"Transforming Local Water Security: Connecting Research, Action, and Policy"

Proceedings of the National Symposium

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Co-organisers:

Southasia Institute of Advanced Studies (SIAS), Nepal Development Research Institute (NDRI), The Small Earth Nepal (SEN), International Water Management Institute (IWMI), Nepal, Nepal Water Conservation Foundation (NWCF), and the Australian National University (ANU), Australia under the leadership Water and Energy Commission Secretariat (WECS), Nepal.

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Acronyms

ACIAR	**Australian Centre for International Agricultural Research**
AI	Artificial Intelligence
ANU	Australian National University
CFUG	Community Forest User Group
CIAA	Commission for the Investigation of Abuse of Authority
CRHM	Cold Regions Hydrological Model
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DEM	Digital Elevation Model
DoWRI	Department of Water Resources and Irrigation
DRR	Disaster Risk Reduction
DSS	Digital Decision Support System
EWS	Early Warning System
FAO	Food and Agriculture Organisation
FECOFUN	Federation of Community Forest Users, Nepal
GCF	Green Climate Fund
GDM	Glacio-Hydrological Degree Day Model
GEF	Global Environment Facility
GESI	Gender Equality and Social Inclusion
GLOF	Glacial Lake Outburst Flood
HEC-RAS	Hydrologic Engineering Center's River Analysis System
HKH	Hindu Kush Himalaya
HRU	Hydrological Response Unit
ICIMOD	International Centre for Integrated Mountain Development
IoE	Institute of Engineering
IoF	Institute of Forestry
IWMI	International Water Management Institute
KU	Kathmandu University
ML	Machine Learning
MODFLOW	Modular Groundwater Flow Model
NAP	National Adaptation Plan
NDC3	Nationally Determined Contribution (third iteration)

NDRI	Nepal Development Research Institute
NNGWWW	Nepal National Glacier, Water and Weather Week
NWCF	Nepal Water Conservation Foundation
OP	Operational Plan
ROR	Run-of-River
ROS	Rain-on-Snow
RoSPro	Roadside Spring Protection
RS	Remote Sensing
SAR	Synthetic Aperture Radar
SEN	The Small Earth Nepal
SIAS	Southasia Institute of Advanced Studies
SPHY	Spatial Processes in Hydrology
SWAT	Soil and Water Assessment Tool
TU	Tribhuvan University
WECS	Water and Energy Commission Secretariat
WUA	Water User Association

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1 Context

Nepal's waterscape is changing and increasingly fragile. Climate change, shifting land and water use practices, and aggravating water-related disasters have altered water availability, disrupted local hydro-social systems, and jeopardised livelihoods. Local water management has become precarious, intensifying conflicts over access to and control over water resources and exacerbating water insecurities. Women and marginalised groups disproportionately bear burdens of increasing water insecurities.

Water insecurity is not only a technical challenge but also a complex governance issue. A holistic understanding of the complex hydro-social dynamics and collaborative effort are the cornerstone to addressing water insecurities and exploring context-suited, inclusive, equitable, climate-resilient, sustainable water management strategies. Research, policy, and action, however, often remain disconnected, leading to fragmented responses and short-term fixes rather than systematic, sustainable change.

Against this backdrop, the National Symposium on 'Transforming Local Water Security: Connecting Research, Action, and Policy' brought together researchers, practitioners, policymakers, and community-based organisations with the aim of fostering critical dialogue for bridging the gap between research, action, and policy, inspiring interdisciplinary and intergenerational knowledge exchange, and facilitating evidence-informed, inclusive, and sustainable local water governance in the context of accelerating climate change impacts and increasing water insecurities. The event was organised on the occasion of the Nepal National Glacier, Water and Weather Week (NNGWWW) 2026, under the theme of World Water Day (22 March 2026): 'Water and Gender', captured in the slogan "Where water flows, equality grows".

The symposium was co-organised by SIAS, NDRI, SEN, NWCF, IWMI, Nepal, and ANU, Australia, under the leadership of WECS, Nepal.

The event focused on three **key thematic areas**:

Theme 1. **Understanding local hydro-sociology and restoring local water sources:** *How have climate change and changing land and water uses impacted local water security and livelihoods? How can such impacts be mitigated?*

Theme 2. **Inclusive local water governance and equitable water access:** *What are the challenges and opportunities to effectively manage water insecurities and related conflicts amid compounded impacts of climate change and urbanisation?*

Theme 3. **Analytical tools, frameworks and approaches for hydro-social water governance:** *What analytical tools, frameworks, and approaches can help unpack hydro-social dynamics and support evidence-informed, inclusive, and locally led water governance?*

This proceeding summarises the discussions and presents key messages of this collaborative event.

2 Opening Session

The Opening Session included Welcome Remarks by Dr. Anushiya Shrestha, Keynote Presentation by Dr. Mandira Shrestha and remarks by His Excellency Simon Ernst, the Australian Ambassador to Nepal and the Opening Session Chair, Mr. Tika Ram Baral, Joint Secretary, WECS.

2.1 Welcome Remarks

Dr. Anushiya Shrestha, from SIAS, welcomed participants as the MC of the opening session. She briefly highlighted that the symposium aims to promote intergenerational and interdisciplinary knowledge exchange for evidence-based, inclusive, and integrated approaches to sustainable water management and strengthening local water governance in Nepal. The symposium was supported by the ACIAR and the CSIRO, through 'Springwater management, agriculture and resilient livelihoods in the mid-hills of Nepal' (Muhan) Project.

She briefly introduced the Muhan project, which is funded by the Australian Centre for International Agricultural Research and implemented through the Commonwealth Scientific and Industrial Research Organisation and Australian National University, in coordination with the Water and Energy Commission Secretariat. Muhan is a four-year action research initiative (2024-2028) implemented by an interdisciplinary team of SIAS, NDRI, NWCF, Tribhuvan University, and Kathmandu University in close coordination with the local governments of Kamalamai Municipality and Sunkoshi Rural Municipality of Sindhuli District. She also informed participants that further details on the Muhan Project can be obtained from the Information Brief displayed at the Poster Presentation Section.

The program overview included the Opening Session with Keynote presentation and remarks by dignitaries, followed by Technical Sessions with Oral and Poster Presentations, followed by a panel discussion and final closing remarks. She invited the Joint Secretary of the Water and Energy Commission Secretariat to serve as the Session Chair and formally start the Opening session. His Excellency Simon Ernst and keynote speaker Mandira Shrestha were greeted, and all participants were welcomed. The Opening session then formally commenced under the chairmanship of Mr. Tika Ram Baral.

2.2 Keynote Presentation Session

Speaker: *Dr. Mandira Shrestha, Board Director, Water Center 21 Pahal*

Dr. Mandira Singh Shrestha is a disaster risk reduction, climate services, and water resources specialist with over 30 years of experience in the HKH region. She serves as Board Director of Water Centre 21 Pahal and has over two decades of experience at ICIMOD. Her work focuses

on flood forecasting, early warning systems, and climate services for resilience building. She has also led the efforts to localise climate services for key sectors such as agriculture and tourism and build institutional capacity around future climate projections. She holds a PhD from Kyoto University, a Master's from the University of Washington, and a Bachelor's from IIT Roorkee.

Key Messages from the Keynote Speaker:

Water is the primary medium through which climate change impacts occur. She emphasised that South Asia faces issues of too much water and too little water, which has led to the water insecurity affecting the ecosystems, livelihoods and economic development. Focusing on the **Hindu Kush Himalayan Region,** the "Water Tower of Asia" supporting the livelihoods of over 1 billion people, Dr. Shrestha highlighted the key water-related challenges and pragmatic approach to addressing these challenges in this region characterised by high climatic and topographic variability and multi-hazard risks such as floods and landslides.

Key highlights from the Keynote presentation:

1. The Hindu Kush Himalayan (HKH) region is highly climate vulnerable

The region is warming faster than the global average, leading to glacier retreat, altered river flows, and increased frequency of extreme events like floods, droughts, and glacial lake outburst floods (GLOFs).

2. Water availability is uneven and increasingly stressed

Around 80% of annual rainfall occurs in just four months, creating cycles of "too much" (floods) and "too little" (droughts), compounded by population growth, urbanisation, and rising water demand.

3. Drying springs pose a major local water security threat

Springs critical for nearly 100 million people are rapidly declining, with about 50% becoming seasonal or drying up, especially in mid-hill regions. However, revival is possible through proper springshed management.

4. Disaster risks are intensifying and disproportionately affect vulnerable groups

Nepal and the HKH region face cascading multi-hazard risks. Women and marginalised communities are more vulnerable due to limited access to resources, information, and decision-making power.

5. "*Where water flows, Equality Grows":* Integrated, gender-responsive, and collaborative approaches are essential

Women are disproportionately burdened by water management responsibilities and affected by disasters. Yet their access to information is limited, their knowledge is relegated and they are restricted from decision-making power. Strengthening climate information services, using advanced technologies (AI, remote sensing), and fostering collaboration between research, policy, and communities while ensuring gender-responsive planning are key to achieving sustainable water security.

2.3 Remarks by His Excellency Simon Ernst, an Australian ambassador to Nepal

His Excellency Simon Ernst greeted the Session Chair, the Joint Secretary of WECS, as well as the co-organisers and participants on behalf of the Australian Embassy. He commended the organisers for co-convening this symposium and promoting an inclusive, integrated, and collaborative approach for addressing the complex climate and water-related challenges, including the extreme weather events affecting Nepal and around the world. He emphasised the importance of strengthening partnerships across research, policy, and practice to build climate-resilient futures and expressed his trust that the symposium will serve as a bridge between research, action, and policy in addressing the growing water security challenges. He also highlighted that the Australian government has long been a committed partner in supporting Nepal's efforts to advance inclusive, integrated, and climate-resilient water management and governance. These reinforced the importance of domestic, collaborative, and institutional responses to water-related issues.

2.4 Remarks by Opening Session Chair: Mr. Tikaram Baral, Joint Secretary, WECS.

Speaking on behalf of the Nepal Government, the Session Chair appreciated the symposium as a timely platform, aligned with the Nepal Water and Weather Week 2026. In his remarks, he underscored the growing urgency of water security challenges and emphasised the need to strengthen partnerships between research, policy, and practice to build climate-resilient futures.

He also highlighted that Water and Energy Commission Secretariat is leading the coordination in water sector governance and is currently drafting a Water Resources Bill.

He acknowledged the importance of institutionalising dialogue mechanisms to ensure continuous and meaningful engagement among stakeholders, rather than limiting interactions to one-time events. He stressed that structured platforms are essential for fostering sustained knowledge exchange and for ensuring that the discussions and insights generated are effectively translated into policy-relevant outputs. This includes developing actionable recommendations and practical guidance that can inform decision-making processes and strengthen water governance frameworks.

The remarks further underscored the growing urgency of water security challenges, particularly in the context of climate change and increasing stresses on water resources. It

also emphasised the need to strengthen partnerships between research, policy, and practice, recognising that stronger collaboration across these domains is critical for bridging existing gaps and ensuring that knowledge is effectively applied in real-world contexts. Such integrated efforts were highlighted as key to building climate-resilient futures and promoting more adaptive, inclusive, and responsive water management systems.

3 Thematic Session 1: Understanding local hydro-sociology and restoring local water sources

The first session had four oral presentations and was chaired by Dr. Shankar Shrestha, with moderation by Ms. Shreya Bajimaya from NDRI. The presentations in this session centred on local water systems and restoration, covering diverse topics such as terrace farming and water conservation technologies, aquifer recharge in the Chure–Bhabar–Terai region, climate-resilient livelihoods through riverbank stabilisation, and the vulnerability of spring water sources under changing climatic conditions. In addition, a presentation on water quality as a key driver of water insecurity was also included under this theme; however, the presenter was unable to attend and share his findings due to the ongoing conflict in the Middle East. Below we present the key highlights of the presentations from thematic session

Presentation 1: Terrace Farming in the Middle Hills and Water Conservation Technologies for Local Water Security and Community Sustainability
Authors: *Dr. Umesh Parajuli and Dr. Prachanda Pradhan*
Presenter: *Dr. Umesh Parajuli*

Dr. Parajuli opened the session with a compelling re-framing of Nepal's terraced Middle Hills — not merely as an agricultural landscape, but as a critical piece of water management infrastructure. His presentation argued that the hydrological functions of terraces have been systematically undervalued in both research and policy, and that their deterioration carries serious consequences for downstream communities and watersheds. Below are the key highlights of his presentation:

1. Terraces in Nepal’s Middle Hills are not only agricultural systems but also critical water management infrastructure, although their hydrological role remains undervalued in policy and research.

2. It is not merely the physical presence of terraces, but the nature of water control within them that determines the level of ecosystem services and downstream hydrological benefits.

3. Terraces perform key hydrological functions by reducing surface runoff, enhancing groundwater recharge, and regulating downstream flows. However, their effectiveness depends on proper water management (e.g., well-managed paddy terraces), not just their existence.

4. Well-managed terraces also generate significant downstream benefits—for example, paddy terraces with 15–20 cm levees can retain 100–150 mm of rainwater in a day, thereby reducing flood risks downstream.

5. Despite their ecological importance, these systems are declining due to terrace abandonment, poor management, and the lack of integration between agricultural practices and water management.

6. Terrace revitalisation should be treated as a priority for water security and climate resilience in Nepal's mid hills

7. Revitalisation must be closely linked with agricultural transformation and commercialisation

Presentation 2: Groundwater Access Status Under Climate Variability and Increased Demand in the Chure–Bhabar–Terai Area of Madhesh

Authors: *Nirman Shrestha, Sumitra KC and Saurav Pradhananga*
Presenters: *Dr. Nirman Shrestha and Ms. Sumitra KC, IWMI*

Dr. Nirman Shrestha and Ms. Sumitra KC presented findings from a hydrogeological study of groundwater access in the Chure–Bhabar–Terai area of Madhesh, focusing specifically on the Dhanusa–Mahottari–Sarlahi *Khahare* Basin. Their presentation combined advanced hydrological modelling and detailed assessment of the institutional and policy gaps that limit effective groundwater management in Nepal. Below are the key highlights of their presentation:

1. Alluvial springs show strong seasonal variability, increasing in the monsoon and declining in the dry season, leading to periodic water stress under rising demand and climate variability.
2. Hydrological modelling using SWAT (surface water) and MODFLOW-NWT (groundwater flow and hydraulic head) was applied to understand water dynamics.
3. Scenario analysis tested recharge interventions, showed that Chure has rapid infiltration, Bhabar has strong recharge (12–18 days restorage), and Terai interventions had limited impact.
4. Targeted recharge structures can raise groundwater levels by ~1.5 metres within an 8 km radius, indicating strong potential for localised interventions.
5. Significant groundwater governance gaps exist, including absence of monitoring frameworks, lack of sub-national policies, weak inter-agency coordination, and no dedicated groundwater institution.
6. Strengthening institutional arrangements, establishing systematic groundwater monitoring, and improving coordination across sectors (forest, land, water, agriculture) are critical for effective groundwater management.

7. Retention ponds in the Bhabar–Terai interface should be identified as an effective intervention for balancing infiltration, water retention, and evaporation control.
8. Groundwater decision support systems should be promoted through partnerships between government agencies, local user groups, development partners, and research institutions to enable science-driven policy formulation.

Presentation 3: Strengthening Climate-Resilient Livelihoods Through Riverbank Stabilisation and Commercial Utilisation of Vetiver Grass in the Mahakali River Basin
Presenter: *Mr. Sandip Paudel, Heifer International*

Mr. Sandip Paudel from Heifer presented a practical, community-centred intervention in the Mahakali River Basin — specifically in Wards 12 and 13 of Bheemadatta Municipality in Sudurpashchim Province of Nepal. The presentation offered an example of how nature-based solutions can simultaneously address water security, livelihood insecurity, and climate vulnerability. Below are the key highlights of his presentation:

1. The Mahakali River Basin is experiencing multiple, compounding water security challenges, including climate change impacts, post-2015 earthquake vulnerabilities, seasonal flooding, disaster risk from nine glacial lakes in the upper catchment, and ongoing riverbank erosion.

2. Conventional flood protection infrastructure, particularly reinforced concrete T-walls (RCT walls), are both economically prohibitive and insufficient for many affected households.

3. Vetiver has a deep and extensive root system making it highly effective for soil binding and erosion control. In addition, it provides multiple livelihood co-benefits, including use as livestock fodder, raw material for handicrafts, and extraction of high-value Vetiver oil.

4. Vetiver oil has strong commercial potential, and this economic value supports its transition from a subsistence-based intervention to a commercially viable ecosystem-based adaptation strategy, thereby creating strong livelihood incentives for adoption.

5. Vetiver-based riverbank stabilisation should be formally integrated into municipal Disaster Risk Reduction (DRR) policies.

6. Institutional support is required to scale up Vetiver cultivation and to facilitate community access to commercial markets for Vetiver oil and related products.

Presentation 4: Assessment of Spring Water Resources and Vulnerability Mapping of Households Under Changing Climatic and Socio-Economic Conditions
Presenter: *Ms. Monika Pandit, IoF*

Ms. Monika Pandit presented a multi-objective study of spring water resources in the Mid-hills of Nepal, with Kaski district as the study area. Her presentation combined hydrological measurement, land use change analysis, climate trend analysis, and household vulnerability assessment to provide a comprehensive diagnosis of spring decline and its drivers. Below are the key highlights of her presentation:

1. The presentation highlighted a critical decline in spring water systems across Nepal's Mid-hills, posing a direct threat to household water security, particularly for the 40% of households dependent on springs for drinking water.

2. Field measurements conducted pre-monsoon indicated that approximately 91% of springs exhibit low discharge levels, with additional springs outside the primary watershed boundary included due to their significant community use, underscoring the need for flexible analytical boundaries in spring studies.

3. Land use and land cover analysis (1990–2024) revealed an unexpected increase in forest cover alongside the reduction in agricultural land; however, this increase in forested area has not improved spring discharge, suggesting that the abandonment of agricultural terraces and associated land management practices has contributed more significantly to spring decline than forest change alone.

4. Climate trend analysis showed a temperature increase of +1.2°C and a 17.06% decline in precipitation, along with five recorded drought years, although no long-term decline in rainfall was observed, indicating that spring degradation is more closely associated with land use change and rising temperatures than shifts in precipitation patterns.

5. The household vulnerability assessment found that 73% of households fall within high-to-medium vulnerability categories, with reliance on single spring sources identified as a major risk factor for water insecurity.

6. Policy recommendations included promoting conservation farming practices to enhance infiltration and groundwater recharge, protecting and delineating spring recharge zones from disruptive land use changes.

7. Commissioning dedicated springshed research to improve understanding of recharge dynamics, and strengthening the adaptive capacity of households dependent on single-source water systems is also equally important.

Question and answer session

The Q&A session was facilitated by Moderator Ms. Shreya Bajimaya. Questions from participants included queries on the methodologies and findings presented, and stimulated discussion on the practical pathways for translating research into policy and program design. The session reflected a high level of engagement from participants, with questions touching

on the scalability of Vetiver-based interventions, data gaps in groundwater modelling, the political economy of terrace revitalisation, and the institutional mechanisms needed to address the groundwater governance gap.

Closing Remarks from session chair, Dr. Shankar Shrestha

Dr. Shankar Shrestha closed the session with synthesising remarks that depicted together the threads from all four presentations. He highlighted the convergence of evidence across different geographies and methodologies, noting that the session had demonstrated both the depth of Nepal's water security challenge and the richness of the research being conducted to address it.

Dr. Shrestha emphasised that the session's presentations collectively reinforced three imperatives: the need to move beyond single-sector approaches to water management; the urgency of translating research findings into institutional action; and the importance of grounding national and provincial policy in the hydrological and socio-economic realities documented at the local level. He encouraged presenters and participants to continue building the evidence base and to actively engage with policy processes to ensure that research findings reach decision-makers.

4 Poster Presentation Session

Thematic Session 1 was followed by the Poster Session which was facilitated by the SIAS team. A total of 10 participants (2 male and 8 female) presented posters. A list of poster title and the presenters is presented in Annex 4. The informal format of the poster presentation session allowed for deeper one-on-one engagement between researchers and interested participants, enabling more detailed discussion of methodologies, findings, and potential collaborations. Additional research outputs were displayed and discussed, complementing the thematic presentations from the session.

The poster session also included showcasing of the Photo stories of the Muhan project.

5 Thematic Session 2: Inclusive local water governance and equitable water access

The second session comprised five oral presentations and was chaired by Dr. Dil Khatri, with moderation by Dr. Gyanu Maskey from SIAS. The presentations examined the complexity of water governance in Nepal, emphasising how institutional arrangements and ambiguities, social hierarchies, and environmental change collectively shape water access and management outcomes. The session further explored themes of grassroots water diplomacy and the role of wetlands as climate-resilient infrastructure, as well as the evolving institutional dynamics of spring water systems and their implications for livelihoods and local political

identities. Overall, it underscored that water governance is inherently political, socially embedded, and influenced by intersecting institutional, ecological, and equity dimensions. Below we present the key highlights of the presentations from thematic session 2.

Presentation 1: Water, Caste, and Control: An Intersectional Analysis of Water and Sanitation Inequality in Malangwa Municipality ward number three

Presenter: *Sunita Bhukhaju Shrestha, TU*

Ms. Sunita Bhukhaju Shrestha presented findings from an intersectional analysis of water and sanitation inequality in Sindhuli District, based on qualitative research methods. The study highlighted the social dimensions of water management within Madhesi communities, showing that water scarcity is strongly shaped by financial capacity, power relations, and political connections. It emphasised that the exclusion of Madhesi Dalit women cannot be understood through a single-axis lens, as overlapping inequalities related to caste, gender, class, and language jointly produce deep and layered marginalisation that is not easily addressed through conventional policy approaches. Below are the key highlights of her presentation:

1. The study revealed deep-rooted discrimination in water access, including the distinction between “touchable” and “untouchable” water sources, resulting in continued exclusion of Dalit communities.
2. It also identified intra-Dalit discrimination and generational variations in the practice of “chuwachut” (untouchability), indicating that social exclusion persists despite gradual changes over time.
3. The study observed clear spatial segregation between Dalit and non-Dalit settlements that further reinforced unequal access to water and sanitation infrastructure.
4. Poor sanitation conditions, particularly leaking open drainage systems, were found to expose children to significant health risks such as drowning and infections, with minimal institutional response.
5. The presentation highlighted that access to safe drinking water remains a serious concern, as handpumps and groundwater sources were reported to be highly contaminated, leading communities to rely on unsafe water sources.
6. The study concluded that representation of marginalised groups is largely symbolic and recommended participatory planning with Dalit communities, awareness campaigns in local languages, and inclusive infrastructure design to ensure equitable water and sanitation services.

Presentation 2: Grassroots Water Diplomacy in the Mid and Low Stream of Mahakali Basin in Kanchanpur District: Women’s Roles in Conflict resolution, Cooperation, and Inclusive Transboundary Governance

Presenter: *Mr. Kiran Bhandari, FAO*

kr. Kiran Bhandari presented findings from a study conducted in the Mahakali Basin, highlighting the role of women in inclusive transboundary water governance. The study examined women's lived experiences in managing water-related risks and conflicts, as well as the factors influencing their participation in water governance and decision-making processes. It further emphasised women's contributions to cooperation, conflict mediation, and climate resilience. Below are the key highlights of his presentation:

1. The study highlighted women's active role as "water diplomats," contributing significantly to cooperation, conflict management, and community-level water governance.

2. Women's involvement was observed through formal and informal mechanisms, including cooperatives and digital platforms such as WhatsApp groups, which are also used for early warning systems and communication during disasters.

3. They play an important role in disaster preparedness and environmental stewardship, including waste management and efforts to reduce illegal fishing for ecosystem conservation.

4. Women's leadership was found to be largely trust-based, facilitating dispute resolution and strengthening community interactions in water-related conflicts.

5. Despite their contributions, household responsibilities and limited participation in ward-level decision-making processes remain key barriers to meaningful engagement in governance.

6. The study emphasised strong willingness among women to participate in governance processes and recommended that their inclusion would enhance the sustainability and effectiveness of water governance systems.

Presentation 3: The complex web of springwater Institutions in Sindhuli: How are they reshaping water access, livelihoods, and political identities?

Authors: *Anushiya Shrestha, Thanesh Bhusal, Salu Basnet, Hemant Ojha, Arif Watto and Shahriar Wahid*

Presenter: *Salu Basnet, SIAS*

Ms. Salu Basnet presented findings from an ongoing study in Sindhuli District, focusing on the institutional dynamics of spring water governance and their implications for water accessibility and livelihoods. The presentation highlighted springs as the primary water source in the mid-hills that are experiencing a steady decline due to climate change and land-use changes. It also emphasised how increasing water demand has intensified local conflicts, further complicated by underlying power dynamics and institutional contestations. The study underscored that ensuring sustainable access to spring water requires addressing these

interlinked environmental, social, and governance challenges. Below are the key highlights of her presentation:

1. The presentation highlighted the roles of various actors and institutions in shaping water access for both drinking and irrigation purposes.

2. It noted that springs are increasingly being diverted by large and medium-scale drinking water supply projects, with significant impacts on downstream users, particularly farmers and agricultural livelihoods, including spring rice cultivation.

3. The registration of springs and water sources has also increased considerably, often driven by efforts to attract government and donor support while safeguarding sources for future use.

4. The importance of mediation in addressing emerging water-related conflicts was emphasised, given growing pressures and competing demands.

5. Water security was identified as increasingly vulnerable due to multiple intersecting factors, including resource competition and governance complexities.

6. The discussion further pointed out that benefits and opportunities are often concentrated among socially and politically privileged groups, reflecting persistent inequities and the rapidly evolving and contested nature of spring water governance systems.

Presentation 4: Promoting Wetlands as Climate Infrastructure: A Case Study from Bhajani Municipality in Eastern Kailali

Authors: *Nirmal Mani Dahal, Ngamindra Dahal, Anu Dahal, Sudip Acharya, Ranjan Bhatt, and Umesh Balal Magar*

Presenter: *Dr. Nirman Mani Dahal, NWCF*

Dr. Nirman Mani Dahal presented the findings of the study conducted in Kailali District that used qualitative research methods to examine wetlands as natural climate infrastructure for flood buffering, groundwater recharge, and enhancing climate resilience. It investigated how governance dynamics shape wetland conservation and explored institutional mechanisms for balancing competing stakeholder interests. The analysis applied the Grid–Group framework to understand interactions among key actors, including the private sector (individualists), Community Forest User Groups (egalitarians), and local government institutions (hierarchists), highlighting how differing governance logics influence wetland management outcomes. Below are the key highlights of his presentation:

1. The study highlighted wetlands as natural “sponges” that absorb and gradually release excess monsoon floodwaters, thereby helping to reduce flood risks.

2. It also found that wetlands support groundwater recharge by storing surface water and facilitating slow infiltration into aquifers, which helps sustain groundwater levels.

3. The study further showed that wetlands provide essential ecological services, including habitat for diverse flora and fauna such as migratory birds and aquatic species.

4. In addition, wetland vegetation and soils contribute to climate change mitigation by sequestering carbon and reducing atmospheric CO_2 concentrations.

5. Key governance challenges identified include overlapping mandates between forest and local government authorities, the absence of clear wetland restoration guidelines, weak benefit-sharing mechanisms, and limited integration of climate adaptation into lake management practices.

6. The study recommends institutionalising a Wetland Restoration and Management Guideline through collaborative governance involving CFUGs and municipalities.

Presentation 5: Hybrid Water Governance in the Babai Irrigation Project: Why Integration Fails and Ambiguity Works

Presenter: *Jigyasha Rai Yangkhurug, DoWRI*

Jigyasha Rai Yangkhurung presented findings from a study conducted under the Babai Irrigation Project in Bardiya District. The presentation highlighted that climate change is increasingly affecting the system, with the Babai River experiencing more erratic conditions and a projected decline in dry season flows. It also emphasised that irrigation management operates through a dual governance structure, combining formal WUAs and the traditional Tharu Barghar system. Overall, the presentation underscored that effective irrigation governance emerges through the integration of these formal and customary systems. Below are the key highlights of her presentation:

1. The study found higher levels of trust in the traditional Barghar system, though some respondents were unfamiliar with its existence.

2. Comparative analysis showed that the Barghar system is perceived as more effective than WUAs across multiple aspects, particularly in accessibility and responsiveness.

3. Spatial variations were evident along the canal: head reach farmers showed more balanced preference between WUAs and Barghar, mid-sections farmers relied on negotiation between Barghar and WUAs, while tail-end users expressed greater trust in Barghar institutions.

4. Barghar meetings were found to be more accessible and inclusive, with relatively higher participation of women, although their involvement often remains symbolic due to quota-based representation.

5. Power imbalances persist, with WUAs often dominated by elite farmers, while the Barghar system maintains local legitimacy and enables faster conflict resolution, explaining why governance ambiguity can function effectively.

6. The study concludes that effective irrigation governance relies on institutional bricolage—integrating formal and traditional systems—and recommends recognising traditional institutions, strengthening collaboration, enhancing representation of tail-end farmers, and incorporating these systems into climate adaptation strategies.

Question and answer session

The question-and-answer session, moderated by Dr. Gyanu Maskey, highlighted key issues of gender, power, and governance in water management. It underscored limited trust in female leadership within traditional systems, persistent power imbalances favouring politically connected groups, and concerns around tokenistic participation of women. The discussion also noted emerging roles of women as active contributors, highlighted the importance of deeper understanding of the contextual view and vulnerabilities of the upstream and downstream communities and emphasised the importance of coordination among local governments and stakeholders to address cross-jurisdictional water management challenges.

Closing Remarks from session chair, Dr. Dil Khatri

In concluding the session, Dr. Dil Khatri synthesised key insights from the five presentations, emphasising the importance of understanding how formal institutions interact with informal systems and the need to strike a balance between them for effective water governance. He highlighted the critical role of infrastructure in securing water resources, stressing that it must be contextually aligned with local socio-environmental realities. He also underscored gender as a central theme, noting that increasing outmigration has expanded women's roles and calling for their meaningful inclusion in decision-making through an intersectional lens. Furthermore, he pointed to the link between water rights and land ownership and stressed the importance of addressing inter-palika dynamics where water sources and users span multiple administrative boundaries.

6 Thematic Session 3: Analytical tools, frameworks and approaches for hydro-social water governance

The third session had five oral presentations and was chaired by Dr. Madan Lal Shrestha, with moderation by Ms. Suchita Shrestha from SEN. The presentations in this session highlighted emerging research, methodological innovations, and practical approaches to water security

and climate risk management in Nepal's mountain regions. The presentations underscored the growing impacts of climate change on glaciers, river basins, and spring systems, while showcasing tools such as hydrological modelling, remote sensing, and geospatial analysis. Overall, the session emphasised translating scientific evidence into actionable strategies for disaster risk reduction, water resource management, and resilient infrastructure planning. Below we present the key highlights of the presentations from thematic session 3.

Presentation 1: Rain-on-Snow Triggered Supraglacial Lake Drainage in Langtang Valley, Nepal: Sentinel-1 SAR Evidence and CRHM Modelling (2017)

Authors: *Bandana Koirala and Dhiraj Pradhananga*

Presenter: *Ms. Bandana Koirala, IoE*

Ms. Bandana Koirala presented a study conducted in the Langtang Valley of Rasuwa district, which investigated how extreme summer melt conditions, particularly during the record 2017 season, pre-conditioned supraglacial lakes to near-capacity levels, increasing their susceptibility to outburst. The study further examined the role of a warm Rain-on-Snow (ROS) event as a critical trigger that generated a sudden hydraulic pulse and analysed the resulting "fill-and-spill" cascade mechanism, whereby high-altitude saturation propagates downstream to produce a major drainage event. Below are the key highlights of her presentation:

1. The study identified 2017 as the most negative mass balance year for Langtang basin glaciers since 2011, indicating heightened vulnerability
2. The study applied the Cold Regions Hydrological Model (CRHM) to simulate snow accumulation, melt, and runoff processes, discretising the Langtang basin into HRUs for detailed analysis, while utilising ERA5 climate data—bias-corrected with observations from Kyanjing station—to enhance model accuracy.
3. The study demonstrated that snow saturation can serve as a pre-event signal for early warning, unlike conventional river-level-based systems.
4. It also showed strong potential for integration into early warning systems (EWS), including Nepal's BIPAD Portal.
5. The study concluded that the 2017 drainage event resulted from combined effects of extreme melt and a distinct ROS pulse.
6. The study provided a robust and transferable framework for glacier hazard monitoring in data-scarce Himalayan regions.

Presentation 2: Assessment of Hydropower Potential and its Sensitivity to Climate Change in the West Seti River Basin, Western Nepal: An Integrated Geospatial and Glacio-Hydrological Modeling

Presenter: *Mr. Manish Praja, KU*

Mr. Manish Praja presented a study conducted in far-western Nepal that focused on assessing the technical hydropower potential of the glacierised West Seti River Basin and examining the sensitivity of its hydrological regime to changing climatic conditions. The study simulated daily

river discharge using GDM, identified suitable ROR hydropower sites and estimated their technical potential under current conditions, and further analysed the impacts of future climate change scenarios on river discharge and hydropower generation. Below are the key highlights of his presentation:

1. The study identified 35 technically viable run-of-river (ROR) projects, with a combined baseline capacity of 1,227.1 MW.
2. Findings indicate that hydropower potential is highly sensitive to precipitation variability:
   a. 837 MW under a dry scenario (+1°C, −20% precipitation)
   b. 1,298 MW under a wet scenario (+1°C, +20% precipitation)
3. The analysis underscores the crucial role of glaciers and snowmelt contributions in maintaining dry-season river flows.
4. It also highlights potential long-term risks to hydropower reliability associated with glacier mass loss under changing climatic conditions.
5. The study stresses the importance of incorporating climate resilience into hydropower infrastructure planning.
6. It concludes that while the West Seti Basin holds strategic significance for Nepal's renewable energy future, it requires adaptive and forward-looking planning to address evolving hydro-climatic uncertainties.

Presentation 3: Understanding the Spring Hydrogeology and Flow Dynamics for Water Security in Nepal's Mid-Hills

Authors: *Rajendra K. Shrestha, Garima Bindari, Divas B. Basnyat, Tara Nidhi Bhattarai, Girish Lamsal and Shreya Bajimaya*

Presenters: *Rajendra Kumar Shrestha and Garima Bindari, NDRI*

Mr. Rajendra Kumar Shrestha and Ms. Garima Bindari presented a preliminary analysis of an ongoing study in Sindhuli District, focusing on spring water systems that are crucial for rural water supply. The study documented 244 springs and integrated field investigations with geospatial and geological analyses. It aimed to identify and delineate springshed areas while piloting socio-technical interventions for spring revival. Below are the highlights of their presentation:

1. The study showcased its key methodological components for the identification and delineation of the springshed that included:
   a. Measurement of spring discharge and hydrograph analysis
   b. Geological mapping and fracture network analysis
   c. Springshed delineation using DEMs and field-based data

2. A major finding indicated that springshed areas are predominantly controlled by subsurface fracture networks rather than surface topography.

3. This underscores the importance of detailed geological field investigations in springshed assessment.

4. The study concludes that effective spring management depends on integrating hydrological and geological perspectives.

5. It further highlights that such integrated approaches are critical for developing sustainable, community-based water management interventions.

Presentation 4: A Spatially Adaptive Bathymetric Correction Framework for Resolving Flow Partitioning and Flood Inundation in Bifurcated Lower Karnali River

Presenter: *Mr. Kumar Aryal, SEN*

Mr. Kumar Aryal presented a study conducted in the Karnali River Basin that focused on developing a spatially adaptive bathymetric correction framework for bifurcated river systems. The study aimed to improve flow partitioning and channel geometry representation in HEC-RAS 2D, generate more accurate flood inundation maps for flood events, and characterise hydraulic regime transitions, including the identification of bank-full thresholds, to enhance overall flood modelling and river system analysis. Below are the key highlights of his presentation:

1. The presentation showed the simulated flood scenarios across multiple return periods (10–150 years), generating improved flood inundation maps.

2. The study addressed and corrected a major issue of flow misrepresentation in bifurcated channels, resolving a 66.5% flow reversal error.

3. It also Identified a bankfull discharge threshold (11,178 m^3/s) indicating transition to floodplain flow.

4. The study observed a stable flow contribution from the Kothiyaghat channel across different scenarios.

5. It found only a 4.93% increase in inundation area between 100- and 150-year flood events, with increased hazard primarily driven by greater depth and flow velocity.

6. The results highlighted the importance of accurate, field-informed bathymetric correction for realistic flood modelling, especially in complex and bifurcated river systems.

Presentation 5: Water Security in Mountain Communities: Integrating Roadside Spring Protection (RoSPro) in Eastern Nepal

Presenter: *Saroj Yakami, GOPA MetaMeta*

Mr. Saroj Yakami presented findings from a project conducted in Dhankuta Municipality and Chhatar Jorpati Rural Municipality that integrates water resource management into road infrastructure development. The project applied the Roadside Spring Protection (RoSPro) approach as an integrated strategy to address water security challenges in mountain communities. Below are the highlights of his presentation:

1. The presentation emphasised that springs are a vital water source for mountain communities, supporting daily needs and livelihoods, but are increasingly under threat from climate change, road construction, and land-use change.

2. The project applied the RoSPro approach, which integrates hydrogeological mapping, socioeconomic assessment of spring sources, participatory co-design with local communities, and a Digital Decision Support System (DSS) based on SPHY modelling.

3. The RoSPro DSS facilitates evidence-based decision-making by empowering local governments and communities, improving transparency and participatory planning, and providing a scalable framework for enhancing water security in mountain regions.

4. The presentation concluded that RoSPro illustrates the importance of integrated, participatory, and data-driven approaches in strengthening water security and resilience.

5. It further highlighted that the approach delivers tangible benefits in terms of water security, livelihoods, and community resilience.

6. The presentation underscored strong potential for scaling such approaches across mountain regions, highlighting the role of digital decision-support tools in enabling locally led, evidence-based, and scalable governance, and calling for collective action to replicate and adapt these integrated approaches for sustainable water futures.

Question and answer session

The question-and-answer session, moderated by Ms. Suchita Shrestha, raised concerns regarding the confidence of models in capturing changing landscapes alongside climate variables. It was clarified that while glacier data is incorporated, the model remains constrained by its reliance on temperature and precipitation inputs. The discussion also highlighted continuous engagement with government stakeholders, with budget limitations identified as a key challenge for scaling the ongoing RoSPro project. In addition, jurisdictional overlaps were emphasised, along with the need for stronger coordination among stakeholders, ensuring municipalities remain central to implementation and that interventions complement government efforts.

Closing Remarks from session chair, Dr. Madan Lal Shrestha

Dr. Shrestha synthesised the session's presentations, emphasising that uncertainty in weather and climate is a defining characteristic of Nepal's water systems and should be viewed as a driver of scientific inquiry rather than a constraint, as it necessitates continuous modelling and deeper understanding of complex systems. He noted that although rainfall variability may appear erratic, it is governed by physical processes, with institutions such as the Department of Hydrology and Meteorology steadily improving forecasting capabilities.

Reflecting on ongoing environmental change, he highlighted glacier retreat and shifts from snow to rain, underscoring their significant implications for water availability and hydropower reliability. He further called for strengthened, institution-led geological mapping efforts in place of fragmented initiatives and stressed the importance of advancing research through emerging tools such as artificial intelligence to improve accessibility and policy relevance. Dr. Shrestha concluded by emphasising the need to translate research into actionable policy to support informed decision-making.

7 Panel Discussion

The panel discussion centred on key issues shaping local water security in Nepal, highlighting the need for integrated, inclusive, and evidence-based approaches. It examined the use of analytical tools and frameworks to better understand complex hydro-social dynamics, as well as the barriers that limit the interaction of research, policy and practice. The session also emphasised the importance of ensuring gender equality and social inclusion in water governance. In addition, it addressed the growing challenges of climate-induced extremes and underscored the importance of nature-based solutions for strengthening resilience across diverse landscapes. The discussion further highlighted gaps in hydro-meteorological services and stressed the need for open and accessible data systems to support informed and inclusive decision-making.

The five panellists (below) expressed their views and opinions on the above-mentioned themes.

1. Prof. Dr. Vishnu Prasad Pandey Executive Director, Center for International Relations, Tribhuvan University, Nepal Professor, Institute of Engineering, Tribhuvan University

2. Dr. Manju Sharma, Senior Sociologist, Department of Water Resources and Irrigation, Government of Nepal

3. Dr. Bishnu Poudyal, Liaison Officer, Green Climate Fund

4. Prof. Dr. Narendra Khanal, Geographer (Watershed Management Planner)

5. Ms. Shanti Kandel, Senior Divisional Meteorologist (Office Chief), Office of Hydrology and Meteorology, Pokhara

The Panel discussion session was moderated by Dr. Divas Basnyat from NDRI. Below is the summary of the panel discussion session:

Prof. Dr. Vishnu Pandey highlighted the importance of applying rigorous analytical tools and approaches to better understand complex hydro-social dynamics and to support evidence-based, inclusive, and locally driven governance. He underscored the challenges of designing effective interventions, noting that there is no universal, one-size-fits-all solution. He further stressed that government-led identification of research needs, combined with demand-driven approaches, helps ensure that research remains aligned with policy priorities and grounded in real-world contexts, thereby enhancing its relevance and uptake of the research findings.

He highlighted the importance of developing context-specific national systems and focusing on critical local realities, including institutional challenges. A major concern raised was the challenge of defining credible evidence in policymaking, alongside the growing problem of "evidence pollution," which undermines trust in scientific outputs. He stressed that rigorous scientific processes, credibility, and strong professional networks are essential for ensuring that evidence meaningfully informs policy and practice.

Panellists noted that while technical tools such as modelling and mapping are useful for understanding systems, there remains a significant gap in community ownership. Even when systems are in place, people often do not feel responsible for them. This highlights the importance of recognising that social systems vary widely and must be approached with critical, context-sensitive perspectives.

Against the backdrop of 2026 World Water Day theme, captured in the slogan "*Where water flows, equality grows*", Dr. Manju Sharma focused on equity and inclusion, particularly the need to bring marginalised communities into the centre of water governance discussions. She emphasised three key priorities: ensuring access to decision-making, understanding disparities across different social groups, and analysing policies through an equity lens. Although formal participation, such as women's representation, has improved in some areas, she noted that meaningful inclusion and empowerment still require significant attention.

Talking about how climate extremes- captured in the "too much water, and too little water" dilemma increasingly threaten local water security, Prof. Dr. Narendra Khanal reinforced the idea that no single model can be universally applied. He pointed out gaps in institutional frameworks, particularly the absence of clear legal responsibility for watershed management in Nepal. He also highlighted the importance of integrating traditional practices, such as rainwater harvesting systems like Patelo, bamboo structures, and ponds, with modern approaches. He stressed that water security must be addressed across micro, meso, and macro levels through stronger institutional linkages.

Prof. Khanal discussed the differences of water-induced disasters across the Himalaya, Mahabharat and Chure ranges, and the Terai. He highlighted shifting precipitation patterns due to climate change, increasing risks of flash floods in mountainous regions, and the growing threat of GLOFs. Nepal's experience with several major GLOF events has led to significant economic losses, particularly in hydropower infrastructure. Although early warning systems exist, their effectiveness is limited by very short lead times and weak transboundary communication, especially between Nepal and neighbouring countries. Regional differences were also noted, with water scarcity in the mid-hills and water management challenges in Nepal's Terai region presenting distinct issues.

Dwelling on the theme of "Observing Today, Protecting Tomorrow" of 2026 World Meteorological Day, Ms. Shanti Kandel discussed the challenges of delivering reliable, timely and accessible hydro-meteorological services. While forecasting accuracy has improved significantly, sometimes reaching around 90 percent, the real issue lies in public trust and action. Limited monitoring infrastructure, high costs, and the country's complex geography make precise predictions difficult. She emphasised that forecasting systems must become more action-oriented and that stronger local coordination and public awareness are necessary to ensure effective responses.

Dr. Bishnu Poudel focused on climate finance and the adaptation gap highlighted in the NDC3 and the NAP. He highlighted that, despite significant global funding opportunities, Nepal struggles to access and effectively utilise climate finance due to weak institutional and financial capacities at the local level. He questioned whether local governments are adequately prepared to meet the requirements of compliance mechanisms such as that of the Green Climate Fund. He stressed better alignment and coherence with national plans and decentralised climate finance flow. Strengthening financial management, project preparation, and governance structures at the local level was identified as a key priority.

Across the discussion, several cross-cutting challenges emerged, including weak coordination between federal, provincial, and local governments, fragmented research efforts, and limited data sharing. Panellists stressed the need for open data systems, improved transboundary collaboration, and stronger integration of research findings into policy and practice. The importance of building local capacity and fostering community ownership was repeatedly emphasised.

During the question-and-answer session, participants raised important concerns about integrating fragmented research, improving decentralisation, strengthening local authority, and enhancing data sharing across borders. Questions were also raised about the adequacy of current investments in high-altitude monitoring and the need to build public trust in climate forecasts.

In conclusion, the panel discussion underscored that water security is an interdisciplinary and collective responsibility that requires coordinated action across all levels. Research output needs to be validated by responsible agencies, and research questions need to be co-produced with the local stakeholders. Locally led adaptation should be prioritised by centering the needs and priorities of local communities, rather than imposing solutions designed at the national level. Solutions must be evidence-based, demand-driven, and adaptable to local contexts. Strengthening governance systems, improving access to climate finance, enhancing research credibility, and building institutional capacity were identified as critical steps forward.

8 Concluding Remarks and Vote of Thanks

Dr. Manohara Khadka, Country Director IWMI-Nepal gave the concluding remarks and thanked all the participants for their active participation. In her concluding remarks, Dr. Manohara Khadka appreciated the efforts of the co-organisers, SIAS, NDRI, SEN, NWCF, IWMI, and ANU, in collaboratively organising the Symposium together with the WECS. She also expressed her thanks to WECS and all Muhan partners for preparing and delivering the Symposium, bringing together diverse stakeholders through three thematic sessions that focused on local hydro-sociology and source restoration, inclusive governance and equitable water access, and analytical tools and frameworks for hydro-social governance. The thematic sessions showcased 15 oral and 10 poster presentations reflecting the depth of transdisciplinary and interdisciplinary research from experienced as well as early-career researchers and practitioners across Nepal's diverse landscapes. The insightful panel discussion that followed the thematic sessions enriched the discussions through rich research and practice-based knowledge and reflections. She stressed that the Symposium became an exemplary collective platform that enabled learning, while co-creating new research ideas and linking scientific knowledge to policy and practices

Key messages

- **Water insecurity is not only a technical challenge, but rather a complex governance issue** rendering exclusionary impacts, especially for women and other socio-culturally marginalised groups. Climate change is impacting water, and it has implications for farmers, women, and men at all levels.
- **Water is not only a resource, but also a human right.** Understanding changing water availability, quality, variability, and the impact of climate change on water systems need an interdisciplinary approach.
- **Managing water resources and water security is a complex issue, and a system/nexus approach is needed for understanding and addressing it**. A holistic understanding of the complex hydro-social dynamics is the cornerstone to addressing water insecurities and exploring context-suited, inclusive, equitable, climate-adaptive, sustainable water management strategies. This requires a

government-led identification of research needs, demand-driven research, and interdisciplinary teams and equitable partnerships in co-designing and conducting research.

- **Experiences of water insecurities vary, diverse and context-suited solutions are needed**: An understanding of water security across the different types of actors/institutions. Similarly, experiences of water security issues vary across the physiographic region. Hence, a uniform solution would not be effective in all regions. Water security should be the agenda at policy, research and implementation levels (national and sub-national level). Scaling solutions and roles of research to assess and validate the achievements and gaps in the policies and practices are important.
- **Gender Equality and Social Inclusion (GESI) issues of water security**: Water policies are in GESI awareness level. While these encourage participation of women and marginalised communities, their involvement is largely tokenistic. Structural barriers such as patriarchal norms, workload, and limited access to resources, information and opportunities prevent women's agency in water management. Gaps in water policies and understanding of these issues hinder GESI transformative actions, pivotal for delivering equality. Intersectional lens is critical for unpacking the differential experiences of water security issues and the exclusion within the excluded groups (Dalit women).
- **Water crisis is a governance crisis**. Once water governance is transformed, society fosters contributing to water security and gender equality, and women and highly marginalised people can benefit from water management. Water governance entails a convergence of formal and informal institutions. While formal institutions are expanding their influences across scales, customary governance continue to play a key role in conflict management, water allocation, irrigation operation, and management.
- **Local governments are the frontline of water security**. However, there are gaps in their capacities and assigned responsibilities. Overlapping roles and poorly coordinated planning add to persisting gaps in policy and practices. The political economy of water security in the context of the implementation of roles/power of the three levels of government in the federal context needs further research.
- **Community-centric nature-based solutions have proven effective** in roadside spring restoration, groundwater recharge, vetiver-based bioengineering, showing strong potential as low-cost, women-friendly, and community-centric options for riverbank stabilisation, ecological restoration, water security, disaster risk reduction, and climate resilience.
- **Scaling is the key to considering proven solutions** and utilising the skills and strengths of public, private, research, communities, and academia. Strong and coordinated **institutional arrangements** are needed for meso-micro-macro level watershed management. Lessons from past practices and initiatives, such as the

revitalisation of terraced agriculture, can contribute to water recharge and improve water and food security.

- **Harnessing climate finance in the water sector**: The water sector is marginalised in climate finance. Consortia of research institutions can be instrumental for priority identification across the provinces and regions, and co-developing proposals targeted at GCF, GEF for resilience/adaptation through water.
- **Interdisciplinary methods** integrating socio-hydrological approach and geohydrological analysis for resource mapping, regular monitoring, and modelling for data-driven source protection and future planning through evidence-informed policy and institutional analyses are important **for climate-sensitive analysis and climate-resilient infrastructure.**
- **Lessons for future collaborative events:** Continuation of the collaborative effort through 2 days event co-organised through shared resources could include more policymakers, the private sector, and implementing agencies and allow time for more reflective and solution-oriented discussions focused on GESI and political economy of water security in the federal context.

Annexes:

Annex 1: Concept Note

Introduction

The National Symposium on 'Transforming Local Water Security: Connecting Research, Action, and Policy' is co-organised by SIAS, NDRI, SEN, NWCF, IWMI, Nepal, and ANU in collaboration with WECS, Nepal.

The symposium is organised on the occasion of NNGWWW 2026, and brings together researchers, practitioners, policymakers, and community-based organisations. The event is organised with financial support from the ACIAR and CSIRO through the "Springwater management, agriculture and resilient livelihoods in the mid-hills of Nepal" (Muhan) project and IWMI-Nepal. The event aims to foster critical dialogue, inspiring interdisciplinary and intergenerational knowledge exchange, and evidence-informed, inclusive, integrated, and sustainable local water governance in the context of accelerating climate change impacts and increasing water insecurities.

The Thematic Focus

Nepal's waterscape is changing and increasingly fragile. Communities depend on diverse water sources - springs, groundwater, and rivers - for drinking, agriculture, and other livelihoods. Climate change, poorly planned development and unsustainable water use practices have, however, disrupted local hydro-social systems. These interconnected challenges are drying up springwater sources, depleting groundwater, increasing water stress, aggravating water-related disasters, and jeopardising life and livelihoods. While water is a key area of research across multiple disciplines, studies often remain fragmented, which has limited research influence on decision-making processes. Similarly, initiatives aimed at addressing the water crisis are often driven by political motives and disconnected from rich traditional knowledge about water management, as well as from evidence-based research insights. The lack of a holistic, multi-level, and interdisciplinary approach has led to short-term fixes rather than long-term sustainable solutions. Consequently, local water management has become precarious, exacerbating water insecurities and intensifying conflicts over access to and control over water resources.

Water insecurity is not only a technical challenge, but rather a complex governance issue rendering exclusionary impacts, especially for women and other socio-culturally marginalised groups. A holistic understanding of the complex hydro-social dynamics is the cornerstone to addressing water insecurities and exploring context-suited, inclusive, equitable, climate-adaptive, sustainable water management strategies. Hence, there is an urgent need to foster critical dialogue among interdisciplinary scholars and practitioners. Such a collaborative platform can be instrumental in bridging the gap between research, action, and policy,

inspiring interdisciplinary and intergenerational knowledge exchange, and facilitating evidence-informed, inclusive, and sustainable local water governance in the context of accelerating climate change impacts and increasing water insecurities.

The **key thematic areas** that the symposium will focus on are:

Theme 1. **Understanding local hydro-sociology and restoring local water sources:** *How have climate change and changing land and water uses impacted local water security and livelihoods? How can such impacts be mitigated?*

- Climate-water- infrastructure nexus
- Hydro-climatic variability, extreme events, monsoon shifts, disasters and impacts on local water availability
- Reviving hydrological systems and restoring local springs for sustainable livelihoods
- Water-Food- Ecosystem nexus and nature-based solutions for resilient water management

Theme 2. **Inclusive local water governance and equitable water access:** *What are the challenges and opportunities to effectively manage water insecurities and related conflicts amid compounded impacts of climate change and urbanisation?*

- Policies and practices for equitable water access, water rights, and gender inclusive decision processes
- Commodification of water, exclusionary impacts, and context-suited innovations
- Water-related conflicts, their management and fostering collective actions
- Inter-governmental coordination, institutional realignment and capacity constraints in local water governance

Theme 3. **Analytical tools, frameworks and approaches for hydro-social water governance:** *What analytical tools, frameworks, and approaches can help unpack hydro-social dynamics and support evidence-informed, inclusive, and locally led water governance?*

- Integrating traditional/local and modern technology for climate-resilient water management
- Technology, inter-generational knowledge and innovation, including the role of DSS, RS, Artificial Intelligence (AI)/Machine Learning (ML) for climate-resilient water governance
- Improved springshed management as a tradition-based and technology-enabled nature-based solution
- Participatory approaches for inclusive, integrated, and climate-resilient water management

Annex 2: Program Agenda

Time	Activities
9:00 - 9:15	Registration and tea
	Opening Session
9:15 - 9:30	Welcome Remarks: Dr. Anushiya Shrestha, SIAS
9:30– 10:00	Keynote Address: Dr. Mandira Shrestha, Board Director, Water Center 21 Pahal
10:00-10:05	Remarks by H.E. Simon Ernst, Australian Ambassador to Nepal
10:05 – 10:15	Remarks by Opening Session Chair: Mr. Tika Ram Baral, Joint Secretary, WECS, Government of Nepal
10:15-10:20	**Group Photo**
	Thematic Session 1: Understanding local hydro-sociology and restoring local water sources (Session Chair: Dr. Shankar Shrestha, NDRI; Moderator: Ms. Shreya Bajimaya, NDRI)
10:20 – 10:25	Brief introduction of the theme and presenters: Moderator
10:25 – 10:33	Terrace farming in the middle hills and water conservation technologies for local water security and community sustainability – Dr. Umesh Parajuli
10:33– 10:41	Beyond quantity: Pesticide pollution as a hidden cause of water bankruptcy in rural Nepal – Dr. Hari Ram Upadhyaya, Rothamsted Research, UK
10:41 – 10:49	Restoring the Chure–Bhabar–Terai Lifeline: Evidence-Based Managed Aquifer Recharge for Local Water Security – Dr. Nirman Shrestha, IWMI
10:49 – 10:57	Strengthening Climate-Resilient Livelihoods Through Riverbank Stabilization and Commercial Utilization of Vetiver Grass in the Mahakali River Basin – Mr. Sandip Poudel, Heifer International
10:57 – 11:05	Assessment of spring water resources and vulnerability mapping of households under changing climatic and socio-economic conditions– Ms. Monika Pandit, IoF
11:05 – 11:20	Question and Answer (Facilitated by session moderator)
11:20 – 11:30	Brief remarks on the papers and theme by the Session Chair
11:30 onwards	**Poster Session (Facilitated by SIAS)**
12:00 – 1:00	**Lunch Break**
	Thematic Session 2: Inclusive local water governance and equitable water access (Session Chair: Dr. Dil Khatri, SIAS; Moderator: Dr. Gyanu Maskey, SIAS)
1:00 – 1:05	Brief introduction of the theme and presenters: Moderator
1:05 – 1:13	Water, Caste, and Control: An Intersectional Analysis of Water and Sanitation Inequality in Malangwa Municipality ward number three – Ms. Sunita Bhukhaju Shrestha, Anahata Nepal
1:13– 1:21	Grassroots Water Diplomacy in the Mid and Low Stream of Mahakali Basin in Kanchanpur District: Women's Roles in Conflict resolution, Cooperation, and Inclusive Transboundary Governance – Mr. Kiran Bhandari, FAO
1:21 – 1:29	The complex web of springwater Institutions in Sindhuli: How are they reshaping water access, livelihoods, and political identities? - Ms. Salu Basnet, SIAS
1:29 – 1:37	Promoting Wetlands as Climate Infrastructure: A Case Study from Bhajani Municipality in Eastern Kailali – Dr. Nirmal Mani Dahal, NWCF
1:37 – 1:45	Hybrid Water Governance in the Babai Irrigation Project: Why Integration Fails and Ambiguity Works – Ms. Jigyasha Rai Yangkhurug, Department of Water Resources and Irrigation
1:45 – 2:00	Question and Answer (Facilitated by session moderator)

2:00 – 2:10	Brief remarks on the papers and theme by the Session Chair	
	Thematic Session 3: Analytical tools, frameworks and approaches for hydro-social water governance **(Session Chair: Dr. Madan Lal Shrestha; Moderator: Ms. Suchita Shrestha, SEN)**	
2:10 – 2:15	Brief introduction of the theme and presenters: Moderator	
2:15 – 2:23	Rain-on-Snow Triggered Supraglacial Lake Drainage in Langtang Valley, Nepal: Sentinel-1 SAR Evidence and CRHM Modelling (2017) – Ms. Bandana Koirala, IoE	
2:23 – 2:31	Climate-Sensitive Hydropower Assessment in the West Seti River Basin Using a Glacio-Hydrological Degree-Day Model – Mr. Manish Praja, KU	
2:31 – 2:39	Understanding Spring Hydrogeology and Flow Dynamics for Water Security in Nepal's Mid-hills – Mr. Rajendra K. Shrestha and Ms. Garima Bidari, NDRI	
2:39 – 2:47	A Spatially Adaptive Bathymetric Correction Framework for Enhancing Flood Governance in the Bifurcated Lower Karnali River – Mr. Kumar Aryal, SEN	
2:47 – 2:55	Water Security in Mountain Communities: Integrating Roadside Spring Protection to improve water security with Local Action in Eastern Nepal – Mr. Saroj Yakami, GOPA MetaMeta	
2:55– 3:10	Question and Answer (Facilitated by session moderator)	
3:10– 3:20	Brief remarks on the papers and theme by the Session Chair	
3:20– 3:30	**Tea Break**	
	Panel Discussion (Moderator: Dr. Divas B. Basnyat, NDRI)	
3:30 – 3:40	Introduction of Panelists	**Panelists** Prof. Dr. Vishnu Prasad Pandey Executive Director, Center for International Relations, Tribhuvan University, Nepal Professor, Institute of Engineering, Tribhuvan University Dr. Manju Sharma Senior Sociologist, Department of Water Resources and Irrigation, Government of Nepal Dr. Bishnu Poudyal Liaison Officer, Green Climate Fund Prof. Dr. Narendra Khanal Geographer (Watershed Management Planner) Ms. Shanti Kandel Senior Divisional Meteorologist (Office Chief) Office of Hydrology and Meteorology, Pokhara
3:40 – 4:30	Moderated discussion	
4:30 – 4:45	Q&A from the audience	
4:45 – 4:50	Key Highlights of the Panel Discussion (Panel Moderator)	
4:50-5:00	**Concluding Remarks and Vote of Thanks on behalf of the co-organizers, Dr. Manohara Khadka, IWMI**	

Annex 3: Participants list

S.N.	Name of the participants	Organisation	Designation
1	Tika Ram Baral	WECS, GoN	Joint Secretary
2	H.E. Simon Ernst	Australian Embassy	Australian Ambassador to Nepal
3	Mandira Shrestha	Water Center 21 Pahal	Board Director
4	Kapil Gyawali	WECS	Sr. Divisional Engineer
5	Sofila Vaidya	Embassy of Australia, Nepal	Programs Manager
7	Yogendra Chitrakar	Ministry of Water Supply	Senior Divisional Engineer
8	Vishnu Prasad Pandey	Center for International Relations, Tribhuvan University	Executive Director & Professor
9	Manju Sharma	Department of Water Resources and Irrigation	Senior sociologist and institutional, social, and GESI expert
10	Bishnu Poudyal	Green Climate Fund (GCF) in Nepal	Country Expert/Liaison Officer
11	Narendra Khanal	Central Department of Geography, Tribhuvan University	Former Professor and Head
12	Shanti Kandel	Office of Hydrology and Meteorology, Pokhara	Senior Divisional Meteorologist
13	Neel Kamal Koju	NAST	Sr. Scientist
14	Rabin Malla	CREEW	Executive Director
15	Jyotsna Lama Khadka	Smart Pani	General Manager

16	Anjil Adhikari	OXFAM	Climate & Water Lead
17	Prachanda Pradhan	The Farmer Managed Irrigation Systems Promotion Trust (FMIST)	Patron
18	Madhav Dhakal	ICIMOD	Senior Intervention Manager – Springs
19	Sijal Pokhrel	UNESCO	Science Officer
20	Bhesh Raj Belbase	Gorkhapatra	Media person
21	Dhiraj Pradhananga	SEN & UNESCO	Executive Director and UNESCO Chair
22	Bhesh Raj Thapa	Universal Engineering College	Principal
23	Dil Khatri	SIAS	Executive Director
24	Anushiya Shrestha	SIAS	Thematic Lead – Water
25	Gyanu Maskey	SIAS	Thematic Lead – Climate
26	Salu Basnet	SIAS	Researcher
27	Aasma Shrestha	SIAS	Knowledge Management Officer
28	Alisha Bhujel	SIAS	Admin and Finance Officer
29	Pradip Dhakal	SIAS	Officer – Admin & IT
30	Samiksha Ghimire	SIAS	Research Intern
31	Shreya Bajimaya	NDRI	SRA
32	Divas Bahadur Basnyat	NDRI	Senior Research Specialist
33	Shankar Shrestha	NDRI	Senior Research Specialist

34	Suchita Shrestha	SEN	Project Lead
35	Madan Lal Shrestha	SEN	
36	Rajendra Shrestha	NDRI	Research Associate
37	Garima Bidari	NDRI	Consultant Research Associate
38	Umesh Parajuli		Consultant Research Associate
39	Nirman Shrestha	IWMI	Researcher
40	Sandip Poudel	Heifer International	Program Officer
41	Monika Pandit	IOF	Student
42	Sunita Bhukaju Shrestha	MPhil Student	Researcher
43	Kiran Bhandari	FAO	Researcher
44	Nirmal Mani Dahal	NWCF	L.G. Expert
45	Jigyasha Rai Yangkhurung	Department of Water Resources and Irrigation	
46	Bandana Koirala	IOE	MSc Student in Climate Change and Development
47	Manish Prajapati	Kathmandu University	MSc Student – Glaciology
48	Kumar Aryal	TU/SEN	Asst. Professor /Researcher
49	Saroj Yakami	GOPA MetaMeta	Country Manager
50	Prabha Mishra	CDES	Student
51	Mandeep Rawat	Teerthanker Mahaveer University, India	Assistant Professor

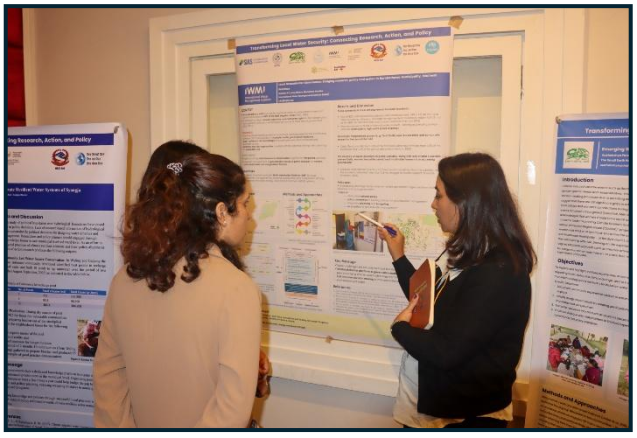
52	Nawraj Bhattarai	Associate Professor, IOE	Presenter
53	Hishila Bajracharya	Kathmandu University	Poster Presenter
54	Sweta Shrestha		
55	Samikshya Gurung	Tri-Chandra Researcher	Researcher
56	Kabin Maharjan		
57	Subhekshya Pandey	SEN	Research Assistant
58	Sumitra KC	IWMI	Researcher
59	Anu Dahal	NWCF	P.O.
60	Laxmi Dutt Bhatta		
61	Shikha Thapa Magar	NDRI	Executive Director
62	Bhawani Shanker Dongol	SEN	Executive Director
63	Manohari Khadka	IWMI	CR
64	Chandra Pandey	Kathmandu University	Associate Professor
65	Anil Aryal	IWMI	Researcher
66	Devaki Kafle	NWCF	Climate Resilient Infrastructure Specialist
67	Saroj Pradhananga	IWMI	Researcher
68	Ratna Pd Lamichhane	DWSSM	DDG

69	Shambhu Dulal	NFIWUAN	Chairman
70	Juri Das	Teerthanker Mahaveer University	Assistant Professor
71	Umesh Chaudhary	IOE	PhD Scholar
72	Ashok Byanju	Dhulikhel Municipality	Ex Mayor
73	Jyoti Prajapati	MoEWRI	S.H.
74	Menuka Karki	KU	Visiting Faculty & Researcher
75	Umesh Balal Magar	NWCF	P.M.
76	Priti Sakha	NWCF	Intern
77	Dipika Tamang	NWCF	Intern
78	Ram B. Karki	NFEDWASUN	T.R.
79	Ganesh Khatiwada	Ecosphere news	Editor
80	Aayosh Niraula	IWMI	Communication Specialist

Annex 4: Posters

S.N.	Title	Authors
1	Assessment of Springs Water quality and the importance of Local government policy for sustainable spring water sources in Kathmandu District, Nepal	Prabha Mishra, Aroma Technologies
2	Water Footprint and Sustainability Metrics in Commercial Fruit Production	Mandeep Rawat and Juri Das, Teerthanker Mahaveer University
3	Impact of Climate Change on Hydro-power Generation: A Case Study of Kulekhani First Hydro power Station in Nepal	Mukesh Regmi, Nawraj Bhattarai and Khem Narayan Paudyal, Institute of Engineering
4	Assessment of Trakarding, Trambau Glaciers and Tsho Rolpa Glacial Lake, Dolakha, Nepal in the Context of Climate Change	Hishila Bajracharya, Prashna Shrestha, Rijan Bhakta Kayastha, Rakesh Kayastha, Kathmandu University
5	Assessing Downstream Risk from Glacial Lake Outburst Floods (GLOFs): A Case Study of Thulagi and GL087945E27781N Glacial Lakes, Nepal.	Sweta Shrestha
6	Bridging the Flow: Socio-Economic Vulnerability and the Imperative for Inclusive Water Governance in the Lower Karnali Watershed, Nepal	Samikchhya Gurung
7	Declining Springs, Increasing Conflicts: Hydro-social Dynamics and Polycentric	Kabin Maharjan
8	Emerging Women's Narratives of River and Flood through Participatory Art Workshop in Lower Karnali Region, Nepal	Suchita Shrestha and Subhekshya Pandey, SEN
9	Local groundwater governance: Bridging research, policy and action for in Barahathawa Municipality, Madhesh Province	Sumitra KC, Manohara Khadka, Anuj Mishra, IWMI
10	Strengthening Local Water Governance: A Case of Climate Resilient Water Systems of Syangja	Anu Dahal, NWCF

Annex 5: Some glimpses of the event




Key Findings
and
Conclusion
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A Child Fell Into the Open Drain
Systemic Neglect
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Thematic Session 2: Inclusive local water governance and equitable water access
Session Chair: Dr. Dil Khatri, SIAS
Moderator: Dr. Gyanu Maskey, SIAS
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A National Symposium
Transforming Local Water Security: Connecting Research, Action, and Policy
Thematic Focus
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