tourism Potential: Leh Valley and Surrounding Environments, Ladakh, India.
Anand Kumar Gupta	AcSIR, Ghaziabad	PS-InSAR-based Slope Deformation Monitoring in the Main Central Thrust Zones in Bhagirathi Valley, Uttarakhand Himalaya
Anju	Kurukshetra University	Geo-Morphometric Analysis of the Pabbar River Basin: Insights From the Lesser Himalayan Region of Himachal Pradesh And Uttarakhand
Ankit Singh	Deen Dayal Upadhyaya Gorakhpur University	Influence of Slope Gradient on Land Use and Land Cover in the Bijul River Basin: A GIS-Based Analysis
Anurag Yadav	Govind Ballabh Pant Social Science Institute	Spatio-Temporal Assessment of Agricultural Drought in Jaisalmer, Rajasthan Using Remote Sensing technique (2004–2024)
Ashish Ranjan	Patna University	Annual Variation in Flood Extent and Its Implications for Socio-Economic Resilience: A Case Study of Bhagalpur District, Bihar
Archana Patil	Savitribai Phule Pune University	Reconstruction of Discharges Using Palaeostage Indicators (PSI) in the Gorge Section of the Kaveri River, Southern India
Archana Raje	University of Allahabad	Significant change in Land use pattern of Ayodhya district of Uttar Pradesh
Arindam Sarkar	University of Calcutta	Reconstruction of Pleistocene Paleoenvironment through Trace fossils in lateritic badland terrain of Gangani, West Bengal
Arnab Saha	Durgapur Government College	A Comparative Study of Geomorphic Features and Shoreline Dynamics of The Gangasagar Coast
Arpan Roy Chowdhury	West Bengal State University	Tide Induced Sedimentation and Basic Nutrients Dynamics along a selected Transect of Kishorimohanpur Area in the Indian Sundarban
Azhar u din waza	University of Kashmir	Understanding Land use Land cover Dynamics in India through the Lenses of ICA Framework
Azizur Rahman Siddiqui	University of Allahabad	Application of Random Forest Classifier and evaluation of varying Intensity of vulnerability in an arid environment using Generalised additive model: A Case Study in Indian desert

Basir Ali Karikar	JamiaMilliaIslamia	Tracing and Mapping the Dynamics of Human Impact on Landuse Landcover in a Tropical Plateau Fringe River Basin of Eastern India: An Implication of Anthropic Indices and Geostatistical Methods
Bilquis Shah	University of Kashmir	Operational Landslide Early Warning System in the Kashmir Himalayas: Integrating Conditioning Factors and Rainfall Thresholds for Landslide Hazard Zonation
Birendra Kumar Yadav	University of Allahabad	A Geographical Review of Land Use Pattern Under Different Crops in Chitrakoot District, Uttar Pradesh
Braj Kishor Dwivedi	University of Allahabad	Encroaching the Floodplain: Geospatial Analysis and Field Observations of Urban Expansion and Riverbank Change Along the Saryu in Ayodhya (1995–2025)
D.D. Chauniyal	Doon University	Dharali Disaster 5 August 2025 in Bhagirathi Valley of Garhwal Himalaya
Daawar Bashir Ganaie	Jamia Millia Islamia,	Long-term trend analysis and seasonal forecasting of temperature and rainfall in Sundarban Biosphere Reserve, India using non-parametric and hybrid deep learning approaches
Daawar Bashir Ganaie	Jamia Millia Islamia	Storm surge flood susceptibility analysis in Sundarban Biosphere Reserve, India: A multi-model stacking ensemble approach with SHAP-based interpretability
Deepangshu Chandra	West Bengal State University	Assessment of neotectonic signatures using geomorphic indices: A study in the Eastern Himalayan piedmont setting
Deeprita Ghosh	West Bengal state University	Hybrid AHP–Entropy Based Stability Assessment of Channel Bars in the Bhagirathi–Hugli River System, West Bengal
Dharmendra Kumar	University of Kashmir	Environmental degradation and the quality of life in slums: A case study of NCT of Delhi
Dinabandhu Barman	Presidency University	Planform MorphologyAnalysis of Oxbow Lakes in the Jaldhaka Floodplain of West Bengal

Dnyaneshwar N. Pawar	Savitribai Phule Pune University	Geomorphic Evaluation and Mapping of Soil Resources in Chandwad Tahsil, Maharashtra: A Geoinformatics Approach
Dnyaneshwar N. Pawar	Savitribai Phule Pune University	Evaluation of Geomorphosites for Sustainable Geotourism Development in Nashik District, Maharashtra
Durdanah Mattoo	Govt College for Women, Sopore	Debating Subaltern Geographies and Gender Justice Discourse in Global South
G. M. Rather	University of Kashmir	Concentration of Trace Element Iodine and prevalence of Thyroid in Mountain Ecosystem of North Kashmir Himalayas
Gaggan Kumar	University of Kashmir	Geographical Assessment of Meteorological Drought and Flash floods in North-Western Himalayas: A Case Study of Jammu Division (J&K)
Gaurav Gamre	MES's Nowrosjee Wadia College	Beachrock Formation and Aeolianite Overprint: Evidence from Lithostratigraphic Section along Diveagar Coastline, Maharashtra
Gitanjali Bramhankar	HPT Arts & RYK Science College	Holocene Flood Records of the Anas Basin, Western India: Implication to Climate Reconstruction
Habibullah	University of Jammu	Impact of climate change on the spatio-temporal dynamics of glacial lakes in Trans-Himalayan region of Kargil-Ladakh: A 1994-2022 Inventory using remote sensing techniques.
Hakim Farooq Ahmad	University of Kashmir	To Evaluate the Channel Planform Dynamics of River Jhelum From Sangam To Asham, Kashmir Valley Jammu And Kashmir, India
Hakima Banoo	Lovely Professional University	Field Study on indoor air quality of households in semi-arid cold region Kargil, India
Hari Ramudamu	Jadavpur University	Hilly Urban Centres through the lens of Urban Geomorphology: A Case of Kurseong Municipality, Darjeeling Himalayas.
Ikhlaq Majeed	University of Kashmir	Edaphic Controls on Treeline Shift in the Kashmir Himalaya: linking soil ecosystem with treeline dynamics

Imran Khan	University of Kashmir	Flood Damage Assessment and Disaster Risk Management during 2024 Kupwara Flash Floods.
Indora Suraj Rajkumar	Kurukshetra University	Characteristics of Landslides along the Mandi-Manali National Highway Stretch in Himachal Pradesh
Indrani Barui	Diamond Harbour Women's University	Assessment of disaster preparedness and accessibility to emergency cyclone shelters in the coastal area of the Indian Sundarban
Iqra Rahman Siddiqui	University of Allahabad.	Mapping Environmental Vulnerabilities for Urban Sustainability: A Case Study of Aligarh City
Ishtiaq Ahmed	Central University of Punjab	Evolution and reconstruction of late Holocene Glacier Extents and Equilibrium Line Altitudes (ELA) in the Lahaul Region of the Upper Chenab Basin, Northwestern Himalaya.
Itu Pal	Vidyasagar University	Role of Geomorphology in Selecting Suitable Landfill Sites Under Different Physiographic Regions.
Itu Pal	Vidyasagar University	Geomorphology and Multi-Criteria GIS–AHP Approach to Landfill Site Suitability in MKDA
Kanchan Sharma	University of Kashmir	Assessing the Impact of Climate Variability on Heat RelatedHealthRisks:AComparativeStudyof Srinaga and Jaipur
Kapil GHOSH	Diamond Harbour Women's University	Multi-Scale Modelling of landslide Vulnerability of Kurseong Subdivision, Darjeeling Himalaya, India
Kulhiu Mero	Central University of Punjab	Multi-Proxy Provenance Analyses of the Basal Conglomerate Formation of Meghalaya, India
Kulsum Salahuddin	Aligarh Muslim University	Rainfall Regime and Urban Flood Vulnerability in the context of Climate Change: A Geomorphological Assessment of the 2006 and Recent Flood Events in Surat City, India
Kunal Mallick	Presidency University	Why does beat-level wildfire mapping matter for (post)fire management in the dry deciduous forests of southern West Bengal?

Lalit A Kalaskar	Savitribai Phule Pune University	Sustainable Development Through Agro-Based Industries: Assessing the Socio-Economic Impact in Nashik District
Lalit Thakare	S. P. College, Pune	Estimation of morpho-sedimentary variations in beach cusp formations along the southern Konkan region, Maharashtra state, West Coast of India.
Lopamudra Roy	Pakuahat Degree College	Application of Remotely Sensed Data for Flood Mapping: A Case Study of the Tangan Valley in Malda District, West Bengal, India
Madhavi S. Waghmare	Savitribai Phule Pune University	Assessment of Adaptibility of Pune Metro Among Citizens: Issues & Solutions
Mahjabeen	Jamia Millia Islamia	Geospatial Assessment of Hazard Susceptibility using Topographical Indices in the Upper Beas Basin
Majid Hassan	University of Kashmir	People's Perception of Flood Risk: Implications for Disaster Risk Reduction in Srinagar, India
Manash Jyoti Nath	Gauhati University	Spatial and Temporal Dynamics of Malaria in the Arunachal–Assam Foothills: Geo-Environmental Determinants and Risk Patterns (2016–2022)
Mary Tahir	University of Allahabad	An Assessment of Retreat Pattern on Changme Khangpu and Kangkyong Glacier, Sikkim, India (1980-2020)
Mary Tahir	Jamia Millia Islamia	Role of Renewable Energy in Reducing Carbon Footprints in Developing Economies
Md. Juel Rana	G. B. Pant Social Science Institute	Measuring Hidden Diabetes in India
Md. Mamoon Rashid	Jamia Millia Islamia, New Delhi	Mapping Glacier Change in the Upper Tons Basin (1993–2023) Using Multi-Sensor Remote Sensing
Mifta ul Shafiq	Cluster University of Srinagar	Disentangling Local Geomorphometric Controls from Climatic Drivers of Glacier Retreat in the North-western Himalaya
Mir Rohi Neelofar	University of Kashmir	WEAP Model Study of Urban–Rural Water Demand and Supply in Srinagar and Ganderbal districts

Mohammad Imran Malik	GDC Sogam	Response of Sediment Yield and Runoff to Climatic Variations in Pohru Watershed of Kashmir Himalayas
Mohd Vaish	University of Allahabad	Agricultural Diversification as a pathway to Livelihood Security: A Case Study of Fatehpur District
Mohd Waseem Naikoo	Jamia Millia Islamia	Integrated Geospatial Assessment of Human Footprint Impact on Regulating Ecosystem Services in the Himalayan Urban Landscape
Mohd Wasit Manhas	University of Kashmir	Physical Risk Assessment of a Potential Glacial Lake Outburst Flood (GLOF) in Kakti Lake, Chenab Basin using HEC-RAS
Mukta Raje	V.B.S.P.University Jaunpur	Evaluating the Impact of the Jal Shelli Model on Socio-Economic Development in the Drought-Prone Bundelkhand Region
Mustaq Ali	Gauhati University	Flan-T5-Based NLP-Driven Geospatial Intelligence for Mortality Risk Mapping and Rainfall-Correlated Micro-Flood Analysis in Assam's 2024 Flood Disaster
Muzamil Hassan Lone	Institute of Technology, Vellore	Enhanced Land-Cover Classification in Rugged Landscapes Using Multi-Temporal Remote Sensing and Machine Learning Techniques
Nahida Yousuf	University of Kashmir	Assessment of water demand and supply using WEAP model in the North Kashmir, India
Nidhi	University of Rajasthan	Indigenous Drought Prediction and Coping Strategies in Jaisalmer District
Nirmal Mondal	University of Kashmir	Coping with Recurrent Flood Hazards: Human Adjustment Strategies In The Kaliaghai River Basin, West Bengal
Nityaranjan Nath	Gauhati University	Identification of Ecologically Vulnerable Hotspots under Climate Change: A Geospatial Study in a Part of the Bhutan Himalayan Foothill Region of Assam, India
Nityaranjan Nath	Gauhati University	Assessing Ecological Vulnerability to Climate Change in the Bhutan Himalayan Foothills of Assam

Olivia Halder	University of Calcutta	The integrated study of basin character, flood plain, meandering dynamics, and channel behaviour of the Dwarka River in eastern India
P C Moharana	ICAR-Central Arid Zone Research Institute	Assessing Land use/Land cover changes and Land degradation using Geospatial technology for identifying hots spots and their restoration in desert region of Rajasthan
P.C. Gangurde	Savitribai Phule Pune University	Evaluating the Spatial Correlation between Rivers and Rural Settlements Using GIS and Statistical Tools: A Case Study of Nashik District, Maharashtra
P.C. Gangurde	Savitribai Phule Pune University	Evaluating Altitudinal Influences on Rural Settlements and Socioeconomic Development in Nashik District, Maharashtra
Partha Pratim Pramanik	Debra Thana Sahid Kshudiram Smriti Mahavidyalaya	Reclaiming Wastewater: Towards Sustainable Urban Water Management in India
Peerzada Tafheemul Islam	Cluster University Srinagar	Green and Inclusive Pathways to Sustainable Development in Jammu and Kashmir
Pramod Kumar Pandey	University of Allahabad	Dense Mineral Variation in the Different Geomorphic Units of Barakar River: Evaluation of the Hinterland
Pramodkumar Hire	HPT Arts and RYK Science College	Are floods on the Mahi River getting worse and more frequent in Anthropocene?
Pranab Dutta	Gauhati University	Natural Hazard and Unstable Rivers: A Gis-Based Assessment Approach in the Bongaigaon District, Assam
Prashant kumar yadav	University of Allahabad	A Review of Floods in Prayagraj: Causes, Consequences and Community Resilience
Pritam Kumar Santra	University of Calcutta	Shoreline Dynamics in the Eastern Subarnarekha Coastal Region
Pritam Sarkar	West Bengal state University	Hydro-Morphological Degradation and Water Quality Impairment in a Tidal Spill Channel: The Study of the Noai River, West Bengal

Priyank Pravin Patel	Presidency University, Kolkata	Mapping sand mining induced landforms in rivers of southern West Bengal: their distribution, classification and ecological implications
Rabbya ul Qalab	University of Kashmir	Flood susceptibility mapping using geospatial techniques: a study of the Kashmir Basin in the Northwest Himalaya
Rajat Bar	MES's Nowrosjee Wadia College	Assessment of Saltwater intrusion of Coastal Aquifer, Alibag Tehsil, Raigad District, Maharashtra
Ram S. Kolapkar	MES's Nowrosjee Wadia College	Mangrove Change Over Two Decades and Current Biomass–Soil Status: A Case Study from Sonakothakhar, Raigad District, Maharashtra
Ramkrishna Maiti		Common Misconceptions in Geomorphology: An Introspection
Ramkrishna Maiti	Vidyasagar University	Climate Justice: Ethics Issues of Climate Change Impacts
Ratna Khoso	West Bengal State University	Assessing the Impact of Cyclones on Soil Salinity Dynamics in Sundarban: A Remote Sensing and GIS Approach
Rayees Ali	Jamia Millia Islamia	A systematic review on climate change induced flood susceptibility, vulnerability and risk: Future research perspective
Rehana Rasool	Government Degree College Eidgah, Srinagar	Drivers, Impacts, and Sustainable Solutions for Land Use Change in South Kashmir, Indian Himalayas
Ria Naskar	North Eastern Hill University	Climate change and landslides: Example from South Sikkim
Riyaz Ahmad Mir	NIH-Jammu	Cryospheric change and water security challenges in cold-arid Ladakh: Evidence from the Ganglas Catchment
Ruturaj Vilas Daphale	NCPOR	Glacial and Lithological Controls on River Chemistry in the Semi-Arid Chandra Basin, Western Himalaya
S. P. Singh	Deen Dayal Upadhyaya Gorakhpur University	Spatial Analysis of Dissection Index: A Case Study in Hilly Terrain

Sabale S. B	Savitribai Phule Pune University	GIS-Based Assessment of Anthropogenic Influence on Forest Fires: Integrating Settlements, Road and Agricultural Proximity Data on Raigad District, Maharashtra, India
Sabreena Farooq	University of Kashmir	Resilience of Critical Infrastructure to Extreme Weather Events in Srinagar City
Sai Tushar Shelar	Savitribai Phule Pune University	Mapping Landslide Susceptibility Zones in the Coastal Districts of Maharashtra
Sana Rafi	Hemvati Nandan Bahuguna Garhwal University	General to Specific Landslide Hazard Mapping in the Garhwal Himalayan Region
Sanchary Debnath	West Bengal State University	Avulsion of the Titi River's Lower Reach in the Eastern Himalayan Foreland, India: Tectonic Trigger or Natural Fluvial Process?
Sandeep Kumar Mondal	NCPOR	Logical Fusion of Optical and Microwave Satellite Data for High Accuracy Mapping of Glacial Lakes and River Streams in the Chandra Basin
Saqib Iqbal Raina	Jamia Millia Islamia	Trend analysis and forecasting of climate in Ladakh region of Western Himalayas using Mann-Kendall test and machine learning models
Satish Handge	Savitribai Phule Pune University	Geomorphological Evaluation of Site Suitability for Farm Ponds in Nashik District, Maharashtra
Sayoni Mondal	IISER Kolkata	Assessment of morphotectonic signatures and depositional sequences in the Subarnarekha River Basin – geomorphometric and geochronological insights
Shafiq Ahmed	University of Jammu	Impact Assessment of changing LULC on LST and UHI pattern. A case study of Srinagar city, Jammu and Kashmir
Shafqat Maqbool	University of Kashmir	Climate Risks in High-Density Apple Systems: A Systematic Review Using the SALSA Framework
Shahid Manzoor	University of Kashmir	Aeolian Landforms in Arid Environments: Insights from Leh, Ladakh
Shahid Saleem	University of Kashmir	Climate Change and Pastoralism in the Kashmir Himalayas: Challenges, Adaptations, and Pathways for Resilience

Shaista Mushtaq	University of Kashmir	Spatio-Temporal Mapping of Land Use/Land Cover Changes in South Kashmir, North-Western Himalayas, Using Landsat Satellite Data
Shakir Ahmad Wani	University of Kashmir	Integrating Network Connectivity and Potential Accessibility: Quantifying Mobility Shifts in the USBRL-Linked Districts
Shakira Gani	University of Kashmir	Evaluation of disaster preparedness in School Education in Pulwama District, JK, India
Shazia Irshad Peer	University of Kashmir	Assessing the Influence of LULC Change on Soil Fertility and Ecosystem Stability in the Pohru Watershed of Kashmir
Shikha Singh	M.M.P.G. College	Resilience and Vulnerability in a New Age: Human-Ecosystem Interaction Under Stress
Shreya Basak	University of Calcutta	Multidimensional Analysis of Mid-Channel Island of the Mayurakshi River: Geomorphological-Hydrological variability, Socio-economic vulnerabilities, and Climate-responsive management approach
Shreya S. Chavan	Nowrosjee Wadia College	A GIS-based characterisation of channel morphology and sinuosity indices: A case study of Vaghotan river basin of south Konkan region, India
Shubham Soni	Savitribai Phule Pune University	Spatio-Temporal Dynamics of Drought Hazard in Ruparail River Basin of Rajasthan: A Multi-Index Assessment
Shuvrangshu Jana	GeoMind AI, Bengaluru	Advanced Landslide Forecasting in the Himalayan Region Using Geospatial Foundation Model
Sinki Yadav	M.M.P.G College	Taming Natures Fury: Unifying Natural Hazards and Climate Change for Resilient Futures
Sk Asraful Alam	Vidyasagar University	Village-Scale Flood Vulnerability, Risk and Resilience Assessment Using Machine Learning and SAR Data: Insights from the 2024 Malda Flood
Sonam Chhomo	Jawaharlal Nehru University	Climatic Drivers for Snow Cover Variability in the Bhaga Basin, Western Himalaya: A Google Earth Engine-Based Analysis
Sonam LAMA	Darjeeling Govt college	A century of channel morphological adjustment of the Mayurakshi River, Eastern India

Soumen Ghosh	West Bengal State University	Spatial Variation of Crab Burrow Characteristics and Its Relation to Morphological and Anthropogenic Variables: A Case Study of Mandarmani Beach, West Bengal, India.
Soumendu Chatterjee	Presidency University	Responses of Tropical Cyclones to Global Warming: Insights from Historical Trends and Idealized Simulations for the Bay of Bengal Region
Subham Roy	Savitribai Phule Pune University	Surface Water Dynamics and Inundation Frequency as Indicators of Hydrological Stress: A Case Study of Birbhum, West Bengal, India
Subhamita Chaudhuri	West Bengal State University	Morphodynamic Response of Coastal Systems: A Comparative Analysis of Selected Sites along the Western and Eastern Coasts of India
Sudipa Sarkar	Sidho-Kanho-Birsha University,	Dynamics of river channel confluences of the transboundary Jaldhaka River system within the Eastern Himalayan Foreland Basin
Suhail Ahmad Dar	Lovely Professional University	Increasing Vulnerability to Cloudburst Hazards in Jammu and Kashmir: A Preliminary Analysis (2006–2025)
Sujata Phadol	HPT Arts and RYK Science College	Rainfall Variability, trends and change detection across the Vaitarna Basin (India): A Spatiotemporal Investigation
Sujit Mandal	Diamond Harbour Women's University	Performances of ADCP and Digital Bathymetric Model (DBM) to explore spatio-temporal variations of hydraulic geometry and channel bed morphology in upper and lower tidal part of river Hugli, India
Sumaira Javaid	University of Kashmir	Quantifying Hydrological Alteration and Environmental Flow Ranges Using a PCA–RVA Framework in the Upper Jhelum Basin
Sumant E. Autade	Swami Vivekanand Night College	Determining Geo-Environmental Parameters Causing Slope Instability in Parts of Western Ghats, Maharashtra, India.
Sumant E. Autade	Rashtriya Shikshan Sanstha's Swami Vivekanand Night College	Determining Geo-Environmental Parameters Causing Slope Instability in Parts of Western Ghats, Maharashtra, India.

Sunando Bandyopadhyay	University of Calcutta	Transformation of the Nayachar Island, Hugli Estuary, West Bengal
Syed Umer Latief	University of Kashmir	Reconstructing Quaternary Glacial History of Kolahoi Glacier, Kashmir, India
Taha Shamim	University of Kashmir	Impact of IOD and NAO Ocean-Atmospheric Oscillations on the Precipitation in Upper Indus Basin
Tahir Ahmad Wani	University of Kashmir	Copula-Based Joint Return Periods of Extreme Rainfall Events and Implications for Flood Risk in the Vishow Catchment, Kashmir Valley
Tanveer Ahmad Najar	University of Kashmir	Risk Analysis of Trace Elements in PM2.5 from the Kashmir Himalayan Region of India
Tapan Kumar Das	Cooch Behar College	Land Capability Classification & Crop Suitability Mapping of Alipurduar District
Tiyasha Ghosh	Presidency University	A Proposed Framework for Hydro-morphological Classification of India's Estuaries
Tushar P. Raut	Savitribai Phule Pune University	Sinuosity Index as a Diagnostic Tool for Flood Susceptibility in Bedrock-Controlled Rivers: Insights from the Upper Krishna Basin, India
Umar Shafi Mantoo	University of Kashmir	Cloudbursts in the North Western Himalayas: Unravelling Geomorphological, Meteorological & Climatological Dynamics
Ummer Ayoub	University of Kashmir	National Saffron Mission in Kashmir: Components and Impact Analysis
Uttara Singh	CMP Degree College	Geographies of Invisible Labor: Women's Work, Mobility, and Climate Stress in Pratapgarh, U.P.
Vitthal K.Anwat	Savitribai Phule Pune University,	Fluvial Landforms of the Bedrock Channel Reaches of the Damanganga River, Western India
Vivek Raj Singh Chauhan	Jai Narain Vyas University	Assessing Vegetation and Thermal Patterns to Detect Ecological Stress: A Spatio-Temporal Assessment of Sariska Tiger Reserve, Rajasthan
Zeba Khannam	Jawaharlal Nehru University, New Delhi,	Thermal Stress across the Indus-Ganges-Brahmaputra Basins: UTCI-Based Trends Analysis

Indian Institute of Geomorphologists (IGI)

INDIAN Institute of Geomorphologists (IGI) is a national platform affiliated to the International Association of Geomorphologists (IAG) exclusively dedicated to the research and development in the field of geomorphology in India. The idea of forming the IGI was seeded at the International Conference of Geomorphology and Environment held at the University of Allahabad in 1987. The headquarter of IGI is in the Department of Geography, University of Allahabad, Prayagraj. The Journal of Indian Geomorphology, published annually under the aegis of IGI, is a UGC-CARE listed journal (Subject Group: Earth and Planetary Sciences).

IGI Executive Council 2025

President: Prof. Ramkrishna Maiti (Midnapur)
Secretary General: Prof. A. R. Siddiqui (Prayagraj)
Treasurer: Prof. Ashwajeet Chaudhary (Prayagraj)

Councillors:

Prof. Milap Chand Sharma (Delhi)
Prof. Savindra Singh (Prayagraj)
Prof. Sunando Bandyopadhyay (Kolkata)
Prof. Soumendu Chattopadhyay (Kolkata)
Prof. Virendra Nagarale (Pune)
Prof. Anju Gupta (Kurukshetra)
Prof. L. N. Satpati (Kolkata)
Prof. Suchitra Pardeshi (Pune)
Dr. Priyank Patel (Kolkata)
Dr. Somasis Sengupta (Kolkata)
Dr. Kapil Ghosh (Kolkata)
Dr. Sayantan Das (Kolkata)

Editor:

Prof. Subhamita Chaudhuri (Kolkata)

INTERNATIONAL CORRESPONDENCE SECRETARY:
Prof. Sunil Kumar De (Shillong)

Vice-Presidents:
Prof. Sudhakar D. Pardeshi (Pune)
Prof. Subhamita Chaudhuri (Kolkata)
Dr. Pradeep Kumar Singh (Kalakankar)
Prof. Padmini Pani (New Delhi)

Joint Secretary:
Prof. Anargha Dhorde (Pune)
Prof. Anupam Pandey (Prayagraj)
Prof. Mukta Raje (Prayagraj)
Prof. Pramod Kumar Hire (Nasik)

Co-opted Members:
Prof. H. S. Sharma (Jaipur)
Prof. V. S. Kale (Pune)
Dr. Amal Kar (Kolkata)
Prof. N. Chandrashekar (Tirunelveli)
Prof. D. D. Chauniyal (Dehradun)
Dr. S. P. Singh (Gorakhpur)
Prof. Subir Sarkar
Prof. Ashis K. Paul (Medinipur)
Prof. Lalit Singh Jhala (Jodhpur)
Dr. V. A. V. Raman (New Delhi)
Dr. Lakpa Tamang (Kolkata)
Dr. Sumat Autade (Mumbai)
Dr. Desh Deepak Singh (Prayagraj)
Dr. Pratap Chandra Mohrana (ICAR)
Prof. Narayan Chandra Jana (Burdwan)
Dr. Arindam Sarkar (Howrah)
Dr. Archana Raje (Prayagraj)
Dr. Archana Patil (Nashik)
Dr. Mehtab Singh (Rohtak)

CHIEF PATRON

Prof. Nilofer Khan
Hon'ble Vice Chancellor, University of Kashmir

PATRON

Prof. M. Sultan Bhat
Dean Research, University of Kashmir

CONVENER

Prof. Pervez Ahmed
Head, Department of Geography & Disaster Management

ORGANIZING SECRETARY

Dr. Akhtar Alam
Assistant Professor
Department of Geography & Disaster Management

ORGANIZING COMMITTEE

Prof. M. Sultan Bhat
Prof. Shamim A. Shah
Prof. Pervez Ahmed
Prof. G. M. Rather
Dr. Javeed A. Rather
Dr. M. Shafi Bhat
Dr. Akhtar Alam
Dr. Farooq A. Dar
Dr. Gaggan Kumar
Dr. Hakim Farooq Ahmad
Dr. Zahoor Ul Islam
Dr. Shahnawaz A. Baba
Dr. Mohd. Waseem Naikoo
Dr. Imran Khan

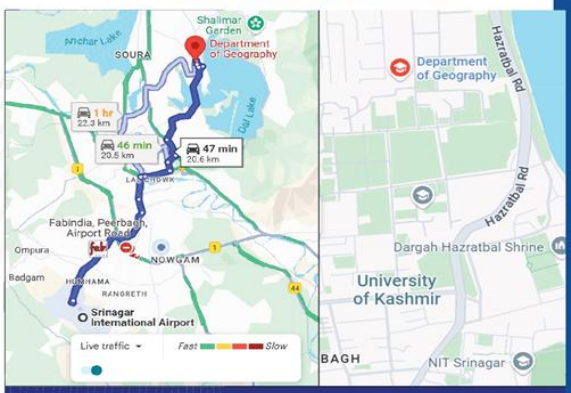
LOCAL ADVISORY COMMITTEE

Prof. Ghulam Jeelani
Prof. Fayaz Ahmad
Prof. Bikram Singh Bali
Prof. Farooq A. Mir
Dr. Sami Ullah Bhat
Dr. Arshid Jehangir
Dr. Irfan Rashid

NATIONAL ADVISORY COMMITTEE

Prof. Talat Ahmad
Prof. M. N. Koul
Prof. Anil V. Kulkarni
Dr. O. P. Mishra
Prof. Tasawoor A. Kanth
Prof. Sunil Kumar De
Prof. Sunando Bandyopadhyay
Prof. Milap Chand Sharma
Prof. Siumendu Chatterjee
Prof. Sudhakar Pardeshi
Prof. Mehtab Singh
Prof. R. K. Ganjoo
Prof. A. R. Siddiqui
Prof. Masood Ahsan Siddiqui
Prof. B. W. Pandey
Prof. Haroon Sajjad
Prof. Atiqur Rahman
Prof. Milap Punia
Prof Shahab Fazal
Prof. Karanjot Kaur Brar
Prof. Anuradha Sharma
Prof. Mohd. Sarfaraz Asgher
Dr. Parmanand Sharma
Dr. Suraj Mal

MAP FOR REACHING THE VENUE



For further information contact:

Prof. Pervez Ahmed (Convener)
+91-9906797287

Dr. Akhtar Alam (Organizing Secretary)
+91-9906416644

Email: igiconf2025@uok.edu.in

Designed by: Nissar A. Wani (Graphic Designer)
PRC/UoK | waninisa@uok.edu.in

UNIVERSITY OF KASHMIR

Established in 1948, the University of Kashmir is a premier institution of higher learning, with its main campus nestled along the picturesque western bank of Dal Lake in the Srinagar City. To expand the reach of quality education, the University has set up Satellite Campuses in Anantnag (South Campus), Baramulla (North Campus), and Kupwara, ensuring greater access for students from remote and underserved areas.

Dedicated to academic excellence and innovation, the University offers a dynamic and intellectually enriching environment that promotes high-quality teaching and cutting-edge research across a wide spectrum of disciplines. Its academic portfolio spans major faculties including Arts, Business & Management Studies, Education, Law, Applied Sciences & Technology, Biological Sciences, Physical & Material Sciences, Social Sciences, Medicine, Dentistry, Engineering, Oriental Learning, and Music & Fine Arts.

Evolving to meet the changing demands of students and society, the University regularly introduces innovative and interdisciplinary programmes, reinforcing its commitment to relevance and academic leadership. Recognized as one of the leading state universities in India, it achieved the 14th rank among State Public Universities in the NIRF 2024 rankings and was awarded the prestigious NAAC A++ accreditation in 2025, which is a testament to its unwavering pursuit of academic and research excellence.

DEPARTMENT OF GEOGRAPHY & DISASTER MANAGEMENT

ESTABLISHED in 1979 as "Department of Geography and Regional Development" with a vision to promote geographic knowledge and research, the department holds a prominent position on the education landscape and has progressed to address emerging academic and societal needs. With the launch of a specialized postgraduate programme in Disaster Management in 2014, it was aptly renamed as "Department of Geography & Disaster Management" in 2021, reflecting its broad academic scope and relevance.

The Department of Geography & Disaster Management at the University of Kashmir is one of the pioneering academic centers in the region, offering postgraduate and doctoral programs. With a team of experienced faculty and modern laboratory facilities, the department encourages critical thinking, scientific inquiry, and interdisciplinary research on domains such as Geomorphology, Climate, Cryosphere, Hydrology, Water Resources, Urban Planning, Mountain Ecosystems, Environmental Change, Natural Hazards, Disaster Risk Reduction, Natural Resources, Tourism, Sustainability, Socioeconomic Development and Policy Formation.

The Department has earned recognition for academic excellence and research capacity. It has been awarded funding by the Department of Science and Technology (DST) under the prestigious FIST (Fund for Improvement of S&T Infrastructure) programme. Additionally, it has been inducted into the University Grants Commission's (UGC) Special Assistance Programme (SAP) at both DRS-I and DRS-II levels, highlighting its leadership in geographic and disaster studies at the national level.