

PROCEEDINGS OF IRRIGATION SEMINAR 2025: WATER FOR AGRI FOOD SYSTEM TRANSFORMATION

Government of Nepal
Ministry of Energy, Water Resources and Irrigation
Department of Water Resources and Irrigation



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Proceedings of Irrigation Seminar 2025: Water for Agri Food System Transformation

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Editorial Team

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Ms. Ezee G.C.

Mr. Birendra Kumar Yadav

Ms. Manju Kawan

Ms. Sushma Chaudhary

Ms. Palpasa Maharjan

Ms. Shanti Satyal

Organizer





Government of Nepal
Ministry of Energy, Water Resources and Irrigation
Department of Water Resources and Irrigation
Jawalakhel, Lalitpur



5-437136
5-437137
5-437313
5-437219
5-437311
5-437312
5-437308
5-437306
5-437302

Ex:- 5-435382
5-427442

R.F No.:

C.No.:

Fax+ 977-01-5437169

Web: <https://www.dwri.gov.np>

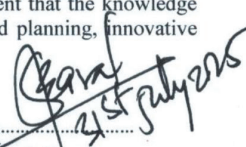
FOREWORD

It gives me great pleasure to present the Proceedings of Irrigation seminar 2025 titled **Water For Agri-food System Transformation**, jointly organized by the Department of Water Resources and Irrigation (DWRI), International Commission for Irrigation and Drainage (ICID), Nepal National Committee on Irrigation and Drainage (NENCID), Consortium of International Agricultural Research Centers (CGIAR), The International Water Management Institute (IWMI), and the Centre for Applied Research and Development at the Institute of Engineering (CARD/IoE). This collaborative effort brings together a broad spectrum of professionals and stakeholders committed to transforming Nepal's agri-food systems through sustainable irrigation and integrated water management.

Irrigation is more than just a means to watering crops—it is a strategic asset for achieving national food security, economic resilience, and inclusive development. In Nepal, where agriculture remains a backbone of livelihoods and a cornerstone of the economy, ensuring reliable, efficient, and timely irrigation services is fundamental. However, with the increasing challenges posed by climate change, resource scarcity, fragmented planning, and infrastructure inefficiencies, a paradigm shift is essential. We must rethink how we manage, invest in, and integrate water resources with agriculture to ensure our systems are productive, resilient, and equitable.

This seminar serves as a platform for reflection, dialogue, and action. It aimed promoting synergy between the irrigation and agriculture sectors, enabling informed policymaking, encouraging evidence-based practices, and aligning sectoral strategies with Nepal's development priorities and global commitments—particularly the Sustainable Development Goals (SDGs 1, 2, and 6). Through focused discussions on efficient water use, climate-smart agriculture, inclusive services, and enabling institutional frameworks, we hope to foster a shared understanding and commitment toward resilient and productive farming systems.

I extend my sincere appreciation to all the partners and participants whose expertise and dedication have enriched this seminar. Your insights, experiences, and recommendations are vital to shaping the future direction of irrigation and agri-food system transformation in Nepal. I am confident that the knowledge generated and shared through this forum will contribute significantly to informed planning, innovative solutions, and sustainable progress in the sector.


(Sanjeeb Baral)
Director General
31st July, 2025
Director General

"Professional and Creative Administration : Development, Prosperity and Good Governance"

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ACRONYMS

BBDMP	Bheri Babai Diversion Multipurpose Project
CARD	Centre for Applied Research and Development
CIAA	Commission for the Investigation of Abuse of Authority
DoA	Department of Agriculture
DWRI	Department of Water Resources and Irrigation
FANSEP	Food and Nutrition Security through Sustainable Agriculture
FMIS	Farmer Managed Irrigation Systems
GDP	Gross domestic product
IoE	Institute of Engineering
ICID	International Commission for Irrigation and Drainage
ICWMP	Integrated Crop and Water Management Program
IMEP	Irrigation Modernization Enhancement Project
IWMI	International Water Management Institute
JICA	Japan International Cooperation Agency
MIIP	Mechanized Irrigation Innovation Project
MIP	Mahakali Irrigation Project
MoEWRI	Minister for Energy, Water Resources, and Irrigation
NARC	Nepal Agricultural Research Council
NENCID	Nepal National Committee on Irrigation and Drainage (NENCID)
NGOs	Non-Governmental Organizations
NPC	National Planning Commission
PMAMP	Prime Minister Agriculture Modernization Project
PPP	Public Private Partnership

PSC	Public Service Commission
RJKIP	Rani Jamara Kulariya Irrigation Project
SDG	Sustainable Development Goals
SIP	Small Irrigation Project
TU	Tribhuvan University
WECS	Water and Energy Commission Secretariat
WUA	Water User Associations

1. Background

Irrigation serves as a foundational pillar for agriculture, food security, and economic development. In Nepal, where agriculture provides livelihoods for a substantial proportion of the population and contributes approximately 25% to the national gross domestic product (GDP), the availability of timely, reliable, and efficient irrigation is not merely supportive but imperative. Beyond its role as a production input, irrigation is transformative, reshaping agri-food systems, enhancing environmental sustainability, strengthening economic resilience, and fostering synergies across water, food, energy, land, and ecosystems.

However, emerging challenges such as climate change, escalating water scarcity, and suboptimal water use underscore the need for a paradigm shift in how irrigation and broader water resources are governed. Achieving high water productivity by improving irrigation efficiency and integrating irrigation with sustainable agricultural practices is essential to safeguard food systems and catalyze inclusive economic growth.

Given Nepal's vulnerability to climatic variability, aging irrigation infrastructure, and lack of coordination between the agriculture and irrigation sectors, the nation continues to face persistent barriers to enhancing agricultural productivity and ensuring food security. These complex challenges call for a systemic and transformative approach to irrigation and water governance, aligned with a holistic vision for agri-food systems transformation that secures long-term food sovereignty and resilient agricultural growth.

Strengthening agricultural extension systems and ensuring equitable access to affordable, high-quality agricultural inputs are vital for developing inclusive, climate-resilient farming landscapes. While irrigation expands cropping potential, its true impact is realized only when paired with improved agronomic practices, post-harvest technologies, institutional reform, supportive policy frameworks, and robust market connectivity. Strategic investments in integrated irrigation-agriculture planning will not only increase food production but also contribute to poverty reduction, improved rural livelihoods, inclusive development, and sustained national economic advancement.

This seminar was jointly organized by the Department of Water Resources and Irrigation (DWRI) in collaboration with the Nepal National Committee on Irrigation and Drainage (NENCID), The International Water Management Institute (IWMI), and the Centre for Applied Research and Development (CARD) at the Institute of Engineering (IoE).

2. Objectives

The primary objective of the seminar was to explore the critical importance of water in achieving sustainable agricultural development, ensuring food security, and promoting inclusive and equitable growth. The event convened a diverse range of stakeholders including policymakers, researchers, practitioners, development partners, and civil society actors to identify opportunities and co-develop strategies for improving irrigation access and efficiency. Emphasis was placed on creating effective linkages between irrigation and agriculture to enable transformative shifts in Nepal's agri-food systems.

Specific objectives included:

- To identify opportunities and challenges in fostering collaboration between the irrigation and agriculture sectors and to share innovative practices where water plays a significant role in agri-food transformation.
- To deliberate strategic approaches that strengthen coordination and constructive collaboration between irrigation and agricultural development, with a focus on achieving food security, inclusive economic growth, climate resilience, and sustainable rural livelihoods.

This seminar aimed at aligning interventions with Nepal's national priorities on agriculture and water, while also contributing to global commitments such as the Sustainable Development Goals (SDGs)—specifically SDG 1 (No Poverty), SDG 2 (Zero Hunger), and SDG 6 (Clean Water and Sanitation).

3. Participants

The seminar engaged a broad spectrum of participants, including:

- Government officials and policymakers from the National Planning Commission, Ministry of Energy, Water Resources and Irrigation, Department of Water Resources and Irrigation, Water and Energy Commission Secretariat, Water Resources Research and Development Centre, Ministry of Agriculture and Livestock Development, Department of Agriculture, Provincial and Local Governments, and related institutions.
- Researchers and academics from universities and think tanks, representatives from international organizations, development partners, and the private sector.
- Representatives from Water User Associations (WUAs), non-governmental organizations (NGOs), and civil society working at the intersection of irrigation, agriculture, and rural development.

4. Content of the Seminar

The main theme of the seminar was “Transforming Nepal’s Agri-Food Systems through Sustainable Irrigation and Water Management.” The whole program was divided into five sessions, viz:

- i. The Opening Session
- ii. Session 1 (Panel Discussion)
Irrigation for Food Security: Key Practices and Bottlenecks
- iii. Session 2 (Group Work)
Identifying Pathways for Synergizing the Interventions of Irrigation and Other Agricultural Inputs for Food Security
- iv. Session 3 (Panel Discussion)
Way Forward – Translating the Pathways (Developed in Group Work) into Action
- v. Closing Session

5. The Opening Session

The opening session of the seminar was chaired by Mr. Sanjeeb Baral, Director General of the Department of Water Resources and Irrigation (DWRI). The event was graced by Hon’ble Dipak Khadka, Minister for Energy, Water Resources, and Irrigation (MoEWRI), who served as the chief guest. Distinguished special guests included Prof. Dr. Shiva Raj Adhikari, Hon’ble Vice Chairman of the National Planning Commission (NPC); Mr. Madhav Belbase, Hon’ble Member of the Public Service Commission; Mr. Suresh Acharya and Ms. Sarita Dawadi, Secretaries at MoEWRI; Dr. Govinda Prasad Sharma, Secretary at the Ministry of Agriculture and Livestock Development (MoALD); Mr. Madhu Prasad Bhetuwal, Secretary of the Water and Energy Commission Secretariat (WECS); Dr. Marco Arcieri, President of the International Commission for Irrigation and Drainage (ICID); and Dr. Mark Smith, Director General of the International Water Management Institute (IWMI).

The seminar commenced with a symbolic gesture of environmental consciousness, as Hon’ble Minister Dipak Khadka formally inaugurated the event by watering a plant. This was followed by the collective singing of the national anthem by all participants, setting a tone of unity and purpose.

Mr. Mitra Baral, Deputy Director General of DWRI, delivered the welcome address and outlined the objectives of the workshop. In his remarks, he

emphasized the crucial linkages between irrigation, environmental sustainability, economic growth, and food security. Highlighting the pressing challenges posed by climate change, he stressed the importance of efficient water use in irrigation practices. Mr. Baral further noted that the seminar provided a vital platform for stakeholders to discuss strategies aimed at transforming agri-food systems. He underscored the need to prioritize climate-resilient irrigation policies and to empower farmers as central agents of change. Concluding his address, he called for the adoption of integrated water resource management practices that align with the broader goals of sustainable development.

Following the inauguration of the seminar, a series of keynote speeches were delivered by distinguished guests, beginning with Prof. **Dr. Shiva Raj Adhikari**. In his address, Dr. Adhikari provided critical insights into the national economy and underscored the pivotal role of the agricultural sector. He observed that although the post-pandemic economic recovery remains sluggish and the contribution of agriculture to GDP is declining, the sector's value addition has been increasing, demonstrating its relative stability compared to more volatile non-agricultural sectors.

Drawing from empirical data, he noted that agricultural value addition has risen by 52 percent over the past 15 years. Emphasizing the importance of maximizing public returns on irrigation investments, he advocated for controlling land fragmentation and discouraging the conversion of agricultural land for non-agricultural purposes. Dr. Adhikari concluded by reaffirming that agriculture is not only the backbone of the national economy but also foundational to other sectors. He emphasized that fostering synergy and strategic value trade-offs across all sectors is essential to achieving long-term food security. The major takeaways of his speech were that the underperformance of Nepal's agricultural sector is a national development challenge and sectoral integration is essential to transform agriculture from subsistence to enterprise and fuel inclusive growth. Finally, he stated that agriculture must work in synergy with infrastructure, industry, education and environmental management. Similarly, integrated planning and localized implementation are key to unlocking agriculture's full potential.

The second keynote speech was delivered by **Dr. Mark Smith** on the theme, *"How Can Water Systems Facilitate Agri-Food System Transformation: Experiences from Research for Development."* Dr. Mark Smith's presentation explores how water systems can drive the transformation of agri-food systems, particularly under the pressures of climate change, water insecurity, and socio-economic vulnerabilities. Dr. Smith opened his remarks by emphasizing the need to move beyond outdated assumptions and adopt a paradigm shift in response to

escalating climate change scenarios. Citing his 2024 research, he highlighted that the global hydrological cycle is increasingly destabilized, posing a significant threat to an equitable and sustainable future. About food and water scarcity in Nepal, Dr. Smith stated that food systems in Nepal are stressed by urbanization, outmigration, and poor market access, Nepal's agricultural dependency on foreign markets increased 5-fold (2009–2018) and climate projections show rising temperatures (1.5–4.6°C by 2100) and erratic precipitation.

In addressing interconnected global challenges, he referred to as five “wicked problems”: hunger, poverty, ecosystem degradation, climate change beyond 2°C, and deep uncertainty. He underscored the urgent necessity of addressing negative externalities arising from water misuse and pollution, framing these as critical challenges for contemporary water management. Symbolically referring to water as the “teeth and claws” of climate change, Dr. Smith emphasized the intensifying impact of climate-induced disruptions on water systems. He pointed out that the consequences are disproportionately borne by vulnerable populations, particularly farming communities, women, and marginalized groups. Strengthening the capacity and resilience of these groups, he argued, is essential for mitigating the broader impacts of climate change on the agricultural sector and ensuring a more inclusive and adaptive agri-food system transformation.

The final keynote speaker of the session was **Dr. Marco Arcieri**, who presented on the topic *“How the Challenges of Coherent Interventions in the Agriculture and Irrigation Sectors Can Be Translated into Opportunities: Learnings from Various Regions Across the Globe.”* Dr. Arcieri opened by framing global agriculture within a moment of profound uncertainty. He highlighted the pressing challenge of feeding a growing global population expected to reach nearly 10 billion by 2050 while grappling with 20% less arable land per capita. Agriculture must produce 50% more food by 2030 and double output by 2050. Dr. Arcieri addressed the increasing need for higher agricultural productivity per hectare, driven by rapid urbanization, changing dietary patterns, and the compounding effects of climate change and water scarcity.

He emphasized that these challenges could be transformed into opportunities through strategic interventions. Key among his recommendations were improving irrigation efficiency through the correct timing and application of water and promoting innovation in water conveyance systems such as the incorporation of canal lining, pipelines and aqueduct restoration, photo-voltaic powered gates and sluices, automated delivery systems such as “Irri frame”, electronic card-based remote water distribution and remote monitoring and emergency alerts. According to Dr. Arcieri, the adoption of such technologies has demonstrated up

to 30% water savings and significantly enhanced irrigation efficiency in practice. The major takeaways of Dr Arcieri's speech are that the integration of modern irrigation technologies, efficiency practices, and alternative water sources is crucial, solutions must be context-specific, climate-resilient, and supported by institutional innovation, and global examples prove that even under crisis, innovation and informed interventions can turn challenges into opportunities.

After the Keynote speeches, there were remarks from the distinguished guests in the seminar. A five-minute time frame was provided for each speaker in this time slot. First to present his remarks was **Dr. Govinda Prasad Sharma**. Dr. Sharma opened his remarks by highlighting the fact that the Department of Agriculture and the Department of Water Resources and Irrigation have a long history of collaboration and the development of agriculture is impossible without this collaboration. He also gave emphasis to working hard to make water accessible year-round in agricultural lands with irrigation facilities. He focused that the government agencies who are directly responsible for upgrading agricultural sector in Nepal should work together for increased productivity. For this, the short-term and long-term studies should be carried out to address the issues such as defunct tube wells in the terai regions, water recharge issues, and so on. He also stated that we have not thought about the post-harvest water need which should be addressed in the future planning process.

The second set of remarks was delivered by Hon'ble Minister **Dipak Khadka**. He underscored the importance of the multipurpose use of water, emphasizing that water must be managed and utilized efficiently. Considering the increasing impacts of climate change in recent years, irrigation has become more critical than ever. Minister Khadka highlighted that irrigation extends beyond the construction of canals and infrastructure, it also involves empowering farmers to use water effectively and to enhance their agricultural livelihoods. He stressed the necessity of collaborative efforts among all stakeholders and reaffirmed the Ministry's strong commitment to working in close partnership with farmers and relevant actors to achieve sustainable outcomes. Concluding on a hopeful note, he stated, "Let's use water not just to grow crops, but also to grow health, hope, and hospitality."

The third remarks were provided by Secretary **Ms. Sarita Dawadi**, who began by asserting that irrigation is not an isolated sector but one that is essential for resilience and livelihoods. She noted that the regional and seasonal variability of water resources necessitates the advancement of technologies, institutional reforms, and robust stakeholder commitment. For the sustainable development of the irrigation sector, she emphasized the need to place farmers at the center of policy and implementation efforts, with particular attention to enhancing

the capacities of women and marginalized communities. Secretary Dawadi also highlighted the importance of multi-stakeholder engagement, involving government bodies, inter-agency coordination, private sector participation, and international development partners. She concluded by emphasizing that the development of irrigation must address not only technical aspects but also social and institutional dimensions to ensure long-term sustainability.

The fourth remarks were provided by Hon'ble **Madhav Belbase**, who began by asserting that the vital nexus between water and food, a relationship deeply rooted in human history but increasingly urgent in the context of climate change. He emphasized that, despite its importance, water is often overlooked in climate change discussions and called for this gap to be addressed both globally and in Nepal. To institutionalize this approach, he proposed transforming Nepal's Water and Energy Commission into a Water and Climate Change Commission, reflecting the need for integrated solutions.

He highlighted the importance of fully implementing basin-level plans and adopting a new approach to irrigation one that blends traditional knowledge with modern technologies such as drones, AI-based design, pre-cast canals, rubber lining, and laser-guided systems. He also suggested multi-functional infrastructure, such as installing solar panels over canals and integrating fisheries. Belbase advocated for treating irrigation systems as industries, promoting commercialization and cooperative models that connect farmers directly to consumers, avoiding intermediaries. Finally, he raised concerns about groundwater depletion along Nepal's borders due to overextraction and proposed a joint study with IWMI to address transboundary water issues, especially groundwater.

The last remarks were delivered by **Mr. Sanjeeb Baral** who asserted that agriculture remains the backbone of Nepal's economy and livelihoods. Considering increasing water demand and climate-related pressures, he underscored the urgent need for a strategic shift in resource planning and allocation to ensure sustainable agricultural growth. He emphasized that water security is central to achieving the nation's long-term development vision, particularly in relation to food security, economic resilience, and rural transformation. To realize this vision, the speaker called for substantial investments in irrigation infrastructure to bring all irrigable land under reliable water supply. Referencing national frameworks such as the Irrigation Master Plan and the newly endorsed National Irrigation Policy 2080, the Mr. Baral highlighted their role in guiding efforts toward equitable access to irrigation, enhanced water storage, and integrated water resource management.

A key priority, he noted, is the modernization of Farmer Managed Irrigation

Systems (FMIS), which are essential for improving service delivery, water use efficiency, and climate resilience. The adoption of canal lining, automated gates, and other efficiency-enhancing technologies was cited as critical for reducing water losses. However, the speaker cautioned that technological and physical improvement alone are insufficient. He called for strengthened collaboration across institutions and sectors, emphasizing the need for integrated planning, joint management and monitoring mechanisms, and the empowerment of Water Users Associations (WUAs) as key actors in governance and local ownership. In closing, Mr. Baral recognized the seminar as a valuable platform for dialogue, knowledge exchange, and cross-learning, encouraging stakeholders to leverage such forums to accelerate progress toward a more inclusive, efficient, and climate-resilient irrigation sector.

6. Session 1 – Panel Discussion

“Irrigation for Food Security: Key Practices and Bottlenecks” was the theme of panel discussion in session 1. Mr. Nabin Chandra Adhikari, Project Director of Kaligandaki Tinau Diversion Multipurpose Project facilitated the discussion. First of all, the primer presentation was carried out by Mr. Tika Ram Baral, Joint Secretary, WECS. The topic of his presentation was “*Synchronizing Efforts of the Irrigation and Agriculture Sectors for Improved Agriculture Productivity.*”

Mr. Tikaram Baral highlighted the importance of transforming successful collaborative initiatives between the irrigation and agriculture sectors into structured program modes to ensure better integration and long-term sustainability. He emphasized the need to revise the Integrated Crop and Water Management Program (ICWMP), underscoring its critical role in facilitating high-level coordination and joint implementation at the grassroots level. Mr. Baral also addressed ongoing policy dilemmas, particularly the difficulty in balancing target-based objectives with crop- and area-specific interventions, which can impede effective policy execution. He discussed the constitutional arrangements that define the roles of federal, provincial, and local governments in managing irrigation and agriculture, including responsibilities related to land use planning and natural resource conservation. In outlining the core objectives of project development, he emphasized investment in irrigation scheme modernization, agricultural production support, and the strengthening of water user associations. To illustrate the benefits of coordinated action, Mr. Baral referenced case studies such as TCP-PIAT, which demonstrate the value of synchronized efforts between the irrigation and agriculture sectors in achieving improved and sustainable outcomes.

The panelist of the discussion included Dr. Bimala Rai Paudyal, honorable

member National Assembly, Federal Parliament of Nepal and Former Minister of Foreign Affairs, Mr. Susheel Acharya, Joint Secretary, MoEWRI, Mr. Prakash Sanjel, Director General, DOA, and Dr. K Yella Reddy, Former Vice President, ICID.

Dr. Bimala Rai Paudyal highlighted persistent structural challenges that hinder the effectiveness of investments in agriculture and irrigation. These include geographical constraints that limit the feasibility of large-scale projects, fragmented planning across sectors, and donor support that often fails to align with national priorities. She emphasized that smallholder farmers, particularly women and marginalized communities, continue to face significant obstacles in attaining food and nutrition security. To bridge these gaps, Dr. Paudyal advocated for a coherent policy and institutional framework that integrates agriculture and irrigation, promotes stronger public-private partnerships, and empowers local governments with greater authority and capacity. She underscored the importance of adopting a farmer-centric and context-sensitive approach, incorporating low-cost technologies, evidence-based planning, and a cultural shift toward collaboration and long-term thinking, all underpinned by robust research and development initiatives.

Mr. Prakash Sanjel, Director General of the Department of Agriculture (DoA), underscored that food security is a collective responsibility that relies on the coordinated application of multiple agricultural inputs, with reliable irrigation being a critical component. He acknowledged that inter-agency collaboration, particularly with the Department of Water Resources and Irrigation (DWRI), has shown significant improvement in recent years, as evidenced by joint recent initiatives such as the Rani Jamara Kulariya Irrigation Project, MIIP and IMEP. Mr. Sanjel stressed the importance of expanding spring paddy cultivation and addressing the approximately 20% cultivable land that remains fallow due to inadequate irrigation services. To enhance agricultural productivity, he advocated for the prioritization of efficient on-farm water management, and increasing the irrigation use efficiency, the integration of agricultural services at the local level through a single-window delivery mechanism, and the development of secondary and tertiary canal networks to ensure timely and equitable water distribution. Lastly Mr. Sanjel emphasized the importance of developing permanent infrastructure in command areas exceeding 10,000 hectares, proposing the implementation of targeted programs in these regions. This initiative is viewed as a promising step toward advancing agricultural development.

Mr. Susheel Acharya underscored that although the Ministry of Agriculture and the Ministry of Energy, Water Resources, and Irrigation (MoEWRI)

share aligned objectives, their initiatives often operate in silos, diminishing overall effectiveness. He pointed out that reliable and timely water delivery is fundamental to successful agricultural interventions. However, only 1.5 million hectares of Nepal's 2.5 million hectares of irrigable land currently have access to irrigation services. He further identified key challenges such as seasonal water variability, inefficient service fee collection, institutional fragmentation, and inadequate agricultural extension services. To overcome these barriers, Mr. Acharya advocated safeguarding agricultural land from non-agricultural use, ensuring accountability within the irrigation department for consistent water delivery, and establishing formal coordination platforms such as integrated Agricultural Service Centres to connect irrigation systems with comprehensive agricultural support at the local level.

Dr. K. Yella Reddy, Former Vice President of the International Commission on Irrigation and Drainage (ICID), shared global perspectives drawn from ICID's extensive work, highlighting the critical role of integrated irrigation and agricultural strategies in achieving food security. Citing India's successful transition from famine to food self-sufficiency, he underscored the need to properly value water resources, implement people-centric development models, and scale up proven innovations such as micro-irrigation technologies. He inserted that Nepal has very pleasant climate, and a huge source of water and thus the country has great potential of agriculture and export the produce to other countries as well. Based on international experiences, Dr. Reddy advocated for incentivizing water use efficiency, establishing agricultural infrastructure funds, engaging youth through educational reforms, and strengthening the role of women in water governance and management.

7. Session 2: Group Work

Session 2 of the seminar had group work on the topic of "*Identifying pathways for synergizing the interventions of irrigation and other agricultural inputs for food security.*" The session was facilitated by Dr. Santosh Nepal, Researcher of Water Resources and Climate Change, IWMI. Participants voluntarily divided themselves into groups aligned with the four key segments: Policy, Institution, Research and Practice. To guide the discussions, a set of focused questions was provided.

Group 1: Policy Coherence

The objective of this group was to identify opportunities for harmonizing irrigation, agriculture and climate policies for strengthening agri-food systems. The key questions for discussion were: i) Where do current policies conflict or overlap?, ii) What policy incentives could more effectively integrate irrigation,

seed, fertilizer, and market access?, iii) Are there any good practices and examples of integrated policies between irrigation and agriculture that have reformed the agricultural sector?, iv) How can financial resources be leveraged to enhance agricultural productivity and food security and how can policy support and enable this process?

The group acknowledged that, although some coordination practices are in place, significant institutional barriers remain, primarily due to inadequate documentation and the lack of formalized coordination mechanisms. To address these challenges, they proposed the establishment of a quasi-institutional framework that would integrate Water Users' Associations (WUAs), agricultural cooperatives, and farmers' groups into a unified structure aimed at streamlining service delivery. Strengthening local institutions was deemed essential, with particular emphasis on enhancing market access, improving post-harvest management, and developing long-term storage infrastructure. At all levels of governance, the group advocated for targeted capacity-building initiatives linked to collaborative performance indicators. Additionally, they recommended reviving the practice of joint draft plan preparation, bringing together irrigation, agriculture, and financial institutions, prior to the finalization of sectoral plans, in order to ensure alignment and synergy across sectors.

Group 2: Institutional Strengthening

The objective of group was to explore institutional roles, coordination mechanisms, and capacity-building needs to strengthen agri-food system. The key questions for discussion were: i) What are the major institutional barriers to coordinated irrigation-agriculture sector?, ii) How can local institutions (eg. WUAs, agri cooperatives) be empowered? And iii) What capacities are most urgently needed at the federal, provincial and local levels to improve agricultural productivity and strengthen the agri-food system?

The group observed that irrigation, agriculture, and climate-related policies in Nepal frequently function in silos, characterized by overlapping institutional mandates, inconsistent data systems, and fragmented service delivery mechanisms. A significant gap in coordination was noted between key actors such as agricultural cooperatives and Water Users' Associations (WUAs), compounded by the absence of a unified monitoring and service delivery framework. To enhance policy integration and operational coherence, the group recommended the consolidation of farmers' groups and WUAs, the digitalization of agricultural and water management services, and comprehensive reforms in subsidy mechanisms. Successful initiatives—such as the Rani Jamara Kulariya Irrigation Project, the Irrigation and Water Resources Management Project, and the Climate Smart Villages program—were cited as exemplary models of

coordinated policy implementation. For improved resource mobilization, the group proposed strategies including co-financing arrangements with the private sector, the promotion of public-private partnerships (PPPs), and the formalization of contractual agreements among cooperatives, farmers, and investors to strengthen accountability and attract long-term, sustainable investment.

Group 3: Role of research and Innovation

The objective of this group was to define the contribution of research to evidence-based solutions and technological advancements to transform agri-food systems. The key questions of the discussion were but not limited to i) What research gaps exist in understanding irrigation-agriculture linkages?, ii) How can innovations (digital tools, soil moisture sensors, forecasting) improve food security to transform agri-food systems?, iii) What models can support collaborative research between academia, government and communities?

The group identified several critical research gaps, including the weak linkage between irrigation and agricultural practices, limited climate-adaptive research, and inadequate integration of demand-supply trends in planning and implementation. To address these issues and foster technology adoption, they underscored the importance of conducting in-field demonstrations to build trust among farmers. In the pursuit of enhanced food security, the group recommended the adoption of innovative technologies such as soil moisture sensors, forecasting tools, and digital decision-support systems, including SCADA and now-casting tools to enable evidence-based decision-making. They advocated for the development of collaborative research models, including citizen science initiatives, autonomous research institutions, and improved information systems, to strengthen the interface among academic institutions, government agencies, and local communities. The Department of Water Resources and Irrigation (DWRI)'s initiative to fund student research was highlighted as a commendable example of fostering applied research in the sector.

Group 4: Strengthening Practices

The objective of group was to identify on-ground strategies that integrate irrigation with other agri-inputs for productivity and resilience. The key questions for discussion were: i) What practices (irrigation methods, cropping patterns, on-farm management, etc) have proven most effective in increasing productivity and water efficiency?, ii) How can climate-smart and inclusive practices be mainstreamed? And iii) What are the gaps in scaling successful models to transform agri-food system?

The group identified several effective field-level strategies that contribute to improved agricultural and irrigation outcomes, including micro and

solar irrigation systems, lined canals, piped water distribution, watershed conservation, and soil health enhancement. They stressed the importance of integrating post-harvest management with market linkages and advocated for the promotion of women-friendly technologies, such as solar-powered grids and custom hiring centers. To mainstream climate-smart agricultural practices, the group recommended interventions such as optimized irrigation scheduling, regular field-level data updates, conservation-oriented farming, and increased mechanization. However, they also recognized significant challenges in scaling these successful models. Key barriers include weak policy enforcement, inadequate infrastructure and data systems, limited engagement of youth, and poor dissemination of proven practices such as those implemented under the Prime Minister Agriculture Modernization Project (PMAMP).

8. Session 3: Panel Discussion

“Way Forward – Translating the Pathways (Developed in Group Work) into Action” was the topic of the second panel discussion in the third session of the seminar. Prof. Dr. Vishnu Prasad Pandey, Director, CARD, IoE/TU facilitated the discussion. The panelists included Mr. Sanjeeb Baral, Director General, DWRI, Dr. Sabnam Shivakoti, Joint Secretary, MoALD, Dr. Ganesh Raj Joshi, Agri Economist and former Secretary, former Commissioner, CIAA, and Dr. Bhes Raj Thapa, Water Resources Expert, Associate Professor and Principal at Universal Engineering and Science College.

Mr. Sanjeeb Baral underscored the significance of intersectoral collaboration by referencing successful models such as the Rani Jamara Kulariya Irrigation Project (RJKIP), which has led to notable improvements in both cropping intensity and water-use efficiency. He outlined DWRI's current efforts to replicate this integrated approach in other major initiatives, including the Mahakali Irrigation Project (MIP), the Bheri Babai Diversion Multipurpose Project (BBDMP), and the third phase of RJKIP. However, Mr. Baral stressed that achieving systemic impact requires moving beyond isolated project-level achievements toward programmatic transformation that encompasses both government-led and donor-supported initiatives. He further argued that effective collaboration must not be limited to irrigation and agriculture alone but must also encompass complementary sectors such as land management, labor, and market systems to foster broader economic resilience and improve rural livelihoods. He emphasized the importance of documenting existing best practices in intersectoral collaboration as a critical step toward developing a comprehensive national roadmap for the transformation of Nepal's agri-food system.

Dr. Sabnam Shivakoti acknowledged the institutional challenges that prevent full structural integration between sectors such as agriculture and irrigation. However, she advocated for the establishment of quasi-institutional arrangements and collaborative operational models, particularly at the local level, as pragmatic solutions to enhance coordination. Dr. Shivakoti pointed to successful initiatives such as Gandaki Province's land consolidation program and integrated planning under projects like the Irrigation and Water Resources Management Project (IWRMP) and RJKIP, which have demonstrated measurable impact through joint implementation. She emphasized the necessity of conducting collaborative research and assessments, particularly in on-farm water management and water-use efficiency, to optimize the utility of existing infrastructure and policies. Additionally, she highlighted the need to formally recognize the shared contributions of both the agriculture and irrigation sectors in increasing crop yields and cropping intensity, thereby promoting mutual accountability and coordinated planning.

Dr. Ganesh Raj Joshi emphasized the pivotal role of irrigation in enhancing agricultural productivity and contributing to national economic growth. Citing empirical evidence, he noted that a 1% increase in year-round irrigated area can lead to a 3.9% rise in agricultural total factor productivity, with significant gains observed in staple crops such as rice and wheat. Given that Nepal has limited remaining potential for expanding arable land, Dr. Joshi called for a strategic shift from horizontal land expansion to the vertical transformation of agricultural production systems. This includes the integration of irrigation and agriculture, promotion of agro-industrial development, and value chain enhancement. He stressed the urgency of harmonizing agriculture, irrigation, and climate-related policies while improving institutional coordination through strengthened roles for Water Users' Associations (WUAs) and cooperatives. Moreover, he recommended active stakeholder engagement in planning, implementation, and monitoring processes. Dr. Joshi also highlighted the importance of collaborative research, particularly among DWRI, the Department of Agriculture (DoA), and the Nepal Agricultural Research Council (NARC), to assess water-use efficiency and technology suitability for evidence-based policy formulation.

Dr. Besh Raj Thapa argued for a shift from fragmented, sector-specific development toward an integrated approach that aligns irrigation, agriculture, and related services under a unified framework. While acknowledging the contributions of development partners such as JICA, SIPS, KISAN, and FANSEP in attempting to bridge the gap between infrastructure development and extension services, he noted that many initiatives still operate in isolation, undermining systemic impact. Dr. Thapa emphasized the necessity of synchronizing hardware

components (e.g., irrigation infrastructure) with software elements (e.g., institutional capacity building and farmer training) to achieve sustainable and holistic outcomes. To institutionalize integration, he recommended documenting and synthesizing collaborative experiences into a national-level roadmap for irrigated agriculture. As strategic next steps, he proposed the establishment of a dedicated Department of Irrigated Agriculture and the prioritization of on-farm water management to enhance water productivity and extend the irrigated command area across the country.

Closing Session

The closing session was addressed by **Dr. Santosh Kaini**, Deputy Director General, DWRI. His reflection on the seminar was that irrigation plays a crucial role in providing reliable irrigation facility to irrigable land and enhance production and productivity of irrigable land and contribute significantly to achieving the National Goal of Food Security and support in advancing the commercialization of agriculture in the country. In addition to the various challenges we face, the impact of climate change and climatic variability has further complicated the pursuit of sustainable irrigation development. Reliability and adequacy of water is a challenge. In this context, it is essential to refine our processes and embrace new technologies to ensure efficient and effective execution of our initiatives. In that background, Irrigation seminar 2025 titled water for Agri-food System Transformation holds a great significance in today's country context. We had very esteemed keynote speakers and guests in the inaugural session. Many dimensions of Agriculture and Irrigation development were highlighted in the session

He reflected on the key takeaways from the seminar which are listed as follows:

1. Though Agricultural sector contribution is declining in GDP, value addition is increasing over the years. In such, Irrigation and Agricultural are not a stand-alone sector but each complement to the other.
2. Cross sectoral coordination is the major challenge. Coordination and cooperation from field level to policy level is imperative to address current issues. Coordination in field level for need assessment in project formulation and subsequent planning and budgeting and implementation of the program is imperative.
3. Mega irrigation (Inter-basin transfer, storage projects) is essential for increased access of irrigation facility to ensure year-round irrigation, contributing to increased agricultural productivity and climate resilience.
4. On farm water management another aspect which is often overlooked. Because of that, efficiency of irrigation system as well as crop production from command area is decreasing.

5. Cutting edge Research and Development are essentials for enhancing efficiency and development of technologies.
6. Intensive collaboration with multisector (Gov, Non-Gov, research academia) for technologies advancement and innovation is needed.
7. Private and public sector investment is crucial for the cost recovery of agricultural and irrigation system development.
8. A paradigm shift (such as PPPs) is needed from business-as-usual to demand-driven, profitable and commercially viable agriculture through strategic project prioritization, experience sharing, and timely execution.

The closing remarks were presented by **Mr. Madhu Prasad Bhetuwal**, former Secretary of the Water and Energy Commission Secretariat. Mr. Bhetuwal highlighted Nepal's growing vulnerability to climate change and underscored the urgent need for sustainable management of water and energy resources. He emphasized that Nepal's heavy dependence on climate-sensitive sectors, particularly hydropower and agriculture, necessitates a transformative approach to irrigation and water governance. While recognizing irrigation as a critical component for agricultural development, he stressed that it alone is insufficient. Sustainable agricultural transformation, he argued, must be underpinned by complementary factors such as improved agronomic practices, efficient post-harvest systems, access to quality inputs, enabling institutional frameworks, and robust market linkages.

Mr. Bhetuwal expressed optimism that the seminar had served as a vibrant platform for fostering collaborative action among experts, policymakers, and practitioners. He reiterated that building a climate-resilient and productive agri-food system in Nepal requires a holistic foundation, one that integrates sustainable irrigation practices, promotes social inclusion, aligns sectoral policies, and ensures balanced inputs. These elements, he concluded, are essential to achieving long-term resilience, productivity, and equity in the face of an increasingly uncertain climate future.



Annex 1:
Agenda for the seminar

Time	Agenda
7:30 – 8:30	Breakfast and refreshments
8:30 – 9:00	Registration
Opening Session	
9:00 – 10:45	• Session Chair: Mr. Sanjeeb Baral, Director General, DWRI • Chief Guest: Hon'ble Dipak Khadka, Minister, MoEWRI • Special Guests: - o Prof. Dr. Shiva Raj Adhikari, Hon'ble Vice Chairman, National Planning Commission - o Mr. Madhav Belbase, Hon'ble Member, PSC - o Mr. Suresh Acharya, Secretary, MoEWRI - o Ms. Sarita Dawadi, Secretary, MoEWRI - o Dr. Govinda Prasad Sharma, Secretary, MoALD - o Mr. Madhu Prasad Bhetuwal, Secretary, WECS - o Dr. Marco Arcieri, President, ICID - o Dr. Mark Smith, Director General, IWMI
	National Anthem
	Welcome remarks and workshop objective: Mr. Mitra Baral, DDG, DWRI
	Inauguration by the Honorable Minister
	Keynotes [15 minutes each]:
	• How can water systems facilitate agri-food system transformation: experiences from research for development [Dr. Mark Smith, Director General, IWMI]
	• How the challenges of coherent interventions of agriculture and irrigation sectors can be translated into opportunities (Learnings from various regions across the globe) [Dr. Marco Arcieri, President, ICID]
	• Lost opportunities in economic growth with agricultural sector performance: Areas of consideration for sectoral integration [Prof Dr. Shiva Raj Adhikari, Honorable Vice Chairman, NPC, Government of Nepal]
	Remarks
	• Dr. Govinda Prasad Sharma, Secretary, MoALD [5 min] • Ms. Sarita Dawadi, Secretary, MoEWRI [5 min] • Mr. Madhav Belbase, Hon'ble Member, PSC [5 min] • Hon'ble Kham Bahadur Garbuja, State Minister, MoEWRI [5 min] • Hon'ble Dipak Khadka, Minister, MoEWRI [10 min] • Session Chair, Mr. Sanjeeb Baral, Director General, DWRI [5 min]

10:45 – 11:15	Introduction of poster sessions Group Photo and Tea Break
Session 1 [Panel Discussion]: Irrigation for Food Security: Key Practices and Bottlenecks [Facilitator: Mr. Nabin Chandra Adhikari]	
11:15 – 11:30	Primer presentation: Synchronizing efforts of the irrigation and agriculture sectors for improved agriculture productivity [Mr. Tika Ram Baral, Joint Secretary, WECS]
11:30 – 11:45	Questions and answers
11:45 – 12:45	Panel discussion: Irrigation for Food Security: Key Practices and Bottlenecks Panelist: 1. Dr. Bimala Paudyal Rai, Former Minister of Foreign Affairs 2. Mr. Susheel Acharya, Joint Secretary, MoEWRI 3. Mr. Prakash Sanjel, Director General, DOA 1. Dr. K Yella Reddy, Former Vice President, ICID
12:45 – 13:45	Lunch Break
Session 2 [Group Work]: Identifying pathways for synergizing the interventions of irrigation and other agricultural inputs for food security [Facilitator: Dr Santosh Nepal, IWMI]	
13:45-15:15	Group discussions <i>Guiding questions will be provided</i>
15:15 -15:30	Tea Break
Session 3 [Panel Discussion]: Way Forward – Translating the Pathways (Developed in Group Work) into Action [Facilitator: Prof Dr Vishnu Prasad Pandey]	
15:30 – 17:00	Panel discussion on Translating the Pathways (Developed in Group Work) into Action Panelists: 1. Mr. Sanjeeb Baral, Director General, DWRI 2. Dr. Sabnam Shivakoti, Joint Secretary, MoALD 3. Dr. Ganesh Raj Joshi (Agri Economist) [Former Secretary, CIAA commissioner]
Closing Session	
17:00 – 17:20	Reflections and Key Takeaways: Dr. Santosh Kaini , Deputy Director General, Department of Water Resources and Irrigation
17:20 – 17:30	Closing Remarks: Mr. Madhu Prasad Bhetuwal , Secretary, Water and Energy Commission Secretariat, Nepal
18:00 Onwards	Networking Dinner

Annex 2:
List of Poster Presentation

Mobilizing the Microbes: A Sustainable Approach to Water Management and Agri-food System Transformation

ID-01

Suman Sijapati^{1,*}

¹Sijapati Permaculture Farm, Lamatar

*Corresponding Author's Email: sumansij315@gmail.com

1 Context and Objectives

Location:



- Sijapati Permaculture Farm, Lamatar, Mahalaxmi Municipality, Ward-9, Lalitpur.

Context and Rationale:

- After 2015 earthquake - cheap land: sloping 23%, north-facing, undulated degraded soil, difficult access, no water source – demonstrate change.

Objectives:

- To grow organic food for fresh family consumption.
- To maintain a healthy environment, biodiversity, water and air purifying, etc.
- To make the place look aesthetically pleasing and mentally relaxing.
- To ensure sustainable use of available natural resources (soil building, rainwater harvesting, use of renewable energy, etc.)

Duration:

- Ten (10) years of persistent hard work and on-going

Financing Mechanism:

- Personal

3 Outcomes/Results

Farm layout – “open-book”:

- Maximum visibility
- Optimum utility of available land resources
- Optimum capture of the solar radiation
- Optimum use of available water resources



Terrace and plot layout:

Establishment of basic infrastructure:

- Structured terraces and plots
- Water features



Soil properties improvements through microbes:



- Texture and organic composition transformation

Water management improvements:

- 3 S: slow down, seep and store

Vegetative expansion:

- Bio-diversity: 100 varieties of fruits and seasonal vegetables



Synergy of various farming activities:

- Integration between different farming activities
- Resource recycle – zero waste principle

Continuous adaptation and refinement as per permaculture principles.

Acknowledgements:

Thanks to all who supported in the endeavor

2 Methodology

1. Conduct survey and mapping:

- Survey – total station
- Construction of boundary wall



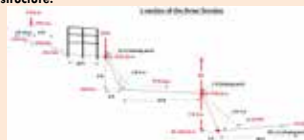
2. Design the layout:

3. Carry out land levelling:



4. Construct the basic infrastructure:

- Parking lot
- Observation room
- Water features
- Greenhouse
- Chicken coop
- Footpath
- Manure pits
- Storage shade



5. Improve the water management:

- Rainwater harvesting, mulching, irrigation through gravity (during deficit)
- Sub-surface drainage, weephole with geotextile material, excess water goes to pond and gets recycled (during period of excess water).



6. Enhance the soil properties:

- Composting – recycling of farm wastes
- Soil texture improvement by adding silty soil “paga mata”
- Mulching – use of fallen leaves for ground cover
- Grow cover crops
- Add aged animal manure

7. Expand the vegetative coverage as per the farm plan:

- Fruits in surrounding fruit circle
- Vegetables in raised bed



8. Integrate crop cultivation with other farm activities:

- Chicken raising
- Fisheries
- Apiculture (bee keeping)
- Rabbit keeping

9. Continuous observation, monitoring and evaluation of the farm

4 Key Message

- It is possible to conserve every drop of water that falls on the land and even those that passes by it
- Both soil and water can host millions of living creatures that can result in healthy terrestrial and aquatic ecosystem beneficial to all
- 3S (slow down, seep and store) principle helps in optimizing the use of available water
- Water can be used multiply and put to multiple use
- Water quality can be tested by the living things it supports
- Excess water can be duly expelled through proper design

Irrigation Modernization Enhancement Project: A case study of five irrigation projects in Nepal

ID-02

Anish Pradhan^{1,*}

¹Department of Water Resources and Irrigation, Government of Nepal

*Corresponding Author's Email: anish.pradhan1997@gmail.com

1 Project Feature and Financing

Location & Purpose:

Implemented in **five provinces of Nepal** (Bagmati, Gandaki, Koshi, Lumbini, Madhesh), the IMEP aims to improve **farm productivity, climate resilience, and profitability in Farmer-Managed Irrigation Systems (FMIS)**. It targets around **56,000 households**, aligning with national strategies to enhance **food security, water use efficiency, and climate adaptation**.

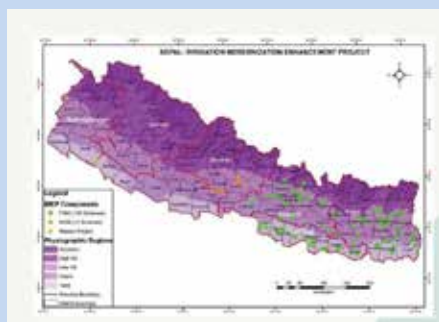
Project Duration: 72-month duration

Financing:

- **ADB Loan:** \$85 million (63.6%)
 - **Saudi Fund for Development:** \$30 million (22.45%)
 - **Government of Nepal:** \$16.14 million (12.08%)
 - **Beneficiaries (WUAs/WUCs):** \$2.5 million (2%)
- Disbursement is coordinated via the **Central Project Management Office (CPMO)** at DWRI/MOEWR.

3 Outcomes

- Modernization of 32,000 hectares of surface water irrigation systems
- Piloting hill lift irrigation to irrigate 1,354 hectares of dry uplands
- Capacity building for farmers and government institutions in ICWM
- Promoting mechanization and commercialization to improve productivity and profitability
- Enabling farmers to become self-sufficient in operation and maintenance of irrigation systems



Output 1: Irrigation infrastructure upgraded — 100 FMISs and the Rajapur Irrigation Project (totaling ~32,000 ha) were modernized, including intake structures, riverbank protection, canals, and 12 pilot hill lift systems.

Output 2: Institutional and farmer capacity strengthened — ICWM training provided to farmers, agencies, and local bodies; WUAs and WUCs established for irrigation and agribusiness; inclusive training with a focus on women and disadvantaged groups; national ICWM roadmap developed.

Output 3: Modern agriculture and value chains promoted — Introduced climate-smart farming, mechanization, and digital services; improved value chain infrastructure; supported WUAs/WUCs with equipment and financing for machinery and facilities.

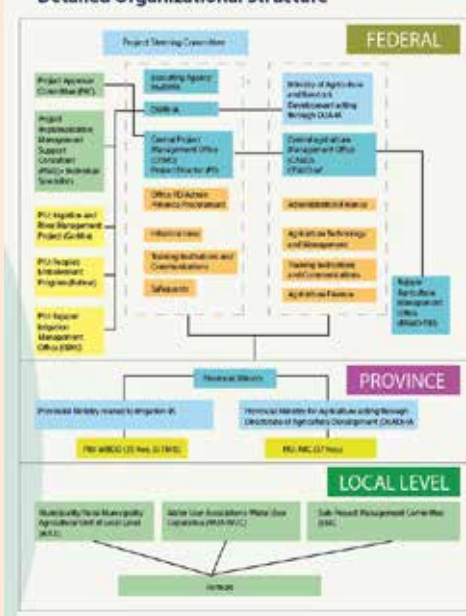
Acknowledgements:

Thanks to all who supported in bringing the project

2 Project Implementation

- **Federal Project Implementation Units (PIUs):** Rajapur Irrigation Management Office (RIMO), Rajapur Agriculture Management Office (RAMO), and the Hill Lift Irrigation Project (HLIP) offices in Gorkha and Butwal.
- **Provincial Project Implementation Units (PIUs):** Respective Water Resources Irrigation Development Divisions (WRIDDs) and Agriculture Knowledge Centers (AKCs)

Detailed Organizational Structure



4 Key Message

The **Irrigation Modernization Enhancement Project (IMEP)** in Nepal aims to improve **farm productivity and sustainability** by modernizing irrigation systems, building institutional capacity, and promoting climate-smart agriculture. It operates through a **structured management framework** involving federal and provincial entities, supported by farmer organizations like WUAs and WUCs.

The project adheres to **ADB procurement policies** and includes robust monitoring, reporting, and grievance mechanisms to ensure effective implementation and accountability. With a focus on strengthening resilience and reducing rural poverty, IMEP is a strategic initiative aligned with Nepal's agricultural and climate goals.



Performance Evaluation of the Mahakali Irrigation Project, Phase-I (A Focus on Agricultural Impact)

ID-03

Crimson S. Negi^{1,*}, Ganesh Pant¹, Bijaya K. Oli¹, Hemant Joshi¹, Bashu D. Joshi¹, Himal Kunwar¹, Janardan Joshi¹

¹School of Engineering, Far Western University, Surkhet, Nepal

*Corresponding Author's Email: negicrimson@gmail.com

1 Introduction, Objectives & Location

Introduction

This study was conducted in June 2024 as part of a credited seminar course in Civil Engineering at Far Western University, Nepal.

The Mahakali Irrigation Project, Stage-I was developed in 1988, which played a crucial role in agricultural development in the far western region of Nepal. Water diverted from the Sharada Barrage irrigates farmland in Nepal's Kanchanpur and Kailali districts. The Mahakali River, with an average flow of 658 cumecs, provides 4.25 cumecs during the dry season (May 15 – October 15) and 28.35 cumecs during the wet season (October 15 – May 15). Phase-I of MIP covers a command area of 5,100 hectares including 11 major distributaries supported by 71 main canal structures, 37 secondary canal structures, 201 tertiary canals, 38 km of drainage, and 98 km of gravel roads (IWRMP n.d.). The Water Users Association was established and actively engaged in efforts to enhance system performance and improve irrigation service delivery.



Fig 1: Location Map of the Study Area (MIP, Stage-I)

Objectives

- To assess water accessibility for irrigation, system reliability and crop productivity.
- To examine structural integrity and maintenance needs of the irrigation system.

3 Results & Discussion

Questionnaire Responses

The results presented below represent the percentage responses from a questionnaire survey of 108 farmers across the three major distributary command areas: Bhujela (48 respondents), Utlakham (43), and Daijee (17). About 77% of farmers experienced improved crop yields, with many cultivating over 10 Bigha/Katha. Around 60% access water directly via canals, though 11.2% rely on alternatives. Continuous irrigation is favored (64.4%) over rotational. Despite high dependence (73%) on canal water, supplementary systems remain underused due to cost or limited availability.

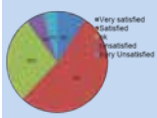


Fig 4: Overall satisfaction of Farmers

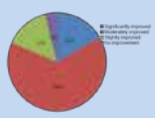


Fig 5: Improvement in crops



Fig 6: Water Application Pattern



Fig 7: Reliability of MIP-I

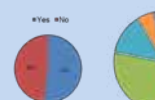


Fig 8: Awareness about WUA among farmers

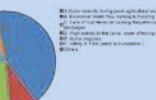


Fig 9: Key Challenges faced by farmers

A majority (85.4%) of farmers reported poor canal lining, leading to water loss; over 60% cited inadequate maintenance, while 67.6% noted issues like silting and vegetation. Additionally, 49.4% of respondents demonstrated limited understanding of the irrigation system, highlighting the need for improved infrastructure and user awareness.

Field Inspection Photographs

The field inventory revealed waterlogging near the source (Bhujela) and scarcity in distant areas (Utlakham, Daijee). Farmers noted water unavailability during critical periods. Poor maintenance across all sites led to damaged structures, silting, scouring, and vegetation overgrowth. Additionally, the Water User Association's activities lacked effectiveness in ensuring efficient irrigation management.



Fig 10: Vegetation in the tertiary canal



Fig 11: Water excess at Bhujela Minor



Fig 12: Damaged regulating structures



Fig 13: Water Scarcity at Utlakham



Fig 14: Using Alternative Irrigation



Fig 15: Using Alternative Irrigation

2 Methodology

Methodology

The study comprised two key components:

- Questionnaire survey:** Targeting farmers within the selected command areas to gather data on water, accessibility, reliability, and agricultural impacts such as crop yield and productivity.
- Structural inventory survey:** To assess the physical condition of the canal networks including minor canals, outlets, control gates and drainage facilities.

A purposive sampling method was employed to select sample size for questionnaire survey among three major distributaries (viz. Bhujela, Utlakham and Daijee) from a total of eleven within Mahakali Irrigation Project, Phase-I. These distributaries were chosen based on their distinct command area sizes and varying proximities to the main water source, ensuring diverse representation across the system.



Fig 2: Study methodology to evaluate the performance of Mahakali Irrigation Project

Performance Indicators

The indicators used for performance evaluation under the "Agricultural and Water Management" category are listed below (Nepal et al. 2024):

- Winter water availability
- Monsoon water availability
- Spring water availability
- Agricultural advice on time
- Operating agricultural equipment
- Intercultural operations due to lack of water
- Use of alternative irrigation method
- Lack of knowledge on A&I
- Soil fertility problem-Monsoon
- Soil fertility problem-Winter.



Fig 3: Project relevance with SDGs

4 Conclusion

The performance assessment of Mahakali Irrigation Project, Phase-I shows notable progress in boosting agricultural productivity through improved water access and expanded land use. Most farmers observed better crop yields and cropping flexibility. However, recurring issues like seasonal water shortages, poor infrastructure maintenance, and inconsistent water supply remain. Additional concerns include canal blockages, silting and low adoption of alternative irrigation methods.

Addressing these challenges through infrastructure upgrades, equitable water distribution, farmer training, stronger Water User Associations, and promotion of supplementary irrigation systems is essential. These measures will enhance MIS-I's efficiency and ensure its long-term contribution to sustainable agricultural growth in the region.

Acknowledgements

We sincerely thank Asst. Prof. Toran Prasad Bhatt for his valuable guidance and supervision. We also appreciate Er. Aashish Bhatt for his technical support and the School of Engineering, Far Western University, along with our teachers, for their continuous inspiration and knowledge.

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Revitalizing Irrigation for Agri-Food Security in Koshi Province, Nepal

Krishna Prasad Rajbanshi^{1,*}, Mahesh Yadav², Saroj Karki³

¹ Irrigation and Energy Development Division, Ministry of Water Supply, Irrigation and Energy, Koshi Province, Nepal

² Water Resources and Irrigation Development Division, Khatang, Koshi Province, Nepal

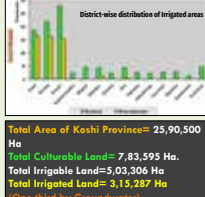
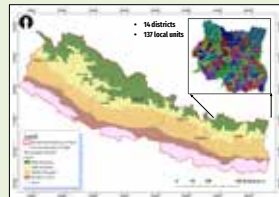
³ Water Resources and Irrigation Development Division, Tahrathum, Koshi Province, Nepal

*Corresponding Author's Email: kprajbanshi@gmail.com

ID-04

1 Koshi Province at a Glance

Province Geographic, Demographic and Irrigation Profile



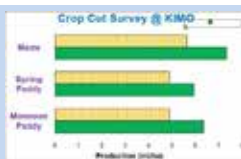
	Nepal	Koshi Province	Percentage of Koshi Province
Area (sq.km.)	1,47,181	26,048	17.7%
Households (Nos.)	6,66,8937	11,91,556	17.9%
Population (Nos.)	2,91,64,578	49,61,412	17.0%
Annual Surface Water=40.48BCM			
Annual Replenishable Groundwater=2.43 BCM			

- Major Irrigation Projects Under the Central Government
 - Sunsari Merang Irrigation Project, 68000 ha
- Under Koshi Province
 - Kankai IMP, 8951 ha
 - Chanda Mohana IMP, 1800 ha

3 Achievements

Crop Cut Survey

- It has been found that by proper irrigation water management and supply, the productivity of monsoon paddy, spring paddy, and maize at KIMO has been increased in comparison to district-level productivity.

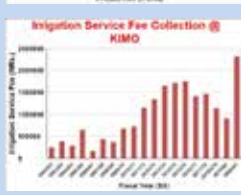


Public-Private Partnership

- Coordination among farmers with Aarju Rice Mill, Jhapa, and Sagar Feed Industry, Itahari has been initiated for the direct sale of agricultural productivity at KIMO

Irrigation Service Fee Collection

- Satisfactory ISF collection at KIMO is shown in the graph alongside. They collect NRs. 500 per bigha/year.
- In Khatang, at Tukure khola Bhasme Dobhan IP (50 ha), farmers collect NRs. 50/ropani since 2068 BS, and circulate the amount for repairs and as a cooperative for needy farmers in interest.



Entrepreneurship

- Off-season farming is enabled by NITPs.
- Private enterprises and agro-vets are being boosted (solar-powered pumps, sprinklers, motors, and accessories).

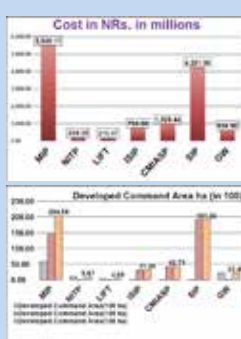
Acts, Regulations, and Policies

- To implement the programs efficiently, MoWSIE has formulated the following documents:

- Province Irrigation Act, 2076
- Province Irrigation Regulations, 2081
- Groundwater Irrigation Project Implementation Directives, 2081
- Koshi Province Renewable Energy Policy, 2081

External Financing

- Irrigation Modernization Enhancement Project (IMEP)
- Kuwait Fund for Disaster Affected Irrigation Projects.
- Small Irrigation Project (SIP)



2 Programs for Irrigation Development

The line ministry responsible for agri-food system transformation in Koshi Province is the Ministry of Water Supply, Irrigation and Energy (MoWSIE).

Since the establishment of Koshi Province, the various programs being implemented by Koshi Province:

- Medium Irrigation Projects (MIP)
- New Irrigation Technology Projects (NITP)
- Lift Irrigation Projects
- SIP (Irrigation System Improvement Project)
- CMIASP (Community Managed Irrigated Agriculture Sector Project)
- SIP (Small Irrigation Project)
- GW (Ground Water Irrigation Projects)

Table 1. Past Programs under MoWSIE

S.No.	Program	Developed Command Area (100 ha)	Total Cost.
1	MIP	100.00	100.00
2	NITP	100.00	100.00
3	LIFT	100.00	100.00
4	SIP	100.00	100.00
5	CMIASP	100.00	100.00
6	SIP	100.00	100.00
7	GW	100.00	100.00
Total		700.00	700.00

The new and innovative programs being implemented by MoWSIE:

1. Solar lift shallow tubewell systems

The illustrated solar shallow tubewell was completed in Gauradaha-6, Jhapa in 2020. The command area covered is 10 ha. The solar system of rated power 3 kW was used for a rated flow of 17 m³/h at rated head of 40 m. The total construction cost of this system was NRs. 2.7 Million. The total number of such systems established were four in different locations of Jhapa district in 2020.



2. Canal Top Solar System in Kankai Irrigation Management System, Jhapa.



The tail end of Kankai Irrigation Systems experiences less water delivery during the early paddy period. To overcome this problem, MoWSIE has initiated a pilot project from this FY 2024/025, a conjunctive use of surface and ground water for tertiary no 19, 20, and 21 of Kankai IMP. A canal top solar system of 200kWp is being established to lift water from 4 deep borings with 30 lps discharge in each. (Under construction)

3. Solar Lift Systems, NITP, TCP-PIAT Programs at Kankai and Chanda Mohana IMO

Apart from the regular MIP programs to extend irrigation area for more yield of crops, the new technologies solar lift and NITP have great contribution for ensuring water to increase the crop productivity.



4 Key Message

- Modern, efficient irrigation systems are key to shifting from subsistence to commercial agriculture.
- Strategic irrigation drives higher yields, stable livelihoods, and regional food sovereignty.
- Entrepreneurship is evolving in water delivery, solar pumping, and irrigation services.
- Provincial policies must support water-user groups, climate-smart infrastructure, and sustainable financing.
- Strengthening farmer-managed irrigation systems and water-user associations is critical for long-term success.

Acknowledgements:

The authors would like to thank the Ministry of Water Supply, Irrigation and Energy (MoWSIE), Government of Province, Koshi Province, Nepal, for the permission to use progress datasets. The authors also acknowledge the use of datasets obtained from Irrigation development/management offices. These datasets have been instrumental in supporting the analysis and interpretation of this poster.

Solar Irrigation Pumping: Clean Energy, Thriving Farms, No More Diesel

ID-05

Ramesh Ranabhatt^{1,*}

¹Alternative Energy Promotion Centre (AEP/C/DKTI Project)

* Corresponding Author's Email: ramesh.ranabhatt@aepc.gov.np

1 Context and objective

Nepal's agricultural sector is heavily reliant on irrigation for year-round productivity, but the high operating costs of diesel-based systems have limited farmer's access to reliable water sources. To address this challenge, the AEP/C initiated a forward-looking solar energy initiative.

With the support of the German Federal Government through the KfW Development Bank, the 'Promotion of Solar Energy in Rural and Semi-Urban Regions of Nepal' project aims to facilitate a clean energy transition by replacing diesel-powered irrigation systems with solar-powered alternatives. This project demonstrates Nepal's commitment to sustainable agriculture and climate change mitigation, aligning with global renewable energy and emission reduction goals.

- **Goal:** Increase solar electricity use and reduce CO₂ emissions by installing solar irrigation pumping systems.
- **Implementation Year:** 2024
- **Subsidy:** Up to 60% of the investment (max. NPR 2 million) per unit under the Renewable Energy Subsidy Policy 2022

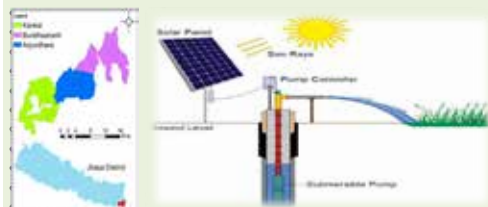


Fig 1: Study site and operation mechanism of solar pump

"Small-scale farmers remain vulnerable in the growing agribusiness economy. Projects like this must prioritize equity and inclusivity." — FAO

"Empowering rural farmers with clean energy is not just climate action— it's social justice." — UNDP

"Access to sustainable irrigation transforms agriculture from subsistence to resilience." — World Bank.

2 Project Implementation

Location: Jhapa District

1. Arjundhara Municipality (10 units)
2. Kankai Municipality (10 units)
3. Buddhashanti Rural Municipality (3 units)

Process:

1. Demand application and screening
2. Simplified feasibility and E & S assessment
3. Bid call and supplier selection
4. Installation, warranty (3 years), and post-installation monitoring

System Types Installed:

1. 7 systems of 2 kWp (2 HP)
2. 16 systems of 3 kWp (3 HP)



Fig 2: Subproject implementation cycle

Acknowledgements:

We thank the AEP/C team, local governments, beneficiary farmers, DKTI Project staff, and implementing partners for making sustainable solar irrigation a reality in Jhapa.

3 Outcomes and Impact

- **Area Irrigated:** 32.99 hectares
- **Diesel replaced:** ~33,622 liters/year
- **CO₂ emissions avoided:** ~90 metric tons/year
- **Water discharge capacity:**
 - 2 HP pump: 70,000 L/day
 - 3 HP pump: 100,000 L/day
- **Crops Supported:** Rice (July-Oct), Wheat (Dec-Mar)
- **Extended Use:** Vegetable farming and fisheries



Photo 1: DG set is used for the pumping of groundwater (before)



Photo 2: Diesel replaced after Solar PV pumping system



Photo 3: Happy beneficiary who is doing fishery nowadays

4 Key Message

Challenges & Way Forward

- Solar irrigation enhances productivity, lowers operational costs, and supports climate resilience.
- Transitioning from diesel to solar empowers farmers with reliable and sustainable water access.
- Farmers are adopting diversified agricultural practices with improved economic returns.

Barriers:

- Limited awareness of solar tech
- High upfront cost
- Small landholding structure

Need: Continued outreach, capacity building, and targeted financial support for small-holder farmers.



Photo 4: Installed SIP-S irrigation pumping system in Kankai Municipality, Jhapa

Irrigation Seminar 2025: Water for Agri-Food System Transformation
15 May, 2025 [Thursday], Kathmandu, Nepal



Impacts of Global Climate Modes on Seasonality of Major Rivers in Nepal

Mahesh Yadav ^{1,*}, Krishna Prasad Rajbanshi¹

¹Ministry of Water Supply, Irrigation and Energy, Koshi Province, Nepal

*Corresponding Author's Email: dr.maheshydv@gmail.com

ID-06

1 Introduction

- Climate modes are recurring, large-scale patterns of climate variability that influence weather and climate over wide regions and time scales ranging from months to decades (can have local, regional, or global impacts).
- A teleconnection is when a change in the climate or atmospheric condition in one part of the world affects the weather or climate in a distant region.

Research Questions:

- How the Nepalese River Basins' discharge anomalies are related with climate modes?
- Objectives:
- To build a statistical predictive model for hydrologic cycles driven by climate modes.
- To quantify the strength of the global climate modes in each target river basin.

Table 1. Literature Review

Author(s) & Year	Study Area	Climate Mode	Findings
Wang et al. (2018)	Yangtze River	AMO	Positive influence on discharge
Wang et al. (2018)	Yangtze River	CP	Negative influence on discharge
Wang et al. (2018)	Yangtze River	EP	Positive influence on discharge
Wang et al. (2018)	Yangtze River	AMO	Positive influence on discharge
Wang et al. (2018)	Yangtze River	AMO	Positive influence on discharge
Wang et al. (2018)	Yangtze River	AMO	Positive influence on discharge
Wang et al. (2018)	Yangtze River	AMO	Positive influence on discharge
Wang et al. (2018)	Yangtze River	AMO	Positive influence on discharge
Wang et al. (2018)	Yangtze River	AMO	Positive influence on discharge
Wang et al. (2018)	Yangtze River	AMO	Positive influence on discharge

3 Results

- Koshi, Narayani and Karnali are snow-fed rivers while Bagmati is a non-snow-fed river.
- The natural flow in Bagmati river disturbed by human activities.

- In Figure 2, much (less) data is available in 25 to 75% range in observed (predicted) anomalies.
- In Figure 3, a significance test is performed at 80% and 90% confidence intervals and revealed that ~50% of predictions are significant.
- In Figure 4, the overall model performance underperforms in the Karnali River.

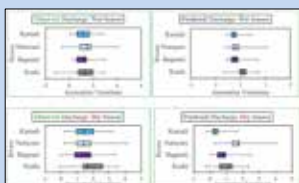


Figure 2. Box plot of observed and predicted discharge anomalies.



Figure 3. Seasonal Flooding and Drought.

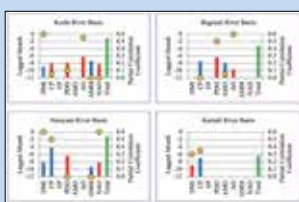


Figure 4. Decomposition of Indices (Red, Blue, and Green colors represent positive, negative, and overall signal, respectively. Orange dots are lagged months).

Acknowledgements:

The authors would like to thank the Department of Hydrology and Meteorology (DHM), Government of Nepal, for the permission to use meteorological data. The authors also acknowledge the use of climate modes datasets obtained from various international sources. These datasets have been instrumental in supporting the analysis and interpretation of large-scale climate variability.

2 Dataset and Methodology

- In-situ monthly river discharge for the period of 1965 to 2010 has been used.
- The simple form of statistical predictive model is given below:

$$Q_{predicted} = a + b \cdot CP + c \cdot EP + d \cdot PDO + e \cdot AMO + f \cdot AO + g \cdot AMM + h \cdot NAO \dots (1)$$
Where, $Q_{predicted}$ = predicted standardized monthly discharge anomaly
 a, b, c, d, e, f, g, h = standardized coefficients for respective indices
 CP = Dipole Mode Index, EP = Central Pacific type El-Niño, EP = Eastern Pacific type El-Niño,
 PDO = Pacific Decadal Oscillation, AMO = Atlantic Multidecadal Oscillation, AO = Arctic Oscillation, AMM = Atlantic Meridional Mode, NAO = North Atlantic Oscillation
- A partial correlation coefficient can be written in terms of simple correlation coefficients:

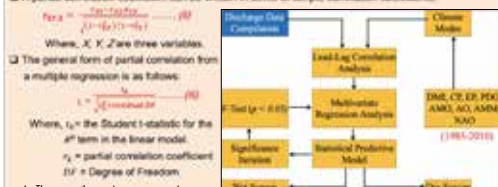


Figure 1. A schematic statistical predictive model.

- A Three-month moving average is applied to smooth the time series.

- Standardization enables the actual variation comparison.
- Wet (dry) season corresponds to the long-term averaged high (low) flow month for each river basin.
- Logged correlation upto 12-month window has been applied.
- Multivariate regression analysis was performed to identify a significant relationship.
- Climate modes from the Pacific, Indian, Atlantic, and Arctic oceans have been used.

Table 2. Description of Climate Modes considered in this study.

Mode	Mode Full Name	Observation	Geographic Location
EP	El Niño Southern Oscillation	Monthly SST Anomaly	10°S-10°N, 120°E-120°W (Central Equatorial Indian Ocean and 10°S-10°N, 10°E-10°W (Central Equatorial Indian Ocean)
CP	Central Pacific	Monthly SST Anomaly	10°S-10°N, 120°E-120°W
EP	Eastern Pacific	Monthly SST Anomaly	10°S-10°N, 120°E-120°W
PDO	Pacific Decadal Oscillation	Five Principal Component of monthly SST anomaly (10°S-10°N, 120°E-120°W)	North Pacific Ocean, 30°N-60°N
AMO	Atlantic Multidecadal Oscillation	Monthly SST Anomaly (10°S-10°N, 120°E-120°W)	North Atlantic Ocean, 10°N-40°N
AO	Arctic Oscillation	Monthly SST Anomaly (10°S-10°N, 120°E-120°W)	The Arctic Ocean, 30°N-60°N
AMM	Atlantic Meridional Mode	Monthly SST Anomaly (10°S-10°N, 120°E-120°W)	The Atlantic Ocean, 10°N-10°S, 20°E-20°W
NAO	North Atlantic Oscillation	Monthly SST Anomaly (10°S-10°N, 120°E-120°W)	The Atlantic Ocean, 40°N-60°N

- Statistical predictive model is a linear combination of the eight climate modes sampled during those months of maximum correlation to predict the standardized discharge anomalies in respective wet or dry season.

River Name	Station Number	Location	Longitude	Latitude
Koshi	485	Chitwan	84.83	26.83
Narayani	486	Chitwan	84.83	26.83
Karnali	487	Chitwan	84.83	26.83

Table 3. Location and Seasonal Flow Index

4 Key Message

- A statistical predictive model for each basin is developed, with wet and dry season discharge anomalies significant at the 95% confidence interval.
- Sub-seasonal analysis (wetter/drier) showed over 50% of predictions are significant at an 80-90% confidence interval.
- The strength and influence of climate modes vary across basins, with distinct signatures.
- Remote climate modes (e.g., from the Pacific and Atlantic Oceans) are tele-connected to the Nepalese river basins.
- Improved understanding of these teleconnections supports flood and drought risk prediction and an early warning system development.
- Human influence on river discharge variability requires further investigation.
- Integrating climate modes behavior with flood, drought, and fire activity can enhance multi-scale preparedness.
- Further validation against high-resolution dynamic models is recommended for operational use.
- Findings support climate-informed water resource planning for resilient agri-food systems in Nepal.



Promotion of Irrigated Agriculture in Kankai Irrigation System, Jhapa (Technical support provided by JICA TCP-PIAT Project)

ID-07

Umesh Kumar Sujakhu^{1,2}

¹Kankai Irrigation Management Office, Koshi Province – Jhapa, Nepal

²Corresponding Author's Email: umeskum@umail.com

1 Outline of JICA TCP-PIAT Project

◆ Overall Goal

- Develop successful **MODEL** Project that will be practiced in Terai Irrigated Area of Nepal

□ Formulation of Guideline and Manual

◆ Project Purpose

Model of Irrigated Agriculture is formed by the **collaboration** among the Federal, Provincial, Local Governments and Water Users Associations (WUAs) and Private sectors.



◆ Expected Outputs

- Formulation of **Action plan** by the Stakeholders of Kankai Irrigation Scheme
- Establishment of **Equitable Water Distribution/ Improvement of O & M** of Irrigation Facilities
- Increase of Income of Farmers through practice of **Market Oriented Agriculture**
- Establishment of **Cooperation/ Collaboration system among stakeholders** for improvement of irrigated agriculture in KIS

◆ Location of the Project/ Targeted Area

JICA Technical Cooperation Project for the promotion of the Irrigated Agriculture (JICA, TCP-PIAT) in Terai Plain was located in **Kankai Irrigation System**, Jhapa managed by Kankai Irrigation Management Office under Ministry of Water Supply, Irrigation and Energy of Koshi Province, Biratnagar.

◆ Duration of the Project

March 2019 to March 2025 (Five years)

3 Results

Project has set **Ten** different **PDM Indicators**, based on that the following achievement were made

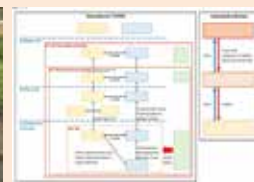
PDM Indicators	Target	Achievements
1. Formulation of Water Distribution Plan and Its Implementation	i) MC to SCs (22) ii) MC to DTOs (56) iii) SCs to TCs (181)	i) MC to SCs (22) Completed ii) MC to DTOs (56) iii) SCs to TCs (181)
2. Field Channel Construction	12 Km	12 Km (100%)
3. Formulation of Irrigation Facility Maintenance Plan and Its Implementation	i) MC (5) ii) SCs (8 model SCs & 14 Non model SCs) iii) Model TCs (13) and Non Model TCs (14)	i) MC (5) ii) SCs (8 model SCs & 12 Non model SCs) iii) Model TCs (9) and Non Model TCs (0)
4. Increase of Annual Irrigated Area	By 7%	End line survey will confirm the target
5. Increase of ISF Collection Amount	Increase by 1.5 times from that one before the project	i) Almost Achieved (NRs. 23,20,449/-) (NRs. 16,17,183/- in 2020/21 targeted amount NRs. 24,25,775/-)
6. Increase of Agriculture Incomes	Increase by 20%	i) Achieved (38%)
7. Preparation of Farm Business Plan	75% of farmers make Farm Business Plan	i) Achieved (more than 75% farmers)
8. Conducting Cooperation Activities	Conducting Four Cooperation Activities by stakeholders	i) Introduction of Laser Land Leveler technology ii) Establishment of Custom Hiring Service Center iii) Demonstration of Polyhouse for Market Orient production iv) Spring Rice Promotion Program v) Introduce Mechanical Rice Transplanter
9. Formulation of Guideline and Manuals	Preparation of Guidelines and Manuals	i) Completed
10. Conducting Training to Stakeholders	Two Irrigation Schemes in Terai area	i) Selection was completed (CMIS & Chandra Nahar IS)

Acknowledgements:

The author on behalf of Kankai Irrigation Management Office, Jhapa would like to thank the Ministry of Energy, Water Resources and Irrigation, Federal Government, Ministry of Ministry of Water Supply, Irrigation and Energy (MoWSIE), Provincial Government, Koshi Province, Nepal, for the permission to use project achieved outputs and outcomes targeted by the project. These key activities carried during the project will definitely support in replicating the results in other Irrigation system of Terai Plain of Nepal through the interpretation of this poster.

2 Project Implementation

The slogan of the project was **"Maximum use of Water Grow for sale"**



◆ Implementing Agencies

- Department of Water Resources and Irrigation (DWRI) under Ministry of Energy, Water Resources and Irrigation (MOEWRI)
- Department of Agriculture (DOA) under Ministry of Agriculture and Livestock Development (MOALD)
- Kankai Irrigation Office (KIMO) under Ministry of Water Supply, Irrigation and Energy (MOWSIE)
- Agriculture Knowledge Center (AKC) under Ministry of Industries, Agriculture and Cooperatives (MOIAC)
- Kankai Irrigation Water Users Association (WUA)
- Four Municipalities** of the Irrigation System

◆ Output 2-Establishment of Equitable & Efficient Water Distribution

- Formulation of Water Distribution Plan and its Implementation
- Formulation of Irrigation Maintenance Plan and its Implementation
- Construction of Field Channel
- Increase of Irrigated Area
- Increase in Irrigation Service Fee Collection (ISF) amount



Gauge painting



Emergency Maintenance



Field Channel Construction



Irrigated Area

◆ Output 3:- Increase of Income of Farmers through practice of Market Oriented Agriculture

- Increase of Agricultural Income
- Preparation of Farm Business Plan



Leader Farmer's in KIS

◆ Output 4:- Establishment of Cooperation/ Collaboration system among stakeholders

The following seven cooperation activities are conducted:

- Introduction of land leveling technology using Laser Land Leveler
- Establishment of Custom Hiring Service Center
- Demonstration of playhouse vegetable nurseries for market-oriented vegetable production (off-season production) to scale-up CAP
- Spring rice promotion program
- Introduction of mechanical rice transplanter program



Demonstration of Laser Land Leveler



Community Custom Hiring Center



Polyhouse Nursery



Mechanical Rice Transplanter in KIS

4 Key Message

- The project creates synergy by forming a common platform for joint action (Coordination, Cooperation & Coexistence) among the **three tiers of Government** with a common goal increase production and productivity through **Equitable and Efficient water distribution** and practicing **Market Oriented Agriculture** introducing mechanization & technology
- Providing a high priority on the **Capacity Development of WUA** (Focal body of stakeholder) is the must
- Developing agriculture as a agri-business attracting private and public sectors, direct linkage of farmers with the market and the industry, ensuring the returns

Irrigation Seminar 2025: Water for Agri-Food System Transformation
15 May, 2025 [Thursday], Kathmandu, Nepal



Towards Modernizing Irrigation Systems in Nepal for Informed Decision Making

ID-08

Santosh Nepal^{1,2}, Jibesh KC¹, Anup Khana², Dinesh Bhatt³

¹International Water Management Institute (IWMI), ²Innovation Engineering Services (IES), ³Department of Water Resources and Irrigation (DWRI)

Corresponding Author's Email: sNepal@cgiar.org

1 Background



The National Irrigation Policy 2023 emphasizes volumetric water allocation to boost agricultural productivity. Improving understanding of irrigation flow data is critical.



Nepal lacks systematic irrigation data collection, leading to inefficient water distribution, especially during dry seasons.



Poor water management and inadequate regulating structures exacerbate head-tail disparities in water access.



The International Water Management Institute (IWMI) and the Department of Water Resources and Irrigation (DWRI) through CGIAR's NEXUS Gains Initiative, introduced basic water measurements in the Babai Irrigation Project (BIP), Western Nepal, in 2023.



The project provides real-time data on water availability and usage, aiding in efficient water scheduling and allocation, ultimately reducing water conflicts and benefiting farmers and irrigation managers.

3 Outcomes

Babai Irrigation Information System (BIIS) dashboard

The BIIS dashboard provides real-time canal flow, meteorological, and soil moisture data on an online server for informed decision making.

- Real-time main canal flow level and velocity in 15 minutes duration.
- Flow level and velocity at the branch canals – two measurements a day.
- Soil moisture and soil temperature data at command areas in 2 hr. duration.
- Meteorological data: rainfall, temperature, and humidity in 10-minute duration.

Link to the web portal: <https://www.stationlogin.com/bip/login>

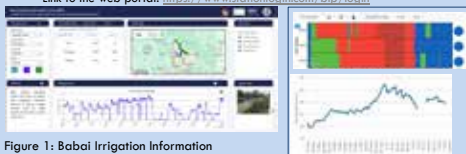


Figure 1: Babai Irrigation Information System Portal

Figure 2: Soil moisture and soil temperature measured in a farmer's field at Bansgadhi, Bardiya in 2024

Data Insights

Real-time flow data helps irrigation managers understand water availability, aiding in informed decision-making.

Maximum flow observed in the eastern canal is 30.6 m³/sec. Discharge drops frequently due to debris blockages and maintenance (Figure 1, discharge data).

220 MCM of water flowed through the eastern canals, irrigating 21,000 hectares of fields in a year, with an average flow of 6.21 m³/sec. Out of which 77 percent flows during the paddy growing season.

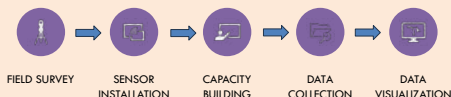
Soil moisture data from six farms in Bardiya district indicated positive impacts on crop management and irrigation scheduling.

Soil temperature trends showed significant soil dryness during the first two weeks of June, influenced by temperature increases and lack of irrigation or rainfall events (Figure 2).

Acknowledgements:

The authors would like to extend gratitude to the Department of Water Resources and Irrigation, CGIAR's NEXUS Gains Initiative, and Babai Irrigation Project.

2 Methodology



Field Survey

An initial field survey in July 2023 identified the need for irrigation flow measurements in Babai - Eastern irrigation canal system.

The eastern canal system and its 25 branch canals were selected for instrumentation.

The B2 branch canal is selected for further soil moisture monitoring.

The field visit was supported by the Babai Irrigation Office, DWRI, DOA, and IWMI experts from Pakistan, South Africa, and Nepal.



Sensor and Instrument Installations



One automatic flow sensor and an array of meteorological sensors at head of eastern canal



25 manual gauges at each branch canal for flow measurements



Six soil moisture sensors at the command areas of the B2 branch canal

Training and Data Collection

10 gate operators learned to read and transfer flow level data via a web-based portal.

Gate operators are providing flow data through web portal

23 farmers (including 8 women) received training on using soil moisture sensors.

Six farmers are providing soil moisture and soil temperature data on a regular basis.

4 Key Message

Irrigation instrumentation enhances data collection, visualization, and informed decision-making.

Seasonal flow variability and head-tail water distribution disparities highlight the need for improved system management.

Key future steps:

- Expand instrumentation system coverage
- Institutionalize data-driven practices
- Develop department-level management information systems
- Need for long-term data collection and analysis



AI-based National-Scale Rainfall-Triggered Landslide Nowcast System: From Data to Prediction

Ananta Man Singh Pradhan^{1,*}

¹Water Resources Research and Development Centre, Ministry of Energy, Water Resources and Irrigation

*Corresponding Author's Email: anantaos@rdo.gov.np

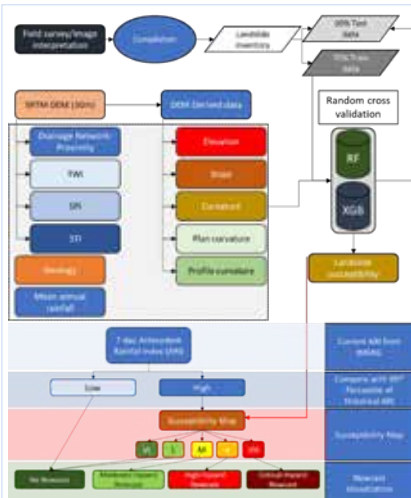


ID-09

1 Introduction

- Landslides are becoming increasingly common in Nepal, and their incidence is expected to grow as precipitation patterns become more severe and road-building increases. This poses a significant threat to the lives and livelihoods of people in the region. In this study, we developed an integrated approach that combines two modeling methods to predict the likelihood of landslide occurrences and develop a near-real-time landslide warning system.
- Predicting when and where landslides may occur and issuing warnings, accordingly, is an evolving area of research. Landslide models can either be designed to function as near real-time or forecasting systems.
- This study aims to evaluate the effectiveness of the Random Forest (RF) and Extreme Gradient Boosting (XGBoost) classifier models in assessing landslide susceptibility, and to compare their applicability in the Nepal Himalaya region. Additionally, it utilizes the Landslide Hazard Assessment for Situational Awareness (LHASA) model, which provides insights into rainfall-triggered landslide potential by identifying times and locations where landslides are more probable relative to other areas.

2 Methodology



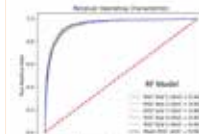
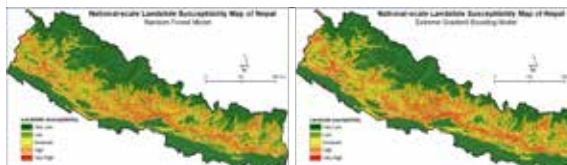
Firstly, 37096 landslides information from 1980 to 2023 were obtained through field investigation and satellite image interpretation, and a predictors database of 11 conditional factors had been constructed. Secondly, non-landslide points were selected to form a complete data set and RF and XGB models were established.

Acknowledgements:

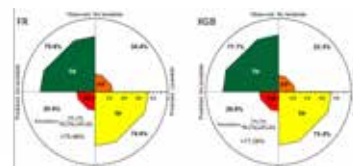
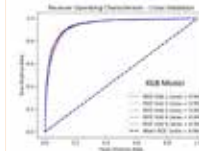
The author is grateful to the WRRDC for their support in the formulation of the landslide nowcasting project. Sincere thanks are also extended to the Koshi Province Government and local authorities for their valuable assistance and coordination during the fieldwork and data collection phases.

3 Results

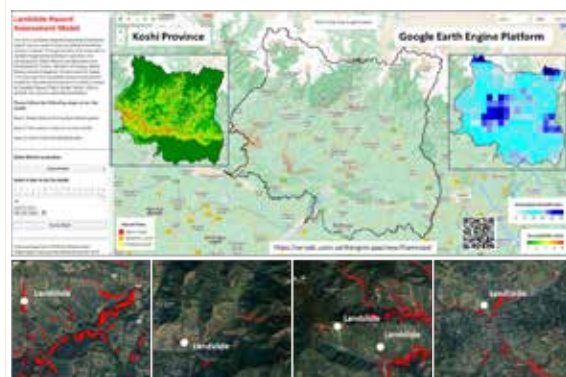
Landslide Susceptibility Mapping



Classification generally reflects the original distribution of presence/absence landslide data, with the dominant class represented by True Positive (TP) and True Negative (TN). Overall, the predictive performance estimated via 5-fold random cross validation schemes achieves good results.



Landslide Nowcast



The true positive rate (TPR) was evaluated by verifying if each of the 116 landslide events (2019–2024) in Koshi Province was predicted by the Alarm Level nowcast. These events were selected based on their "location confidence".

4 Conclusions

- Landslide nowcasting serves as a vital early warning tool in the Nepal Himalaya, offering near real-time assessments of rainfall-triggered landslide potential.
- The nowcast system provides a synoptic-scale view of landslide susceptibility, enabling national and regional authorities to monitor potential hazards across large and inaccessible mountainous areas without the need for dense ground-based networks.
- When combined with local knowledge and field validation, the nowcast can support proactive disaster risk management



Artificial Intelligence-Based Approach for Identifying Locations for Free-Flowing Wells

Ananta Man Singh Pradhan^{1,*}

¹Water Resources Research and Development Centre, Ministry of Energy, Water Resources and Irrigation

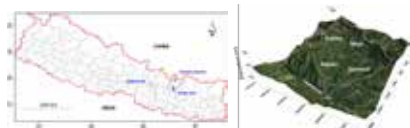
*Corresponding Author's Email: ananta@wrrdc.gov.np



ID-10

1 Introduction

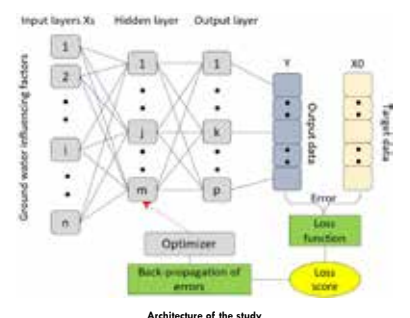
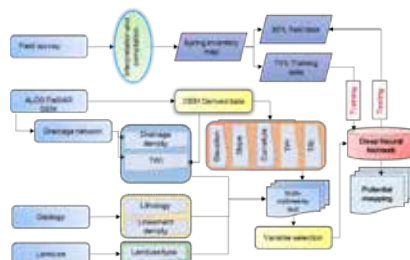
- The study area, Gopi khola watershed lies about 165 km east of Kathmandu, situated almost in the southwestern part of the Dolakha District with an area of 54.3 km². The study area has a gentle slope in most of the area and also has a steep slope in the northern and eastern parts.



- The principal goal of this study is to analyze and resolve the probable distribution of groundwater occurrence and their spatial association in the mountainous terrain of Nepal Himalaya. This study efforts to capture suitable area for groundwater exploration in Gopi khola watershed using an integrated approach of deep neural network (DNN), GIS techniques and field survey.

2 Methodology

- The study comprised four phases: (1) collection and preparation of geospatial datasets—topographic, hydrological, land use, geological—and spring inventory data; (2) data preprocessing and modeling using a Deep Neural Network (DNN) framework; (3) geophysical exploration; and (4) drilling based on integrated analysis.

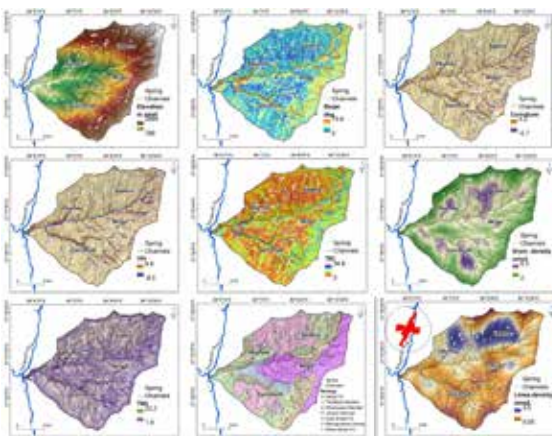


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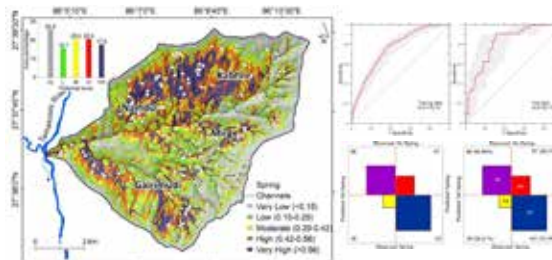
The author is grateful to the WRRDC for their support in the formulation of this project.

3 Results

Spatial analysis

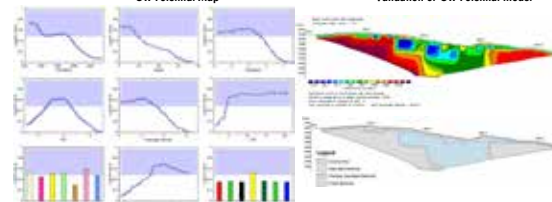


Geospatial dataset



GW Potential Map

Validation of GW Potential model



Response curves

ERT-profile



Drilling site

4 Key Message

- The results confirm that AI-driven methodologies can significantly enhance decision-making in groundwater exploration, especially in complex hydrogeological settings.
- This approach not only improves efficiency and accuracy in site selection but also offers a scalable framework for similar applications in other data-scarce regions.



Evaluating the need and feasibility of micro-irrigation systems for sustainable irrigation

Suzan Karkee Chhetri^{1,*}, Sandeep Kumar Chourasia¹, and Ashish Pandey¹

¹Department of Water Resources Development and Management, Indian Institute of Technology Roorkee, Roorkee, Uttarakhand, India

*Corresponding Author's Email: suzan_kc@iitr.ac.in

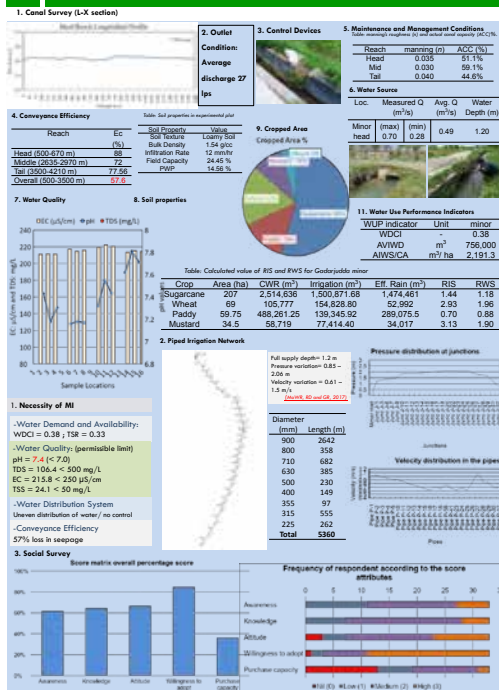


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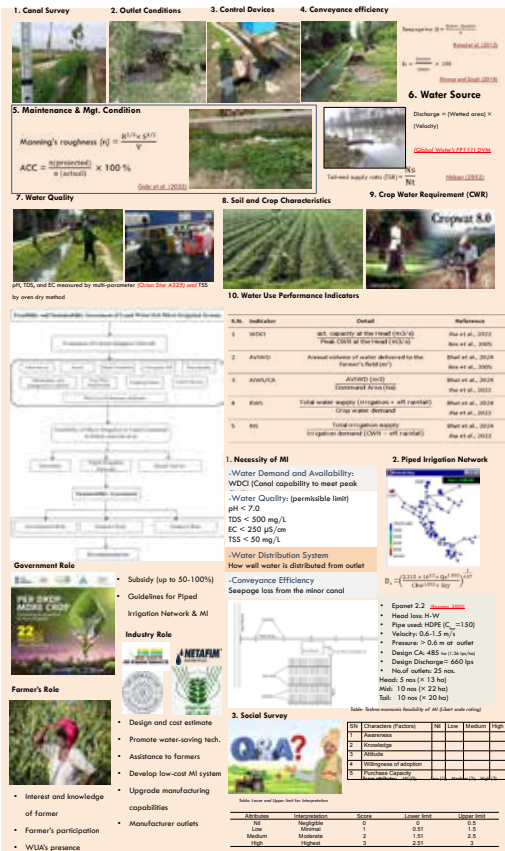
1 Context and study region



3 Results



2 Methods



4 Key Message

- Summary**
 - MI promising tool for water mgt.
 - Need to promote MI in canal command
 - Study in Gadarjudda minor of UGC
 - Current canal conditions:
 - Canal survey, water quality, soil and crop, CWR, water use performance indicators
 - Feasibility of MI:
 - Necessity, piped network design, social survey
 - Sustainability of MI:
 - Government-industry-farmers role
- Conclusions**
 - Average canal profile 1:1600. The upward slope in (ch.750 Gadarjudda and ch. 3200 Nagla Almad). Old brick masonry lining (n=0.35 > 0.018).
 - WDCI = 0.38, TSR = 0.33, Conveyance Efficiency = 57%. Showing erodic supply and need of modernization of Gadarjudda minor
 - Canal profile adequate for gravity pipe flow; replacement pipe network cost INR 83.43 million; willingness to adopt (85%); purchasing capacity (36%). Showing MI in minor command is feasible.
 - Government subsidy available; MI vendors available (70 km); awareness among farmers; WUA non-existence. Showing need of WUA for project sustainability.
- Future Scopes**
 - Expand to branch canal and whole UGC command
 - WaterGEMS for modeling the Piped network and MI in the command
 - Optimization of pipe size using machine learning and a genetic algorithm
 - Extensive social survey for the precise requirements of the study area

Acknowledgements:

Financial support
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Integrated Assessment of Irrigation and Agriculture Management Challenges in Nepal's Flagship Irrigation Schemes

ID-12

Santosh Nepal^a · Mihari Neupane^a · Sanju Koirala^a · Jonathan Lautze^b · Ram Narayan Shrestha^c · Dinesh Bhatt^d · Nirman Shrestha^d · Manju Adhikari^e · Santosh Kaini^e · Shanta Karki^f · Jigyasha Rai Yangkurung^f · Kapil Grawali^f · Ananta Man Singh Pradhan^f · Krishna Timisid^f · Saurav Pradhananga^f · Manohara Khadka^f

a: International Water Management Institute; b: Department of Water Resources and Irrigation; c: Water Resources Research and Development Centre; d: Department of Agriculture; e: Water and Energy Commission Secretariat; f: National Agricultural Policy Research Centre, Nepal Agricultural Research Council

1 Context and Objectives

- Agriculture remains the backbone of Nepal's economy, with irrigation playing a vital role in enhancing productivity, especially amid increasing climate variability. To support year-round farming, the government has invested in several large-scale irrigation schemes, including the Babai, Rani Jamara Kuleriya, and Mahakali systems—considered flagship projects in Western Nepal. Despite significant investments, these systems have underperformed due to recurring issues such as poor maintenance, delayed water delivery, and weak farmer participation. Governance challenges, including overlapping roles of agencies and limited capacity of water user associations (WUAs), further constrain effective management. This study systematically assesses and ranks the challenges across the three schemes to identify core barriers and inform policy and operational improvements in Nepal's irrigation sector.

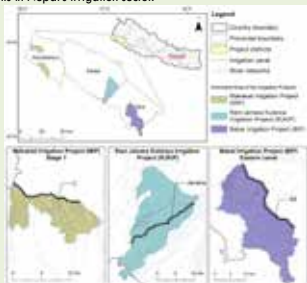


Fig 1: Map of the three irrigation systems (from west to east): Mahakali Irrigation Project (MIP), Rani Jamara Kuleriya Irrigation Project (RJKIP), Babai Irrigation Project (BIP). The main canal in each system is highlighted using parallel black lines.

3 Key Findings and conclusion

- The most significant category of challenges across the three irrigation systems is socio-economic and market conditions.
- The top-rated challenge is the timely unavailability of adequate fertilizer (score: 4.41 out of 5), spring water availability and unfair market prices for agricultural products.
- Babai Irrigation Project (BIP) Faces the Most Severe Challenges particularly the mid-section of the command area.
- Farmers struggle with fertilizer shortages, declining groundwater, and high dry-season water deficits.
- Geographic Location Affects Input Access and Market Dynamics. Proximity to the Indian border in RJKIP and BIP tail sections improves access to fertilizers (including via informal trade) but raises quality concerns.
- Nepali farmers face unfair competition due to lower Indian production costs and subsidies. In contrast, MIP farmers benefit from better product prices due to demand in hill regions.
- GESI (Gender Equality and Social Inclusion) and Governance Are Key Enablers. Despite national policies, subsidy access remains difficult, especially for smallholders.
- Gender challenges persist, with female farmers reporting less participation in WUAs and facing cultural/informational barriers. Male dominance is prevalent in WUA leadership, often resulting in token female representation.
- Water Availability, Especially in the Spring and Winter, is a Major Concern. Water availability during dry seasons is a significant agricultural water management issue. Source-level deficit in BIP, structural conveyance issues in RJKIP, and distribution inequities in MIP hinder effective irrigation.
- Physical and Structural Issues Are Less Severe, but Still Notable. While canal capacity is largely sufficient, poor maintenance, leakages, canal slides, and urban encroachments (notably in MIP) are key issues.
- Maintenance challenges are worsened by ongoing construction in BIP and lack of stakeholder engagement. Challenges are interconnected and require holistic, nexus-based solutions. Problems in one domain (e.g., infrastructure) exacerbate others (e.g., water availability).
- Peripheral enabling conditions (e.g., input access, market prices) are beyond the control of farmers and require stronger government intervention. Emphasis on a holistic and integrated approach that considers socio-economic, environmental, institutional, and gender-related dimensions.
- A replicable, interdisciplinary methodology for ranking irrigation challenges and stresses the need for actions like regular canal flow measurement and groundwater management to support data-driven, adaptive solutions across systems.

2 Methodology and results

- This study identified and assessed irrigation and agriculture management challenges across three flagship irrigation schemes in Nepal based on literature on holistic irrigation and agricultural management.
- Thirty-three performance indicators were selected and grouped into four thematic categories:
 - Physical and Structural (9)
 - Agriculture and Water (10)
 - Socioeconomic and Market (7)
 - GESI and Governance (7)



Fig 2: Irrigation performance indicators based on four thematic categories. Three indicators for each category are listed as an example.

- Two field visits in August and October 2022 included consultations with farmers and Water User Associations (WUAs) to contextualize these challenges. For each irrigation scheme, one representative canal was purposively selected, and stratified into head, mid, and tail sections. This stratification allowed the study to capture variation in water availability and access.
- Likert scale classification (1–5) was used in household surveys yielding 449 responses. Respondents rated the severity of each challenge indicator. A weighted average score (Irrigation Challenge Score) was calculated using the number of respondents from each canal section.
- Stratified random sampling using the 'random walk' method was employed due to the absence of a comprehensive household roster.
- Validation meetings were held in July 2023 to verify findings with stakeholders. Ethics approval was obtained from IWMI, and informed consent was collected from all participants.

Physical and structural

- The three highest-ranked challenges for physical and structural are i) Insufficiency of water at fields (average challenge score: 3.6), ii) maintenance of irrigation canals (3.5), and iii) leakages from canals (3.4)

Agricultural water management

- The three highest-ranked challenges are i) spring water availability (average challenge score: 4.3), ii) inter-cultural operations due to lack of water (4.0), and iii) winter water availability (3.8)

Socioeconomic and market

- The three highest-ranked challenges are i) access to fertilizer (average challenge score: (4.4), ii) fair market price (4.2), and iii) access to input-output market (4.2)

GESI and governance

- The three highest-ranked challenges are i) agricultural subsidies from agencies (average challenge score: Male: 4.1 and Female 4.0), ii) contacting agricultural officials (male/female: 3.9) and iii) Agricultural mechanization support (male/female: 3.9)

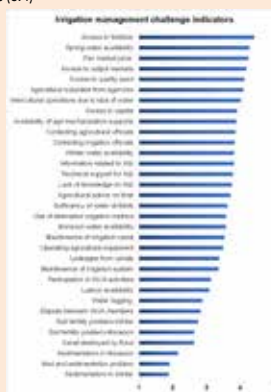


Fig 3: Indicators-wise combined challenge score in all 3 irrigation projects (Note: ARI – Agriculture and irrigation, WUA – Water User Association)

Acknowledgements:

This research study is part of the NEXUS Gains Initiative supported by CGIAR Trust Fund: cglar.org/funders. We would like to express our gratitude to the WUAs of the three irrigation systems who assisted us in the data collection process. We would like to extend our appreciation to the Department of Water Resources and Irrigation (DWRI), and Mahakali, Rani, Jamara, Kuleriya and Babai irrigation field offices for their continuous support throughout this research study.



Identification of Groundwater Potential Zones and Their Impact on Sustainable Crop Transformation: Insights from Banke, Nepal

ID-13

Ravi Prasad Chaudhary^{1,*}, Pralad Phuyal², Santosh Pandit³, Muktinath Jha⁴, Mahesh Yadav⁵

¹ GW Irrigation Consultant, GGGI-Nepal; ² Department of Earth & Environmental Science, Temple University, Philadelphia, PA, USA; ³ Prime Minister Agriculture Modernization Project, PIU Bara; ⁴ Nepal Agriculture Research Center, Khumaltar, Nepal; ⁵ Ministry of Water Supply, Irrigation and Energy, Koshi Province, Nepal

*Corresponding Author's Email: ravi078lee@icasec.edu.np

1 Introduction

- Groundwater is becoming important for irrigation in Nepal's Terai, particularly in the Banke district.
- Surface water sources are becoming unreliable due to seasonal variability.
- 95% of Banke's household depend on agriculture (mainly rice, wheat, and winter legumes; 55.8% cultivated)
- Unregulated groundwater use threatens long-term availability and quality.
- Mapping Groundwater Potential Zones (GWPZs), in conjunction with land use change analysis, supports sustainable water use and crop planning.
- These insights can help local governments implement evidence-based groundwater management and climate-resilient agricultural plans.

◆ Research Question

- How can the identification and utilization of GWPZs support sustainable crop transformation in Banke district, Nepal?
- Which regions of the Banke district have the **highest and lowest groundwater potential**, as determined by several drilling methods, and what are its implications for local water resource planning?

◆ Research Objective

- To identify and **map GWPZs** in Banke district
- To **compare groundwater potential** across the 8 local governments to identify high-potential and vulnerable areas.

3 Outcomes/Results

- Spatial interpolation showed that **shallow groundwater levels** are concentrated in Rapti Sonari and eastern Banke, whereas **deeper levels** are prevalent in Baijanath, Kohalpur, and Narainapur, indicating regional variation in groundwater availability.



Fig.4 LULC change map of Banke District (2010 - 2019) highlighting major land transitions

- Thicker aquifers were found in **southern regions** such as Narainapur and Duduwa, indicating groundwater storage potential, whereas **northwestern locations** (e.g., Khajura) showed thinner aquifer zones.

- Significant land transitions were detected, particularly from **agriculture to built-up areas** in **central to western Banke**, reducing infiltration zones and contributing to groundwater stress.

- Combined interpretation of GWL, aquifer thickness, and LULC trends allowed preliminary identification of GWPZ, distinguishing **high potential areas with shallow water tables and thick aquifers** from **vulnerable zones characterized by deep GWL, thin aquifers, and rapid urban expansion**.

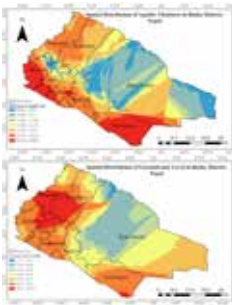


Fig.5 Spatial distribution of aquifer thickness (top) and groundwater level (bottom) in Banke District, Nepal

- Rapti Sonari**, one of the eight local governments, showed **good shallow groundwater**, whereas Baijanath and Kohalpur experienced depth issues.

- These comparisons are helpful for focused drilling, conservation planning, and future recharge interventions.

Acknowledgments

The Authors would like to thank the **Agriculture Knowledge Center (AKC), Government of Nepal, Banke**, for granting access to the groundwater exploration and installation dataset. We also acknowledge the **Groundwater Irrigation Development Division, Banke**, for their valuable technical support during the installation and study period.

2 Research Methodology

I. Site Selection & Preliminary Survey

- 400 sites selected** based on technical feasibility (soil type, depth, aquifer structure).
- Field teams and local technicians were educated to record soil profiles, aquifer depths, and water-bearing strata

II. Drilling Techniques

- Rotary Drilling:** Used for deeper formation to reach confined aquifers.
- Percussion (Cable Tool):** Preferred in semi-artesian zones (e.g. Rapti Sonari, Duduwa).
- Manual Sludge Drilling:** Used in unconsolidated formations using MS pipe system.

III. GIS & Remote Sensing-Based Mapping

- Groundwater level and aquifer thickness were recorded at each site during the dry season.
- Empirical Bayesian Kriging (EBK)** interpolation in ArcGIS Pro was used to generate spatial maps of GWL and aquifer thickness.
- Integrate **multiple layers:** DEM, LULC, soil, rainfall, geology, and drainage
- AHP** method will be used for criteria weighting and overlay in ArcGIS Pro, to determine GWPZ map.



Fig.1 Location of Banke District within Nepal and distribution of groundwater observation wells across its eight local governments.



Fig.2 Workflow for Groundwater Potential Zone (GWPZ) Mapping using ArcGIS Pro and AHP Methodology

IV. Land Use Land Cover (LULC) Change Analysis

- Land conversion trends **were assessed for the period 2010 - 2019** using ArcGIS Pro.
- This provides information about how landscape change influences groundwater recharge and demand.



Fig.3 Field Photographs of Groundwater Observation Well Drilling in Banke District, Nepal

4 Key Message

- In fiscal year 2080/81, AKC Banke installed **364 bore wells** across all municipalities, supporting irrigation on ~40 hectares and benefiting over 2,000 farmers.
- Priority was given to marginalized areas like **Narainapur**, where bore success was high, and **cropping intensity** increased from **two to three cycles** annually.
- Regions like **Rapti Sonari** and **Duduwa** showed artesian aquifers at shallow depths (20 - 30 ft), indicating strong GWPZ potential.
- Sikta irrigation project National Pride project** has **only reached** ~ 21,000 of its planned 42,766 ha coverage, leaving many areas dependent on groundwater.
- These trends, along with rising bore density, highlight the critical need for groundwater recharge strategies and evidence-based GWPZ planning in Banke to maintain long-term agricultural resilience.

5 Future Works

- Generate final GWPZ maps using AHP-based weighted overlay of DEM, LULC, soil, rainfall, geology, and drainage density layers.
- Engage local stakeholders in incorporating GWPZ outputs into irrigation planning, cropping calendars, and groundwater governance.

Irrigation Seminar 2025: Water for Agri-Food System Transformation
15 May, 2025 [Thursday], Kathmandu, Nepal



Assessment of Groundwater Storage Variation in Transboundary Aquifer of Nepal

Ashish Ganesh ¹, Vishnu Prasad Pandey ^{1,2,*}, Rocky Talchabhadel ³, Sanjeev Bickram Rana ⁴

¹ Department of Civil Engineering, Pulchowk Campus, IOE, Tribhuvan University, Nepal

² Center for Water Resources Studies, Institute of Engineering, Tribhuvan University, Nepal

³ Department of Civil and Environmental Engineering, Jackson State University, Jackson, MS, USA

⁴ Kathmandu Valley Water Supply Management Board (KVWSMB), Sainbu, Lalitpur, Nepal

*Corresponding Author's Email: vishnu.pandey@iocampus.edu.np

ID-14

1 Context and Objectives

Problem Statement:

Groundwater (GW) storage management is hindered by inadequate understanding of spatial heterogeneity in its distribution, due to lack of spatially distributed monitoring wells and long-term data. Although few reports claim GW depletion in Terai region, the state of GW storage has not been quantified. In lack of field data, several studies show potential application of remote sensing (RS) data such as GRACE in assessing the GW storage dynamics. Studies conducted using such data have quantified the GW loss in broader Ganga Basin, but fine-resolution data of Terai region is lacking.



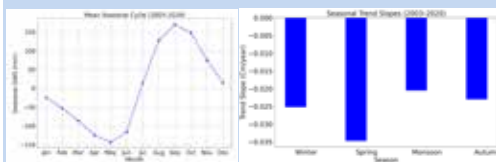
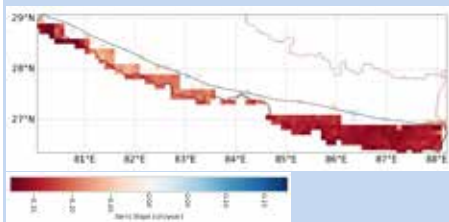
Objectives:

This research analyzes variation in GW storage in the transboundary aquifer of Nepal that extends from Terai region of Nepal to Northern India, and characterizes nature of variation in the Terai region of Nepal. Specific objectives are:

- Assess RS products for representing GW storage variation in Nepal's Terai
- Characterize spatial-temporal patterns of GW storage variation in the study area

3 Results

- Validation demonstrated a strong correlation between GRACE- and GLDAS-derived GW storage estimates and in situ observations.
- The transboundary aquifer exhibited a mean depletion rate of 1.06 cm yr^{-1} , a comparable results reported in literature.
- Within Nepal's portion of the transboundary aquifer, the results showed a decrease in GW storage at an average of 7.96 mm yr^{-1} —equivalent to a total storage loss of 50.66 km^3 from 2003 to 2020.
- A statistically significant depletion was detected in the Terai region, with the most pronounced hotspots located in Madhesh Province.
- Depletion peaked during the spring (March–May), coinciding with the annual minimum in groundwater storage.
- Cross-correlation analysis revealed that precipitation directly influences GW recharge, with no observable lag between rainfall and storage response.



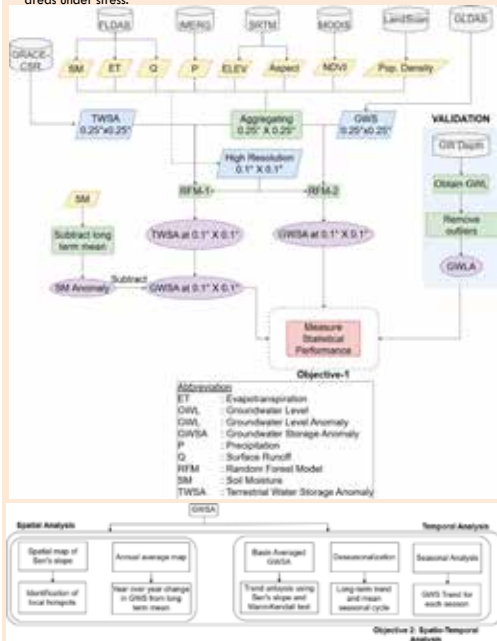
Acknowledgements:

The authors are grateful to Collaborative Research and Capacity Strengthening for Enhancing Water Security (CaREWaS) project, a partnership between Center for Water Resources Studies (CWRS) and Kathmandu Valley Water Supply Management Board (KVWSMB), for supporting this study.

2 Methods

- **Assessing Suitability of RS Products:** Given coarser resolution of RS products, resolution enhancement was performed for improving local-scale applicability by downscaling coarse-resolution GRACE data using random forest technique. Groundwater Storage Anomaly (GWSA) was computed based on downscaled GRACE data and compared with in-situ observation of GW level at selected monitoring wells to verify accuracy in capturing groundwater fluctuations.

- **Spatial Hotspots and Temporal Trends:** Based on GWSA, areas/zones with notable gain loss in GW storage were mapped, to identify critical area for recharge and depletion. Spatial pattern in GW storage variation (hotspots) was characterized based on those zoning. For temporal trends, long-term increase/decrease in GW storage at the 95% confidence level was analyzed to highlight areas under stress.



4 Conclusions

- For proper spatial and temporal coverage of the data, remote sensing products such as GRACE provides good means to study the GWSA at regional scale. However, by downscaling appropriately, they can also be considered for local-scale applicability.
- While downscaled products enhance resolution, there could still be limitation for capturing adequately local scale GW variability, both spatial and temporal. Therefore, results should be interpreted carefully.
- Regional analysis across Nepal reveals significant GW storage depletion, especially during the spring months. Continued reliance on GW heightens risks to agriculture as storage declines persist.
- The pervasive downward trend in GW storage underscores the need for coordinated transboundary aquifer management.

Impact of Cryosphere Changes on Hydrological Drought and Agriculture in Nepal: A Case Study of the Gandaki Basin

Garima Acharya¹, Kamal Biswakarma¹, Bikash Joshi¹, Bipin Kumar Thagunna¹, Jubin Adhikari¹, Bikash Bhandari¹, Vishnu Prasad Pandey^{1,2,*}

¹ Department of Civil Engineering, Pulchowk Campus, Institute of Engineering, Tribhuvan University, Nepal

² Center for Water Resources Studies (CWRS), Institute of Engineering, Tribhuvan University, Nepal

*Corresponding Author's Email: vishnu.pandey@iocampus.edu.np



ID-15

1 Context & Objectives

A. Problem Statement:

Accelerated retreat of the Himalayan glaciers due to climate change (CC) are affecting the river flow patterns. The Gandaki Basin (Figure 1, Area- 36,650 km²) relies on glacier and snowmelt for sustaining river flow. However, the role of glacier and snowmelt runoff in mitigating agricultural drought remains largely under-studied.

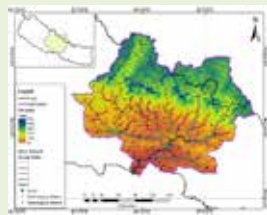


Figure 1: Gandaki River Basin with distributed meteorological and hydrological stations

B. Objectives

1. To assess the impact of climate change on the cryosphere and its effect on the hydrological cycle.
2. To evaluate the potential role of meltwater in agriculture and mitigating drought under changing climatic patterns.
3. To assess the impact of climate change on the hydrological cycle and its effect on the agricultural sector.

3 Results

A. Current hydrological regime

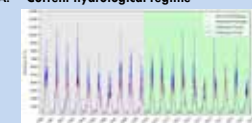


Figure 3: Observed and Simulated Discharge vs. Time



Figure 4: Mean annual contribution of each runoff component to the total runoff

B. Impact of CC on cryosphere

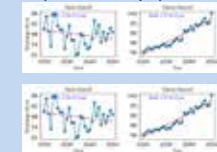


Figure 5: Yearly trend of snowmelt runoff, glacier melt runoff & total runoff under SSP245 & SSP585

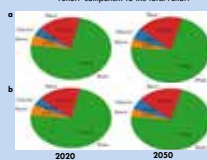


Figure 6: Annual contribution of each runoff component to the total runoff under SSP 245(a) and SSP 585(b) for 2020 (on left) and 2050 (on right)

C. Impact on drought and agriculture

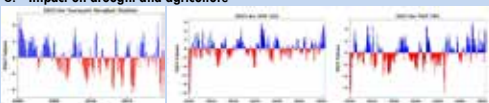


Figure 7: SSI for Narayani Devghat Station

Figure 8: SSI under SSP 245 and SSP 585 for outlet station

Drought : At Narayani Devghat Station, severe droughts were observed in 2013, 2016, and 2019. Under SSP 2.45, extreme droughts occurred in 2020 and are projected for 2026, 2034, and 2035, with wet years in 2023, 2031, 2036, and 2037. Under SSP 5.85, dry months dominated, with extreme droughts in 2020 and 2041, and wet extremes in 2024, 2025, 2037, and 2047.



Figure 9: Projections of dry yield for key crops under SSP245 and SSP585

Figure 10: Mean yearly gross irrigation requirement & snow and glacier runoff under SSP585

Agriculture: Wheat and rice yields are expected to rise from 2025 to 2050 under both SSP245 and SSP585, with higher gains under SSP585. Melt runoff from snow and glaciers exceeds irrigation needs, helping buffer short-term droughts in glacier-fed regions.

Acknowledgements:

We would like to express our sincere gratitude to Dr. Sonu Khanal, Dr. Nirman Shrestha, and MD Zuber for their guidance and contributions to this research.

2 Methods

The methodology framework for quantifying the potential role of meltwater in agriculture and mitigating drought under changing climatic patterns is given in Figure 2.

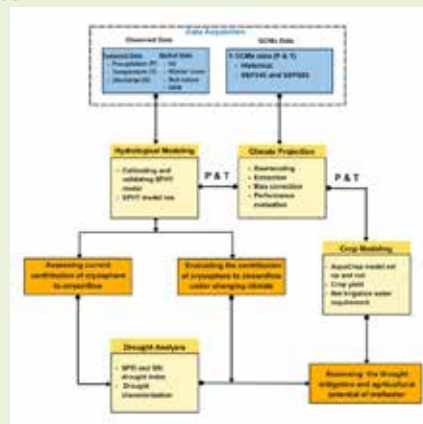


Figure 2: Methodological Framework for the study

A. Understanding the current hydrological regime:

Model Used: SPHY v2.0, suitable for glacierized basins.

Calibration and Validation: Manual calibration with data from the Devghat station. Performance evaluation using NSE, PBIAS, and R².

Outputs: Seasonal runoff components: glacial melt, snowmelt, rainfall runoff, base flow.

B. Climate change impacts on cryosphere:

Climate Projection: CMIP6 GCMs (SSP245, SSP585).

Data Processing: Bias correction using Quantile Mapping (precipitation) and linear transfer function (temperature).

Analysis: Projected changes in temperature, precipitation, and meltwater runoff to assess seasonal water availability.

C. Impacts of cryosphere on drought and agriculture:

Drought Assessment: SSI index to evaluate drought trends.

Agricultural Impact Assessment: AquaCrop model to estimate yield and irrigation need. Focused on Paddy and Wheat in Nawalparasi district (97,000 ha).

4 Conclusions

- Rising temperatures are increasing glacier melt while reducing snowmelt, altering the flow regime and leading to reduced dry season flow in the Gandaki Basin.
- Meltwater peaks during summer, supporting Kharif crop sowing and mitigating pre-monsoon drought. Rice and wheat yields are projected to increase.
- Climate change is projected to result more frequent and severe droughts in specific parts of the Gandaki Basin, revealing a need for location-specific management strategies.
- It is essential to implement water storage and conservation strategies to manage the increased pre-monsoon glacier meltwater, for Kharif sowing and agricultural security. Further, studies integrating hydrological and agricultural models to assess the Water-Food-Energy nexus should be prioritized to decide on optimal allocation and efficient use of resources.



Solar Irrigation for Agricultural Resilience in South Asia (SoLAR-SA) Project

ID-16

Shisher Shrestha^{1*}, Manohara Khadka¹, Darshan Karki¹, Sumitra KC¹, Anuj Mishra¹
¹International Water Management Institute (IWMI)
* Corresponding Author's Email: s.shrestha@cgiar.org

1 Context and Objectives

• **Solar Irrigation for Agricultural Resilience in South Asia (SoLAR-SA)** is a Swiss Agency for Development and Cooperation (SDC) funded project that aims to sustainably manage the water-energy and climate interlinkages in South Asia through the promotion of solar irrigation pumps (SIPs).

• The main goal of the project is to contribute to **climate-resilient, gender-equitable, and socially inclusive agrarian livelihoods** in Bangladesh, India, Nepal and Pakistan by supporting government efforts to promote solar irrigation. This project responds to government commitments to transition to clean energy pathways in agriculture.

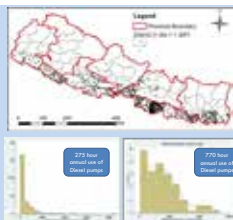
Key Objectives:

- Generating **improved empirical evidence** to support the development of climate-resilient, gender-equitable, socially inclusive, and groundwater-responsive solar irrigation policies.
- **Validating innovative** actions and approaches for promoting gender-equitable, socially inclusive, and groundwater-responsive solar irrigation.
- Increasing **national and global knowledge and capacity** for developing gender-equitable, socially inclusive, and groundwater-responsive solar irrigation policies and practices

3 Results

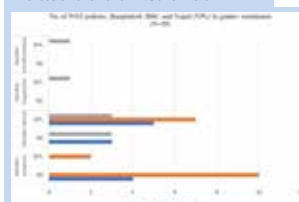
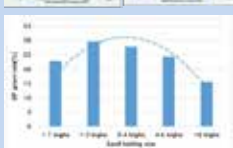
Finding 1 - SIPs reduce diesel use and improve income

- Strong reduction in the use of diesel for SIP farmers compared to non-SIP farmers (Phone Survey, 2021)
- SIP farmers reduced diesel pump use by 64 and 33 percent for monsoon paddy and wheat, respectively (HH Survey, 2021)
- SIP Farmers earned 10% more crop revenue than non-SIP Farmers SIP farmers from the Disadvantaged group reported higher benefits



Finding 2 - Adoption of SIPs faced significant barriers. (HH Survey, 2021)

- ~20% of 9100 farmers who applied for SIPs received subsidized SIPs from AEPCC
- Small and marginalized farmers are less likely to be SIP applicants (Kafle et al., 2022)
- Among those who applied for SIPs, AEPCC chose smaller and DAGs farmers



Finding 3 - Sectoral policies show variability in the understanding and embeddedness of gender and inclusion (Khadka et al., 2024)

- Agriculture policies show greater GESI responsiveness
- Energy policies show much lower GESI awareness, seeing energy as gender-neutral



Finding 4 - Unequal social and gender relations have skewed the adoption and benefits of SIP. (Shrestha et al., 2023)

- Women Friendly – YES
- Change in Gender Stereotypes – NO
- Change in Gender Relations – NO

Acknowledgements:

Swiss Agency for Development and Cooperation (SDC)
Alternative Energy Promotion Centre (AEPCC)
Nepal Electricity Authority (NEA)
Chhippharmoi Rural Municipality, Parsa

2 Project Implementation

Impact Evaluation and GESI Case Studies of APEC's Solar Irrigation Program

A range of research methods have been employed, including:

Rapid Assessment of Renewable Energy Policy and Subsidy Delivery Mechanism for Solar Irrigation Pumps (SIPs) in Nepal

Household Survey (2021) 656 HHs in 7 districts in Koshi and Madhesh Province

- Farmers who applied & got SIPs (n=303);
- Farmers who applied but did not get SIP (n=205);
- Farmers who did not apply for SIP (n=148);

Phone Survey (2021) ~876 farmers in 19 Tarai districts

- Farmers who applied & got SIPs (n=479)
- Farmers who applied but did not get SIP (n=397)

Qualitative surveys (2021) of AEPCC/CIMOD/IWMI-ACIAR Models In-depth interviews (63 qualitative interviews, 9 key informant interviews, and 4 telephonic interviews)

Policy review (2021) of the Water-Energy-Food Policies of Nepal and Bangladesh using a gender continuum scale (39 WEF sectoral policies reviewed)

Qualitative surveys (2024-25 - ongoing) to assess the efficacy of RE subsidy policy changes



Publications

- Khadka, M., Uprety, L., Shrestha, G., Shukya, S., Mitra, A., & Mukherji, A. (2024). Can water, energy, and food policies in support of solar irrigation enable gender transformative changes? Evidence from policy analysis in Bangladesh and Nepal. *Frontiers in Sustainable Food Systems*, 7.
- Shrestha, G., Uprety, L., Khadka, M., & Mukherji, A. (2023). Technology for whom? Solar irrigation pumps, women, and smallholders in Nepal. *Frontiers in Sustainable Food Systems*, 7.
- Kafle, K., Uprety, L., Shrestha, G., Pandey, Y., & Mukherji, A. (2022). Are climate finance subsidies equitably distributed among farmers? Assessing socio-demographics of solar irrigation in Nepal. *Energy Research and Social Science*, 91(August), 102756.
- Kafle, K., Balasubramanya, S., Sifel, D., & Khadka, M. (2024). Solar-powered irrigation in Nepal: Implications for fossil fuel use and groundwater extraction. *Environmental Research Letters*, 19(8).

4 Key Message

Key Takeaways

- SIP subsidy delivery process did not reach all categories of farmers, but AEPCC used GESI-compatible criteria for the selection.
- SIP farmers, who tend to devote more land to vegetables, earn more revenue compared to non-SIP farmers, with mostly positive impacts overall, despite SIPs having an insignificant effect on crop yields.
- O&M and breakdowns remain an issue – need to allocate funds for capacity building of technicians.

Positive Policy Changes:

- Improved smallholder criteria (reduced land size requirements, acceptance of land-lease agreements, community-based systems).
- Increased accessibility for rural women (priority in subsidy allocation).
- Strengthened local government role (mandatory recommendations in the subsidy process).

Remaining Concern: The efficacy of these policy changes at the local level is yet to be seen.



Evaluation of Irrigation System Performance Using Remote Sensing and GIS: A Case Study of Nepal

ID-17

Lalan Baltha¹, Sandeep Kumar Chourasia¹, Dilip Barman^{1,2}, Ashish Pandey¹

¹ Department of Water Resources Development and Management, ² Indian Institute of Technology Roorkee, Uttarakhand, ³ North Western Regional Centre,

National Institute of Hydrology, Jodhpur-342003, Rajasthan, India

Corresponding Author's Email: lalan_b@wrir.ac.in

1. Background & objectives

Efficient irrigation systems are pivotal for agricultural productivity and sustainability, but the lack of real-time information poses a significant challenge to evaluating their performance. Therefore, this study aims to assess irrigation system performance using a remote sensing-based approach. This study explores integrating remote sensing data with irrigation system performance evaluation to enhance water efficiency and sustainability. The proposed study area is the Kankai Irrigation System (KIS) in the Koshi Province, Nepal. It is located between the latitudes of 26° to 27° North and longitude of 87° to 88° East. The study area map is shown in Figure 1.

The specific objectives of the study are as follows:

1. To determine irrigation system operating performance by gathering necessary data and analyzing irrigation efficiency.
2. To evaluate the performance of the irrigation system using standard performance indicators.

2. Methodology and Materials and Methods

Table 1. Salient features of KIS

Name of the System	Kankai Irrigation System (KIS)
Location	Gaund, Jhapa, Koshi Province
Latitude	26° to 27° N
Longitude	87° to 88° E
Elevation	75 to 120 m above MSL
Source of the river	Kankai River
Total command area	8000 ha
Actual command area	7000 ha (Monsoon: 7000 ha; Winter: 4000 ha; Spring: 2500 ha)
Main Canal	36 km
Secondary Canal	74 km (22 numbers)
Tertiary Canal	110 km (287 numbers)

Study area and methodology



Fig 1. Study Area Map of KIS

Fig 2. Flowchart of Methodology for Performance Evaluation

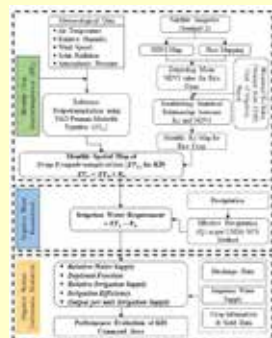


Table 2. Data Requirement for the study

Data/Information	Type of data	Source
Cropping pattern, cropping area, and Crop yield	Cropping details	Kankai Irrigation Management Office (KIMO), Jhapa and reference reports
Design discharge, Supply discharge data, Command area, and Canal networks	Flow rates and field data	KIMO, Jhapa and reference reports
Climatic data (Rainfall, Max and Min Temp, Max. and Min. Relative Humidity, Sunshine Hour, Wind Speed)	Monthly data	CLIMWAT 2.0
NDVI maps (July to November 2022)	Sentinel-2 (10m, 10 days)	Google Earth Engine (GEE)
Crop Coefficients (Kc) Values of Rice	15-days interval	Department of Irrigation

Table 3. Performance Indicators used for the study

Performance Evaluation of the Kankai Irrigation System is determined by using the following indicators:	
Relative Water Supply (Levine, 1992) = $\frac{\text{Total Water Supplied (I + Pe)}}{\text{Total Crop Water Demand}}$	Water Delivery Performance Indicators
Depleted Fraction (Molden, 1997) = $\frac{\text{Total Crop Water Demand} - \text{Total Water Supplied (I + Pe)}}{\text{Total Crop Water Demand}}$	
Relative Irrigation Supply (Perry, 1996) = $\frac{\text{Irrigation Water Supplied (I)}}{\text{Irrigation Water Requirements (CWR - Pe)}}$	Physical Performance Indicators
Irrigation Efficiency (Bandara, 2003) = $\frac{\text{Total Irrigation Water Demand (CWR - Pe)}}{\text{Total Water Supplied (I)}}$	
Output Per Unit Irrigation Supply = $\frac{\text{Yield of Harvested Crop (S)}}{\text{Diverted Water Supplied}}$	Agricultural Performance Indicators
Output Per Unit Water Consumed = $\frac{\text{Yield of Harvested Crop (S)}}{\text{Water Consumed by Crop (m)}} = \frac{\text{Yield of Harvested Crop (S)}}{\text{Water Consumed by Crop (m)}}$	

3. Results and Discussion

NDVI Map

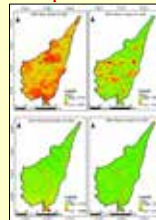


Fig 3. NDVI Map of July to November 2022

Table 4. PET from CROPWAT 8.0

Month	ETf rain	Min Temp	Max Temp	Relative Humidity	Wind Speed	Sunshine hours	Radiation	ETo
	mm	°C	°C	%	km/day	hours	MJ/m ² /day	mm/day
June	222.78	25.10	33.00	77.00	130.00	5.30	18.10	4.38
July	163.09	25.30	32.20	82.00	121.00	4.20	16.30	3.87
Aug	168.53	24.90	32.30	84.00	104.00	4.60	16.40	3.75
Sep	168.82	24.00	31.70	86.00	95.00	5.70	16.60	3.62
Oct	105.17	21.70	31.40	74.00	86.00	7.10	16.20	3.51
							Average E.T	3.83

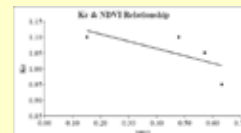


Fig. 4 Correlation between DoI Kc and NDVI

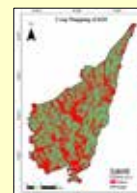


Fig 5 Rice Mapping of KIS

Crop Coefficient (Kc) Map

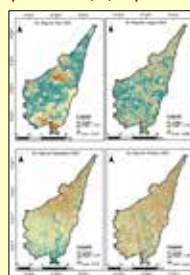


Fig 6. Kc Map of July to November 2022

Actual Evapotranspiration Map

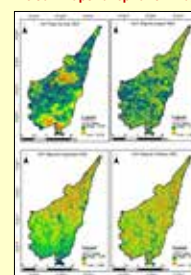


Fig 7. AET Map of July to November 2022

Table 5. Calculations of Different Indicators

Performance Indicators	Standard Value	Calculated Value	Remarks
Relative Water Supply	1	1.01	Beyrbaev et al. (1997)
Depleted Fraction	0.6-1.1	0.99	Bastiaansen (2001)
Relative Irrigation Supply	1	1.02	Molden et al. (1998)
Irrigation Efficiency	100%	97.94%	Bandara (2003)
Output Per Unit Irrigation Supply (US\$/m ³)	0.04 to 0.10	0.19	Molden et al. (1998)
Output Per Unit Water Consumed (US\$/m ³)	0.10	0.20	Molden et al. (1998)

4. Conclusions

- Overall performance of the Kankai Irrigation System (KIS) is satisfactory, but there is scope for improving the irrigation efficiency of this project.

5. Recommendations

- Field data should be updated more frequently, i.e., cropping patterns, irrigated areas, irrigation potential details, etc.
- Water delivery should be based on the CWR and irrigation scheduling.
- The modern intervention of technologies like canal automation as a pilot project may be introduced by integrating remote sensing and GIS techniques in a computerized mechanism.
- Avoid field-to-field irrigation. Farmers should irrigate their fields by field channels.

6. Acknowledgements

- It is my great pleasure to express my sincere gratitude to the Department of Water Resources Development and Management, IIT Roorkee and Kankai Irrigation Management Office, Gaund, Jhapa.

References:

1. Planning and Design of Strengthening Project, M.3 Hydrology and Agro-meteorology Manual(1990), Department of Irrigation (DoI), Nepal.
2. Narziev, J., Nikam, B., & Gopparov, F. (2021). Infrastructure mapping and performance assessment of irrigation system using GIS and remote sensing. E3S Web of Conferences, 264. <https://doi.org/10.1051/e3sconf/202126403005>.



Sustainability of Inter-Basin Water Transfer Under Climate Change: A Case Study of the Bheri Babai Diversion Project, Nepal.

ID-18

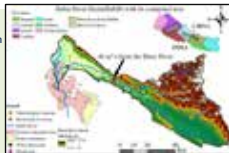
Janak Panthi ^{1,*}

¹ Department of Water Resources and Irrigation

*Corresponding Author's Email: janak.panthi2@gmail.com

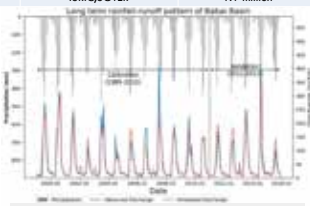
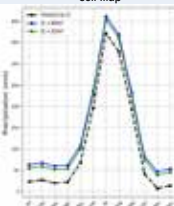
1 Context & Objectives

- The Babai Basin (BaRB), lying in Middle mountain Zone in Nepal, is crucial for agriculture production in Nepal, and faces water deficit conditions due to increasing irrigation water demand.
- Furthermore, the impacts of climate change on irrigation water resources have been drawing attention.
- Although the Inter-basin Water transfer project is ongoing to transfer water (40m³/s) from Bheri to Babai River Basin, no comprehensive study exist to project the streamflow in BaRB considering both the impact of climate change and water diversion.
- This study assesses the impact of climate change on streamflow, crop water requirements (CWR), and irrigation water requirements (IWR) in BaRB using the Soil and Water Assessment Tool (SWAT) and CROPWAT 8.0, with climate data from three General Circulation Models (GCMs).



2 Data and Methodology

Dataset(unit)	Source	Spatial/Temporal Resolution
Observed daily precipitation (mm)	DHM Nepal	7 stations (1990-2015)
Observed daily max and min temperature (°C)	DHM Nepal	3 Stations (1990-2015)
Observed daily river discharge (m ³ /s)	DHM Nepal	1 Station (1990-2015)
Digital elevation model (DEM) (m)	SRTM, USGS https://earthexplorer.usgs.gov	30m*30m
Land use map	ICIMOD	30m*30m (for 2010)
Soil map	ISRIC_SOTER	1:1 million



The water cycle in the SWAT model is based on the water balance equation

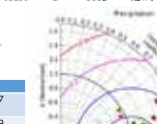
$$\Delta W_t = SW_t - \sum (R_{day} - Q_{surf} - E_a - W_{seep} - Q_{gw})$$

$$NSE = 1 - \frac{\sum (Q^m - Q^o)^2}{\sum (Q^m - \bar{Q}^m)^2}$$

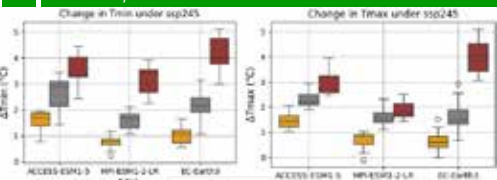
$$BIAS = \frac{\sum (Q^m - Q^o)}{\sum (Q^o)}$$

$$R^2 = \frac{\sum (Q^m - \bar{Q}^m)^2}{\sum (Q^m - \bar{Q}^m)^2 + \sum (Q^o - \bar{Q}^o)^2}$$

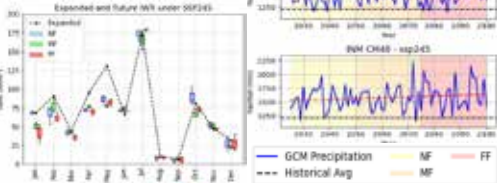
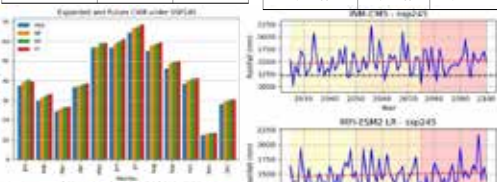
	NSE	BIAS	R ²
Calibration (1999-2010)	0.87	-4.9%	0.87
Validation (2011-2015)	0.88	+10%	0.89



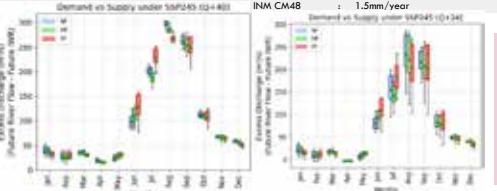
3 Outcomes/Results



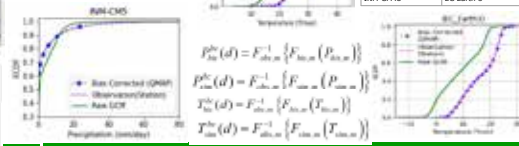
ACCESS-ESM12 LR	MPI-ESM12 LR	EC-Earth 3
$\Delta T_{min} = 2.96^\circ C$	$\Delta T_{min} = 1.89^\circ C$	$\Delta T_{min} = 4.02^\circ C$
$\Delta T_{max} = 2.96^\circ C$	$\Delta T_{max} = 1.89^\circ C$	$\Delta T_{max} = 4.12^\circ C$



"Although CWR is projected to rise, increased precipitation will reduce the IWR."



- CMIP6 climate model data were utilized for climate change projections in the basin
- To identify the most suitable General Circulation Model (GCM), a Taylor Diagram was employed
- Bias correction was done using Quantile Mapping (QM)
- Future projections are analysed across three time windows:
- Near Future (NF): 2025–2050
- Mid Future (MF): 2051–2075
- Far Future (FF): 2076–2100



4 Key Message

- The rise in temperature is projected to increase the Crop Water Requirement (CWR) in the Babai River Basin (BaRB) by around 10% in the future.
- Despite the increase in CWR, the Irrigation Water Requirement (IWR) is expected to decrease due to increased precipitation.
- If the diversion from the Bheri River Basin (BRB) is assured, the BaRB will no longer be a water deficit basin.
- However, a projected 40% reduction in BRB discharge, along with an equivalent reduction in diversion to BaRB, could lead to irrigation water stress in the BaRB—particularly in April.

Acknowledgements: I sincerely thank the ADB-JSP Program for the scholarship to pursue my master's at Tokyo Tech, and Prof. Tsuyoshi Kinouchi for his valuable guidance and support throughout this research."

Irrigation Seminar 2025: Water for Agri-Food System Transformation
15 May, 2025 [Thursday], Kathmandu, Nepal



ID-19

¹ Brihat Bagmati Irrigation Project

*Corresponding Author's Email: baqmatisichai@gmail.com, urrameshsingh@gmail.com

2 Project Implementation

- Context and Rationale:**

Objectives:

- Duration:**

- Seven 7year (2082-2089) years of *persistent hard work and on-going*

1. Enhanced Irrigation Coverage: Irrigation service to 1,22,000 hectares
2. Increased Agricultural Production & Productivity: Per hectare return increases from Rs. 1.29 lakh to Rs. 2.86 lakh.
3. Economic Returns & Viability: Economic Returns & Viability: EIRR 17.32% and B/C ratio: 1.79
4. Livelihood and Employment Benefits/Climate-Resilient Agriculture/Modernized and Sustainable Infrastructure/Institutional Strengthening



-

-

- Thanks to all who supported in the endeavor

Initial studies were conducted as early as 1967–1972 (UNDP-FAO), and major works began in the 1980s.

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1. Rehabilitation of Existing System of Existing 38,600 Ha
2. Command Area Development (CAD) of 7,600 Ha of Existing System
3. Extension of Irrigation Coverage: 76,400 Ha and Integration of IBWT Project.
4. Organizational Setup: Four offices under a central project directorate.



- ✓ Inter-basin water transfer for irrigation
- ✓ The project is a game-changer for water management in Nepal.
- ✓ It sets an example of large-scale, sustainable irrigation integrated with climate adaptation and economic upliftment.

BABAI IRRIGATION PROJECT, BAIDI, BARDIYA

ID-20

Sushil Chandra Devkota^{1,*}, Shekhar Nath Neupane¹, Namita Gautam¹

¹ Babai Irrigation Project, Baidi, Bardiya

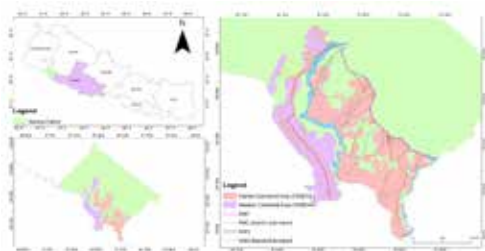
*Corresponding Author's Email: bibabardiya@gmail.com

1 Context, Objectives & Financing

Rationale and Objective of the project

The Babai Irrigation Project started in fiscal year 2045/46 BS fully funded by the Government of Nepal, aims to provide year-round irrigation in Bardiya district to about 36,000 hectares of cultivable land across six local municipalities. The project features two main canal systems: the Eastern Main Canal, which irrigates 21,000 hectares, and the Western Main Canal, covering the remaining 15,000 hectares. Once completed, the project is expected to significantly boost agricultural productivity, improve food security, and uplift the livelihoods of thousands of farming households in the region and helps to achieve the national goal of Prosperous Nepal, Happy Nepal.

Location of the project



Duration and financing of the project:

The total estimated cost of the Babai Irrigation Project as per updated/revised master procurement plan is at NPR 18 arab 96 crore 30 lakh 44 thousand, with the target of completing the project by fiscal year 2082/083 BS. However, due to the impact of COVID-19 and the lack of budget allocation in previous fiscal years as projected by the approved master plan, both the cost and timeline of the project are expected to increase. As a result, preparations are underway to revise the master plan with a new target of completing the project by fiscal year 2085/086 BS. So far, NPR 14 arab 88 crore 67 lakh has been spent, and 76.50% of the total work has been completed.

3 Results

Major Activities	Targets set as per approved Master Plan	Achievements till date
Productivity (FY 2081/82, Paddy)		6.81 ton/ha
Syphon Construction (551 m long and 30 Cumecs capacity)	1 No	Completed
Land Acquisition	576.56 ha.	397.42 ha.
Eastern Main Canal	34.5 km	Completed
Western Main Canal	41.4 km	29.7 km
Branch/ Sub Branch Canals	454.2 km	312 km
Command Area Protection Works (CAP)	32.18 km	28.44 km
Command Area Development Works (CAD)	36000 ha.	26500 ha.

Completion of Construction of Canal Systems and CAD works is crucial for delivering water to farmland, which directly impacts agricultural productivity and the types of food that can be grown, thus transforming the food supply.



Acknowledgements

Babai Irrigation Project would like to thank the Department of Water Resources and Irrigation for organizing the Irrigation Seminar with the theme "Water for Agri-Food System Transformation" and providing the opportunity to present the poster about project.

2 Project Implementation

Phase I: Weir cum Bridge (315m) and Eastern Main Canal (28 km) –completed in 2058 BS



Weir Cum Bridge (315m)

Settling Basin

Eastern Main Canal

Phase II: Started with Syphon in Babai River.

Ongoing Works and Future Works

Eastern Canal System: Tender Award has been completed and construction work has just commenced for the final section construction and strengthening of B2 branch.

The study for the branch/sub-branch canals originating from the final section of the Eastern Main Canal (Ch. 28+000 - 34+000) and command area development work south of the Hulaki Sadak has been completed. Tendering can be done upon receiving source agreement on next FY.



Syphon in Babai River



Lining in Branch/ Sub-branch Canal (Eastern System)

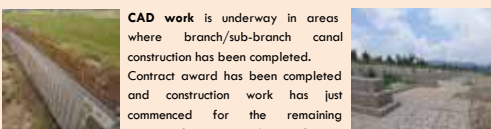


Syphon in Western Main Canal

Drain Under Pass

Western Canal System: Construction work on the final section of the Western Main Canal (Ch. 28+000 - 41+400) and 4 branch canals is progressing rapidly under two awarded contract packages.

The study for the branch canals originating from the final section of the Western Main Canal (Ch. 32+000 - 41+400) and CAD work has been completed. tendering can be done upon receiving source agreement on next FY.



CAD Works

CAP Works

CAD work is underway in areas where branch/sub-branch canal construction has been completed. Contract award has been completed and construction work has just commenced for the remaining command area protection works.

Challenges:

1. Balancing Water Demand & Supply and addressing the Year-Round Irrigation through trans-basin diversion (BDDMP).
2. Budget allocation as per MPP and timely completion of project with no cost overrun.
3. Preparedness for extreme flood events (flood in 2013 damaged road at headwork and prevented damage to headworks but syphon was washed away causing obstruction to supply of water towards Dhodhari and Janti Bargada canals.)
4. Land acquisition is always challenging as locals demand either the provision of alternative land plots or high price for land.
5. Implementing project construction activities in line with canal operation plan and achieving targets set. Also, in National Park and its buffer zones, there is always delay in construction activities.

4 Key Message

- Budget as per Master Procurement Plan must be sanctioned to complete a project on time otherwise it would cause both time and cost overrun.
- Well organized and structured WUAs is mandatory for smooth implementation of any irrigation project.
- Irrigation and agricultural offices linkages at project implementation level is necessary for achievement of targets set.

Irrigation Seminar 2025: Water for Agri-Food System Transformation
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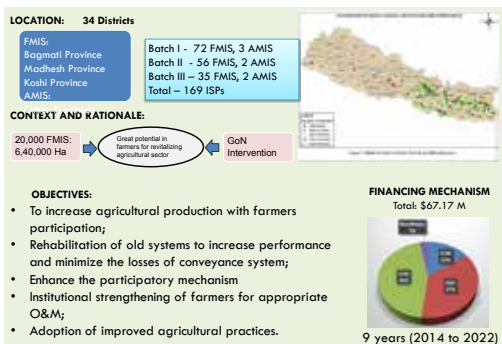


CMIASP-AF: Towards Agri-Food System Transformation

Shanti Satyal^{1,*}, Sanjeeb Baral^{1,*}
Department of Water Resources and Irrigation
Corresponding Author's Email: satyalsanti@gmail.com, sanjeeb.baral@gmail.com

ID-21

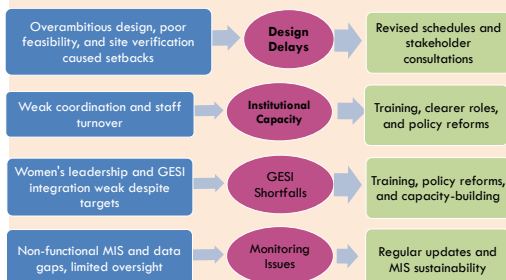
1 Context, Objectives & Financing



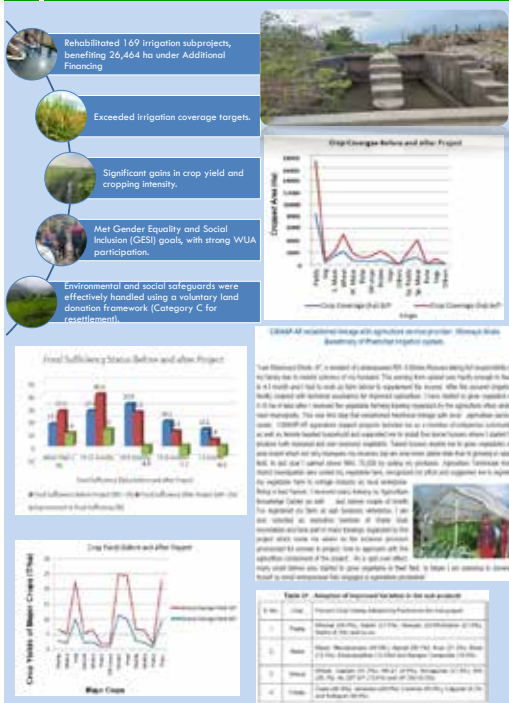
2 Project Implementation

The **Community Managed Irrigated Agriculture Sector Project (CMIASP)** and its **Additional Financing (CMIASP-AF)** in Nepal aimed to reduce rural poverty and promote inclusive growth by improving farmer-managed irrigation systems (FMIS) and supporting agriculture and livelihoods.

Challenges for Implementation and Remedies:



3 Results



Acknowledgements:

Project Completion Report CMIASP-AF 2022
Irrigation Management Division

4 Key Message

Community-driven approaches with strong institutional support improved irrigation, boosted agricultural productivity, and enhanced rural livelihoods sustainably.

Project exceeded goals, proving the value of empowering Water Users' Associations and social inclusion; increased irrigated land, crop yields, and community involvement make it a replicable model for rural agriculture and food security.

Irrigation Seminar 2025: Water for Agri-Food System Transformation
15 May, 2025 [Thursday], Kathmandu, Nepal



Mechanized Irrigation Innovation Project, Jawalakhel, Lalitpur

Ajay Raj Adhikari^{1,*}

Mechanized Irrigation Innovation Project, Department of Water Resources and Irrigation

*Corresponding Author's Email: mip.irrigation@gmail.com

ID-22

1 Context, Objectives & Financing

Location:

- 16 local levels of Sarlahi and Rautahat Districts

Context and Rationale:

- Ground Water Irrigation Schemes through deep tube wells (GWIS);
- Electric VSD/VFD pumps;
- Contribution to dry part of the country to enhance agriculture yield;
- Sustainability of irrigation system envisaged in MOM through PPP modality and establishment of irrigation management company;
- DBO modality: 1st of its kind in irrigation sector in Nepal;

Objectives:

- To increase year-round access to irrigation water in the Terai by constructing a large-scale network of tube wells, pipe based distribution system and dedicated electricity distribution networks
- On-demand irrigation services will be provided to the farmers by the MOM operator against payment through prepaid metering systems
- Specific institutional and capacity development support for the water users to develop self-sustained and long-term crop intensification and diversification, and market support services.

Duration:

- Design build period: four years followed by 10 years of O&M

Financing Mechanism:

- Asian Development Bank loan and grant (80%) and Government of Nepal (20%)

3 Outcomes/Results

1. Improved Irrigation Access and Reliability

- Installation of about 500 GWIS to provide assured round the year irrigation services at the nearest control point.
- Dependency of monsoon rains is over and year-round farming is awaiting.

2. Innovation Through Prepaid Metering System and VFD

- Use of prepaid metering system using smart cards, allowing farmers to pay for water uses digitally, promoting efficient and equitable distribution;
- Reduced water wastage and improved irrigation efficiency among farmers.

3. Increased Agricultural Productivity

- Climate-resilient and diversified cropping practices established;
- Mechanized irrigation allows farmers to grow multiple crops per year, including high-value crops like vegetables and fruits and reduces the risk of crop failure significantly and,
- Crop yields improves significantly due to assured irrigation, resulting in better income and food security.



Fig. Increase in production due to irrigation

4. Empowerment of Farmers and Local Communities

- The project benefits over 121,000 farmers, many of whom were previously marginalized by lack of infrastructure.
- Strengthens the capacity of Water User Groups and encouraged women's participation in water governance.



Fig. Involvement of local level during project planning phase

5. Enhanced Climate Resilience

- Reducing vulnerability to drought,
- Promote sustainable water management practices in the face of climate variability.



Fig. Climate Resilience practice.

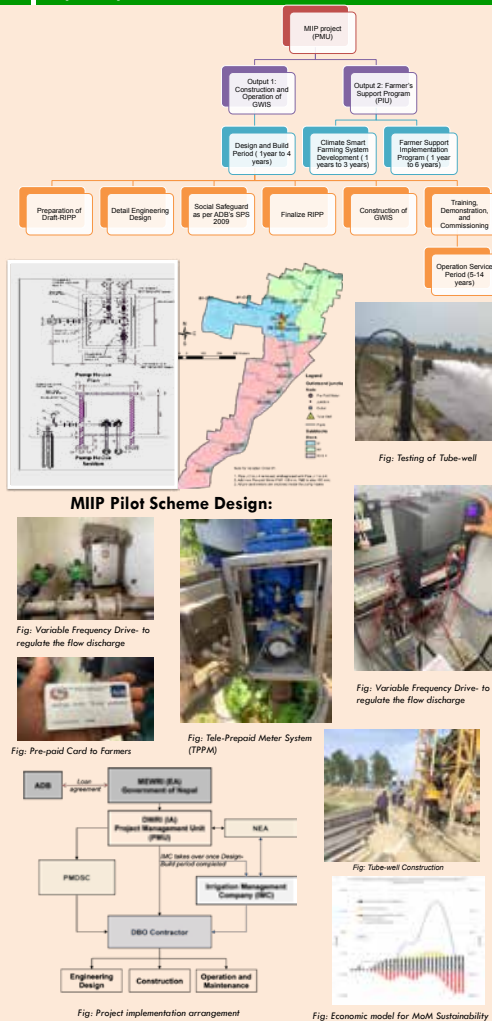
6. Sustainable Operation Through Public-Private Partnership

- Adopted the Design-Build-Operate (DBO) model, where private contractors not only construct the system but also operate and maintain the irrigation systems on behalf of irrigation management company;
- Ensure long-term system reliability and reduced burden on government resources and,
- The collected irrigation tariff is deposited in Escrow account to cover the cost of management, operation and maintenance and remaining money will be fixed deposited for Asset Replacement Fund.

Acknowledgements:

We gratefully acknowledge the on going support of the Government of Nepal, Asian Development Bank and local communities in making the Mechanized Irrigation Innovation Project a successful one for sustainable and climate-resilient agriculture.

2 Project Implementation



4 Key Message

- MIIP brings innovative irrigation technology ;
- It provide reliable year-round irrigation services through deep tube wells and prepaid metering system;
- It transforms lives of 1,21,000 people by increasing the income;
- Ensure smart water management with prepaid metering systems reduces waste and ensures fairness and,
- Ensures system sustainability through introduction of PPP modality in management, operation and maintenance.

Status of Sunsari Morang Irrigation Project

Sunsari Morang Irrigation Project
Corresponding Email: umir_biratnagar@yahoo.com

ID-23

1 Context, Objectives & Financing

The Sunsari Morang Irrigation Project (SMIP), initially designated as the Chatara Canal Irrigation Project (CCP) with the objective of providing year-round irrigation facility to cultivable land of Sunsari and Morang district resulting food security, stands as the largest irrigation system in Nepal. Constructed under a bilateral agreement between Nepal and India, the Government of India undertook the project's construction, which commenced in 1964 and concluded in 1972.



Location map of SMIP head works

The Government of India formally handed over the operational and maintenance responsibilities to the Nepal Government in 1975, leading to the rechristening of the project as the Sunsari Morang Irrigation Project (SMIP). Encompassing a command area of 68,000 hectares, with 40,000 hectares situated in Sunsari District and 28,000 hectares in Morang District, SMIP boasts the Chatara Main Canal (CMC), diverting from the Koshi River at Chatara with a designed discharge of 45.3 cumecs, traversing a 53-kilometer southeast trajectory. The comprehensive gross command area of SMIP spans approximately 112,000 hectares, extending between the Koshi River in the west and the Bakra River in the east.

3 Outcomes/Results

Different Structures constructed during different Stages and Phases



- After the different stages and phases, the water management problems have been greatly reduced by the adaptation of a simply structured irrigation system under the stage - II and stage - III, phase - I project and the participation of farmers from project design to system's operation and maintenance (O and M) resulting the following annual productivity.

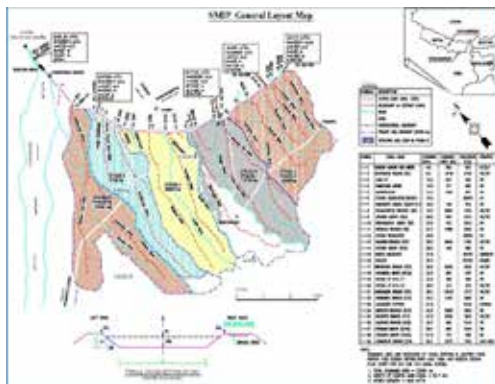
Role of SMIP in Agriculture

S.N.	District	Crops	1975-76				1976-77				1977-78				1978-79			
			Area (ha)	Production (kg)	Yield (kg/ha)	Value (Rs.)	Area (ha)	Production (kg)	Yield (kg/ha)	Value (Rs.)	Area (ha)	Production (kg)	Yield (kg/ha)	Value (Rs.)	Area (ha)	Production (kg)	Yield (kg/ha)	Value (Rs.)
1	Sunsari	Wheat	10000	1000000	100	1000000	10000	1000000	100	1000000	10000	1000000	100	1000000	10000	1000000	100	1000000
2	Morang	Wheat	10000	1000000	100	1000000	10000	1000000	100	1000000	10000	1000000	100	1000000	10000	1000000	100	1000000
Total			20000	2000000	100	2000000	20000	2000000	100	2000000	20000	2000000	100	2000000	20000	2000000	100	2000000

Annual Production and Outcome: Rs. 170405 Lakh

Acknowledgements: All the members of the Sunsari Morang Irrigation Project, related stakeholder, Professionals and researchers.

2 Project Implementation



The Sunsari Morang Irrigation Project (SMIP) was originally implemented as Chatara Canal project (CCP) under the Grand Aid from the Government of India (1964 - 1975).

The initial infrastructure handed by the Government of India included a side intake (Now called as Old Intake), the 53-kilometer long Chatara Main Canal (CMC), 19 branch/distributaries canals covering 203 kilometers, and 234 kilometers of minor canals.

The SMIP has been rehabilitated since 1978 by the financial assistance of International Development Association (IDA). The rehabilitation is divided into three stages of command area development and mitigation of siltation problem, namely Sunsari Morang Headwork Project (SMHP) as follow:

Stage -I : Development of Shankarpur Distributary and its adjacent area (9750 ha) including the Koshi river control and sediment control device. (April 1978 - June 1986).

Stage -II : Development of Sitagunj and Ramgunj Distributaries area (1600 ha) including improvement of Chatara Main Canal (CMC) and related structures (November 1988 - July 1994).

SMHP : Construction of a new intake, a desilting basin, electrically operated dredgers and micro hydro power station in the (March 1993 - November 1995).

Stage -III : It comprises three phases, with Phase I executed from 1997 to 2001, while Phase II includes cad work in 29000 ha of land and Phase III as per master plan are yet to be implemented. Phase I- Development of Biratnagar and Harinagara distributaries (15100 ha) including CMC restoration, Budhi aqueduct and Koshi flood embankment..

4 Key Message

The existing condition of the Sunsari Morang Irrigation Project (SMIP) reveals a significant challenge in water extraction from the river. Despite initial developments covering 38,000 hectares in various stages, operational issues have surfaced within the system. The construction of a new side intake, boasting a capacity of 60 m³/sec, aimed to facilitate water intake into the Chatara Main Canal (CMC) under the SMHP program. However, the lack of a robust diversion structure to manage sedimentation has led to substantial morphological changes in the river, notably impacting the intake's discharge capacity.

Downstream of Chatara, the Koshi River's flow across an alluvial fan has resulted in bifurcation into two channels at the head. While the main stream flows on the right side, a secondary channel supplies water to the CMC on the left bank. Due to water requirements and the system's disability to abstraction water during the dry season, a temporary diversion by earthen dam is constructed on an annual basis, resulting in a significant capital cost burden.

This predicament underscores the pressing need for urgent intervention and modernization to address these operational challenges and ensure sustainable water management, thereby securing reliable year-round irrigation facilities for the command area which will secure food security.

Irrigation Seminar 2025: Water for Agri-Food System Transformation
15 May, 2025 [Thursday], Kathmandu, Nepal



Improved Irrigation and Agriculture Service Enhanced the Livelihood and Farm Production

ID-24

Project Implementation Office and Agriculture Component Implementation Unit, Rani Jamara Kulariya irrigating Project,
Corresponding Email: rikis@dwri.gov.np ; rikis2ndagriculture@gmail.com

1 Context & Objectives

Introduction & Background

- Nepal's oldest and largest Farmer Managed Irrigation Systems: Rani (1896), Jamara (1905), Kulariya (1915) were traditionally built and operated by the Tharu community.
- In 2010 the Government of Nepal merged them into the Rani Jamara Kulariya Irrigation Scheme (RJKIS) covering 14,300 ha.
- Recently the project has planned to cover 38 000 ha.

Challenges Prior to Project

- Unreliable supply: flood-prone intakes with high dry-season losses.
- Inequitable water distribution: head-tail conflicts.
- Low cropping intensity (~160%);
- Labor intensive constructions if intake every year.
- Women's participation in WUAs below 19%.



Project Finance (in USD millions)	
Government of Nepal	125
World Bank	66
Water Users Association	1.3

3 Results



Acknowledgements:

- Mr. Devesh Belbase: Water Governance expert
- Ms. Rubika Shrestha: Task Team Leader, World Bank
- Dr. Bhesha Raj Thapa: Water resource expert

2 Project Implementation

Interventions

Constructed permanent intake at Karnali and modernized canal networks



Strengthened WUAs with 33% women.

Multipurpose system: 4.71 MW hydropower generation for revenue generation and clean energy.



Introduced improved farming technology, farming equipment and machinery, fertilizers, and seeds

Implemented watershed conservation, erosion control flood protection, and dolphin-friendly embankments.



Built 250 km of rural roads and access to market.

4 Key Message

The Rani Jamara Kulariya Irrigation Project has revitalized a historic farmer-built system with modern engineering and robust institutions. It exemplifies how investing in irrigation infrastructure, linking agriculture, and community capacity can drive rural development: water is now equitably distributed to over 25,000 households, yields and incomes have surged, women and men share in governance. This success story offers a model for modernizing other farmer-managed irrigation schemes across South Asia – showing that with the right support, even century-old systems can be transformed into engines of inclusive growth for the future.

Irrigation Seminar 2025: Water for Agri-Food System Transformation
15 May, 2025 (Thursday), Kathmandu, Nepal



Mega Dang Valley Irrigation Project : Efficient Water Use Strong Harvests – Sustainable Irrigation for Agricultural Transformation in Dang Valley

Top Bahadur Khatri Chhetri
Mega Dang Valley Irrigation Project
Corresponding Author's Email: mdvip2016@gmail.com

ID-25

1 Context, Objectives & Financing

Location:



• Mega Dang Valley Irrigation Project, Tulsipur, Dang, Nepal.

Context and Rationale:

With the main objective of finding a direction towards economic prosperity by increasing the agricultural production, the Mega Dang Valley Irrigation Project has been implemented by the Government of Nepal on 2016 (2073 BS).

Objectives:

- ✓ provide year-round, reliable irrigation to 56,000 ha of land in Dang Valley.
- ✓ Promote Sustainable Water Management.
- ✓ Improve Socio Economic Condition.

Duration:

- Ten 10 year (2074-2084) years of persistent hard work and on-going

Financing Mechanism: GoN

3 Results

1. Enhanced Irrigation Coverage:

- Rehabilitation/modernization and strengthening of existing surface irrigation systems- 6000 Ha
- Storage of water from rivers within the Dang valley- 2250 Ha, 35 nos. of storage has been constructed, Some Storage Distribution system is yet to be developed
- Groundwater Irrigation System- 730 Ha, 22 no of Groundwater system (Deep Tubewell) has been completed including distribution system.

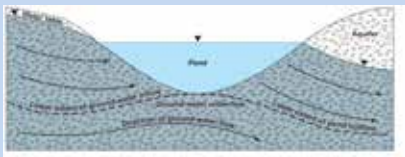


Pic 1- Happy Farmers-Irrigation from storage Component- Deserted Land turned into greenery



Pic 2 –Farmer's Review in Newspaper

Pic 3-Reservoir Tank of Storage Pond

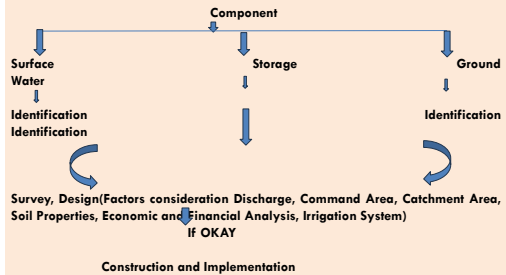


Pic 4- Ground Water Recharge through storage pond

Acknowledgements:

- Thanks to all who supported in the endeavor

2 Project Implementation



Storage

Soil Embankment-Spillway-Stone pitching-Lifting/Gravity-Reservoir Tank-Distribution



Groundwater

Boring-Pump house-Electrification-O/H tank-Pump Installation, fittings-Distribution



Challenges :

- To provide sufficient Irrigation facilities during Dry Period
- Unavailability of suitable soil for construction of Embankment for Storage Pond
- Depletion of Ground Water Table
- Most of the River are Non-Perennial River.

How are they being tackled:

storage pond projects

- Helps in groundwater recharge.
- Impounding surplus water during the monsoon and irrigate during Dry period.

Surface Irrigation System

- Improves water efficiency, minimize water loss

Ground Water Irrigation system

- Reduces Dependency on Monsoon
- On-Demand Access

4 Key Message (Innovation and Significance)

- ✓ Use groundwater wisely— protect it, use it efficiently.
- ✓ Storage ponds: secure irrigation today, sustain water for tomorrow .
- ✓ Surface Irrigation: Efficiency Focused.

Irrigation Management Information System in Nepal: Current Status, Opportunities & Challenges

ID-26

Prajwal Prajapati^{1,2}, Janak Panthi¹, Suchana Acharya¹,

¹Irrigation Management Division, Department of Water Resources and Irrigation

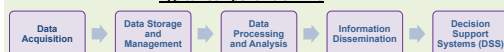
²Corresponding Author's Email: prajwal.dorji@gmail.com

1 Background

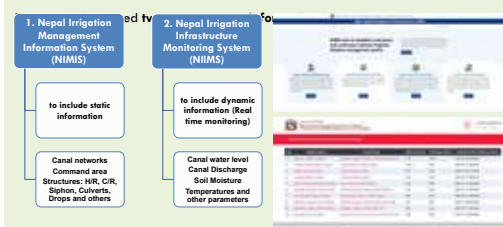
Irrigation Management Information System (IMIS) is a system that integrates **data, hardware, software, and people** to support **informed decision making** in the planning, operation, and management of irrigation systems.

It's a tool that helps to **optimize water use**, assist in **water balance** (supply/demand side), improve **irrigation efficiency**, enhance **agricultural productivity**, ensure **equitable water distribution**, **real time monitoring** of irrigation systems, and better **planning and decision making**.

Typical Components of IMIS



- National Irrigation Policy 2080, **Strategy 9.10** has focused in **developing integrated management information system in irrigation sector** that would collect information and data about irrigation projects from **central, provincial and local level governments**.
- Department of Water Resources and Irrigation (DWRI)** have been developing an **integrated management information system** for systematic collection of data and information relating to irrigation sector with the **goal to assist in decision making** in the field of irrigation water management and future infrastructural planning.



3 Opportunities

- NIMIS and NIIMS** can be developed as **central database information system** integrating information and data from **central, provincial and local level governments**.
- Optimization** of available water for irrigation use through **improved irrigation efficiency**
- Enhancing agricultural productivity** (timely and adequate irrigation guided by the insights of Management Information System leads to better crop yields)
- Ensuring **equitable water distribution** (monitoring of water flow and distribution across the irrigation system)
- Increase in **transparency and accountability** (centralized data platforms ensures to make water management process transparent)
- Enable **Real-time Monitoring** (Integration of technologies such as telemetry that allow for continuous tracking of critical parameters like discharge, soil moisture, rainfall and others)
- Supports for **better planning and informed decision making** (accurate data enables informed decision making about water availability, crop water demand, irrigation scheduling, infrastructure maintenance plan and upgrades and policy development)
- Facilitate in **Climate Change Adaptation** (Data on changing weather patterns, water availability and demand can assist in managing irrigation under varying climatic scenarios)
- Better **Preparedness from Disasters** like flood and drought

Acknowledgements:

The authors would like to acknowledge everyone associated with NIMIS and NIIMS work at Department of Water Resources and Irrigation.

2 Current Status

NIMIS:

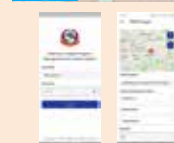
Main goal of NIMIS is to **develop and establish** an operational system to **integrate MIS database with GIS and online reporting systems** (includes developing a location-based information system for unlimited users with varying access rights and data / information needs which can publish results and managing database based on geo-spatial technology for a given region and sector/purpose)

At Present **NIMIS Database system** includes:

- Inclusion of scattered **FMIS systems**
- detailing all the structures at the **AMIS systems**
- Basic information on **Groundwater and Non-conventional Irrigation Systems**.



- This System **demands continuous operation and update** of the existing database (**Asset Inventory data : Rating of structures that contributes to develop Asset Management and Maintenance Plan**)
- Provision of **NIMIS Mobile Application** to support and enhance at **different users' level** to assist in **viewing and updating the information** from the field level as well as other higher levels.



Addition of new FMIS into NIMIS database using NIMIS Mobile Application

Updating status of Asset Inventory of irrigation infrastructure in NIMIS database

NIIMS:

- A dynamic information system developed as a real time monitoring systems **Nepal Irrigation Infrastructure Monitoring System (NIIMS)** for monitoring the status of irrigation water flow through the main canals at various large irrigation systems across the country.
- Developed with a goal to **assist in operation and maintenance** of the irrigation system (assist in irrigation scheduling, water balancing, system management)



4 Challenges

- Limited Infrastructure and Connectivity
- Technical Expertise and Capacity Building
- Data Management and Interoperability
- Financial Constraints
- Institutional and Governance Issues
- Sustainability and Ownership

5 Key Message

- Developing NIMIS and NIIMS as a **Centralized Irrigation Database** can provide accurate data supporting water managers in **making accurate decisions for improving irrigation water management** (Less Conflict, Equitable Distribution).
- MIS can assist in **optimum agricultural production** from existing irrigation infrastructures with **improved irrigation efficiency** through **informed decision making**
- Maximizing the return of scarce financial resources** invested in irrigation infrastructure as data driven approach help in **identifying and prioritizing the maintenance need** in the Irrigation system



Data-Driven Insights for Policy: Evaluating the Impact of Irrigated Areas on Crop Yields through Google Earth Engine and Statistical Data

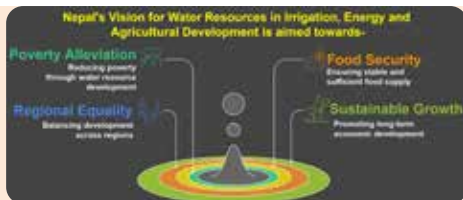
Saroj Karki^{1,2}, Pramit Ghimire², Bharat Khadka³, Vishnu Prasad Pandey⁴, Ananta Man Singh Pradhan⁵

¹ Ministry of Water Supply, Irrigation and Energy, Koshi Province, ² Nepal Development Research Institute, ³ Kathmandu Metropolitan City Office, ⁴ Institute of Engineering, ⁵ Water Resources Research and Development Center

*Corresponding Author's Email: sarojice@gmail.com

ID-27

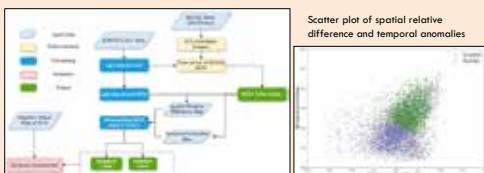
1 Background and Objective



Ultimately, transforming Nepal into a prosperous and self-reliant nation

- Huge investment is pumped towards the development and expansion of irrigation and agriculture sector. Irrigation Master Plan, 2024 aims to expand and improve irrigation services to 2.26 Mha of command areas across Nepal.
- To evaluate the contribution of irrigated command areas, this study aims to first accurately map spatiotemporal dynamics of irrigated agricultural areas and hence, the subsequent crop yield from selected command areas.

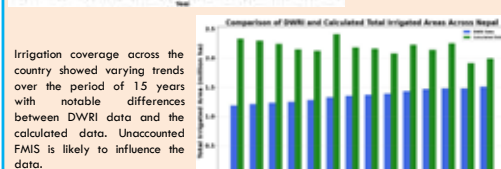
2 Methodology



- Using GEE and ICIMOD cropland data, MODIS Normalized Difference Vegetation Indices (NDVI)
- and applying the concept of temporal stability, its two indices, **Spatial Relative Differences and Temporal Anomalies** maps were generated considering of **time of peak of NDVI**
- And using the **K-means algorithm**, classification of **irrigated and rainfed land** was distinguished.
- Results were analyzed across **selected irrigation projects** to correlate irrigated areas **vs crop yields**.

3 Results and Implications

Results across Nepal



Irrigation coverage across the country showed varying trends over the period of 15 years with notable differences between DWRI data and the calculated data. Unaccounted FMIS is likely to influence the data.

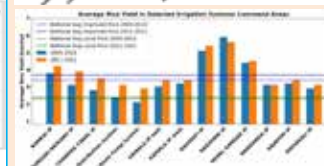
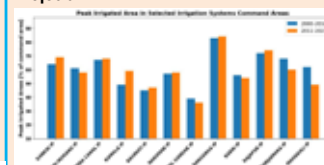
Average irrigated areas increased across all provinces except Gandaki.

Madhesh and Karnali province depicted least irrigation coverage during the peak cropping season.

Koshi and Sudurpashchim Province showed higher increase over the past two decades.

Province	Irrigated areas (%)		% chang
	(2000-2010)	(2011-2021)	
Koshi	63.4	67.3	3.97
Madhesh	51.8	52.4	0.52
Bagmati	62.5	62.8	0.27
Gandaki	69.0	68.0	-0.96
Lumbini	59.6	62.9	3.29
Karnali	53.9	56.6	2.65
Sudur Pashchim	56.04	59.8	3.74

Results across selected irrigation Projects



- Irrigation coverage during peak cropping season varied (36-84%) significantly across irrigation systems.
- This variation can be linked to **limited water availability** in source river, **reduced cropped areas**.
- Although the yield in the selected irrigation projects is **above the national average**, there has been only a **slight increase in crop yield** over the past two decades.

4 Key Message

- In average, 60% of the crop areas was found to be irrigated over the last two decades.
- Inconsistencies in the spatial distribution of total irrigated areas among different agencies are expected to be narrowed by the output of this study.
- Yield is satisfactory but Expanding crop areas within irrigation command zones is vital for boosting production and maximizing project returns.
- Applying remote sensing and the GEE platform enhances our understanding of irrigated area dynamics and hence evaluating their impacts.

References

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Irrigation Seminar 2025: Water for Agri-Food System Transformation
15 May, 2025 [Thursday], Kathmandu, Nepal



Digitalization of Environmental Assessment Process

Tanoj Dulal ^{1,*}

¹ Sikta Irrigation Project, Nepalgunj, Banke

*Corresponding Author's Email: siktaproject@gmail.com, dulaltanoj@yahoo.com

ID-28

1 Context, Issues & Objectives

The environmental clearance process for development projects has been made mandatory, with the level of assessment determined by the nature and scale of the project. However, the current process is outdated, overly complex, and time-consuming. Due to the lack of clear guidelines on assessment levels, involvement of multiple agencies, and the need for repeated follow-ups, the process has become cumbersome for project proponents. As a result, there is growing reluctance among proponents to undertake environmental assessments. Furthermore, the credibility of these assessments is questionable, as they are often conducted merely to fulfill procedural requirements rather than to enhance environmental outcomes. There is also inadequate implementation, monitoring, and auditing of the recommended environmental management plans.

Where Our Environmental Assessment Process Stands?

Nijgadh Airport: Content was copied from a similar document prepared for a hydropower project

Pokhara Int'l Airport: Found only 28 species of birds while conservationists have counted more than 470 species of birds.

Prithvi Highway: Tree with a nest of griffon vulture, an endangered species was cut down despite the plea of Pokhara Bird Society.

Sikta Irrigation Project: Supplementary EIA initiated in 2078 has not been approved yet.

PROBLEMS



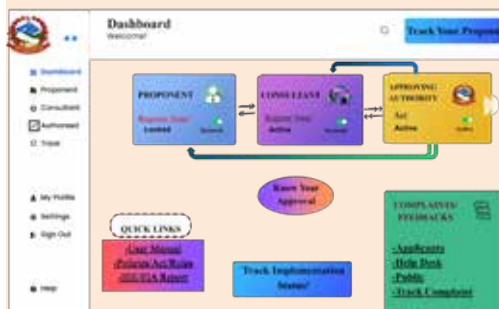
Objectives:

- To develop a centralized, online single window platform that integrates all steps and stakeholders involved in the environmental clearance (EIA) process.
- To simplify and accelerate the clearance process by reducing procedural delays, minimizing manual coordination, and enabling real-time tracking and digital approvals.
- To promote transparency, consistency, and objectivity in decision-making, thereby enhancing trust and accountability in the environmental assessment process.
- To improve accessibility and user-friendliness of the system, encouraging greater compliance and proactive participation from project proponents, ultimately leading to more sustainable and environmentally responsible development projects.

2 Project Intervention

Intervention:

The intervention aims to streamline the environmental clearance process by establishing a centralized, online single window platform that integrates all stakeholders, enhances transparency and efficiency, and encourages greater compliance through simplified, consistent, and result-oriented procedures.



Implementation Framework

Institutionalization

- A department can be formed at MOFE to look after online EIA process.
- Environment Unit will be formed at each public office to handle any EIA related works.

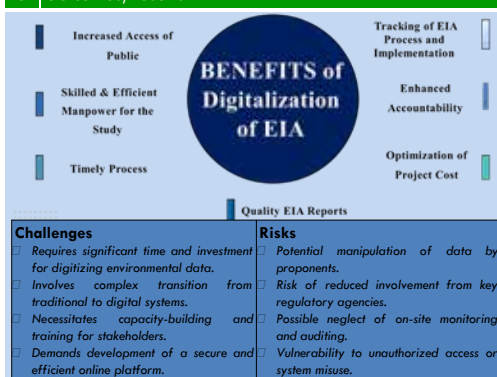
Cost for Implementation

- Cost required to develop & maintain EIA portal
- Cost of Training to Public Officials (can be physical or virtual)

Early Adopters

- A specific type project of any province (e.g. Any Irrigation Project in Lumbini Province) can be taken as pilot project.

3 Outcomes/Results



Acknowledgements:

I would like to express my sincere gratitude to the Project Director and the Sikta Irrigation Project team for their generous support and facilitation of my participation in this seminar.

4 Key Message (Innovation and Significance)

Innovation:

The innovation lies in the creation of a centralized, online platform that streamlines the environmental clearance process, ensuring greater efficiency, transparency, and accessibility while improving coordination among stakeholders.

Significance:

The proposed innovation represents a significant shift in the environmental clearance process by introducing a centralized, online single window system that integrates all stakeholders and steps involved & enhances efficiency, transparency, and accessibility, ultimately leading to more environmentally responsible development projects.

Key Message:

Promoting sustainable development and good governance through the digitalization of environmental assessment process in order to develop sustainable and environment friendly development projects is crucial for ensuring effective decision-making and a positive, lasting environmental impact.



Annex 3:
**Sub-Committees formation for
Seminar**

1. Proceeding Publication Sub-Committee:

Cordinator : Dr. Santosh Kaini

Member: Ms. Ezee G.C.

Member: Mr. Birendra Kumar Yadav

Member : Ms. Manju Kawan

Member : Ms. Sushma Chaudhary

Member : Ms. Palpasa Maharjan

Mamner: Ms. Shanti Satyal

2. Logistics Sub-Committee :

Cordinator : Mr. Gopal Sharma

Member: Mr. Dipendra Laudari

Member: Mr. Prem Lasiwa

Member: Mr. Madhab Koirala

Member: Mr. Janak Panthi

Member: Mr. Prajwal Prajapati

Mamner: Mr. Pushkar Aryal

Member: Mr. Shyam Mani Dhital

3. Poster Presentation Sub-Committee:

Cordinator : Mr. Ganesh Marasini

Member: Mr. Ajaya Raj Adhikari

Member: Mr. Narayan Krishna Ganesh

Member: Mr. Prajwal Prajapati

4. Video Preparation & Other General Management Sub-Committee:

Cordinator : Mr. Nabin Chandra Adhikari

Member: Mr. Raj Kumar Basnet

5. Vehicle /Driver Management Sub-Committee:

Cordinator : Mr. Babu Ram Kharel

Annex 4:
List of Participants

Thursday, 15th May, 2025 [01 Jestha 2082] | Venue: The Everest Hotel

S.N.	Name	Gender	Name of Agency/Organisation	Position / Designation	E-mail
			Ministry of Energy, Water Resources and Irrigation		
1	Mr. Dipak Khadka	Male	Ministry of Energy, Water Resources and Irrigation	Hon'ble Minister	
2	Mr. Kham Bahadur Garbuja	Male	Ministry of Energy, Water Resources and Irrigation	Hon'ble State Minister	
3	Mr. Suresh Acharya	Male	Ministry of Energy, Water Resources and Irrigation	Secretary (Energy)	
4	Ms. Sarita Dawadi	Female	Ministry of Energy, Water Resources and Irrigation	Secretary (Water Resources and Irrigation)	dawadisaratidaoi@gmail.com
5	Mr. Shishir Koirala	Male	Ministry of Energy, Water Resources and Irrigation	Joint Secretary	cckoirala@hotmail.com
6	Dr. Krishna Raj Pathak	Male	Ministry of Energy, Water Resources and Irrigation	Joint Secretary	krishnarajpathak@gmail.com
7	Mr. Chuma Bahadur Wali	Male	Ministry of Energy, Water Resources and Irrigation	Joint Secretary	cbwali69@gmail.com
8	Mr. Susheel Chandra Acharya	Male	Ministry of Energy, Water Resources and Irrigation	Joint Secretary	acharyasusheel@gmail.com
9	Mr. Devaraj Niraula	Male	Ministry of Energy, Water Resources and Irrigation	Joint Secretary	devu2002dec@yahoo.com
10	Mr. Surendra Paudel	Male	Nagmati Dam Project	Project Director	paudelsurendra2010@gmail.com
11	Mr. Shambhu Prasad Marasini	Male	Ministry of Energy, Water Resources and Irrigation	Joint Secretary	smarasaini@gmail.com
12	Mr. Gorakh Bahadur Shai	Male	Ministry of Energy, Water Resources and Irrigation	Under Secretary	
13	Mr. Madhav Raj Marasaini	Male	Ministry of Energy, Water Resources and Irrigation	Under Secretary	
14	Mr. Birat Gyawali	Male	Ministry of Energy, Water Resources and Irrigation	SDE	birat.gyawali@gmail.com
15	Mr. Krishna Prasad Rijal	Male	Ministry of Energy, Water Resources and Irrigation	SDE	krishnarijal@gmail.com
16	Mr. Tara Bhatta	Male	Ministry of Energy, Water Resources and Irrigation	SDE	tarabhatta2005@gmail.com
17	Mr. Sanjeeb Ray				
			Water and Energy Commission Secretariat (WECS)		
18	Mr. Madhu Prasad Bhetuwal	Male	Water and Energy Commission Secretariat	Secretary	bhetuwal@yahoo.com
19	Dr. Jagadishwor Karmacharya	Male	Water and Energy Commission Secretariat	Joint Secretary	j.karmacharya@yahoo.com
20	Mr. Kalanidhi Poudel	Male	Water and Energy Commission Secretariat	Joint Secretary	pkalanidhi@yahoo.com
21	Dr. Maheswor Shrestha	Male	Water and Energy Commission Secretariat	Joint Secretary	maheswor2037@yahoo.com
22	Mr. Tikaram Baral	Male	Water and Energy Commission Secretariat	Joint Secretary	baral.tikaram@gmail.com
23	Mr. Kapil Gyawali	Male	Water and Energy Commission Secretariat	Joint Secretary	water.kapil@gmail.com
24	Mr. Mohan Babu Yadav		Water and Energy Commission Secretariat	Senior Divisional Engineer	maheswor2037@yahoo.com
			Department of Hydrology and Meteorology/DOED		

S.N.	Name	Gender	Name of Agency/Organisation	Position / Designation	E-mail
25	Mr. Kamal Ram Joshi	Male	Department of Hydrology and Meteorology	Director General	dg@dhn.gov.np
26	Mr. Naveen Raj Singh	Male	Department of Electricity Development	Director General	nrsinghdoed@gmail.com
MoALD/DoA					
27	Dr. Govinda Prasad Sharma	Male	Ministry of Agriculture and Livestock Development	Secretary (Agriculture Development)	
28	Mr. Prakash Kumar Sanjel	Male	Department of Agriculture	Director General (Agriculture Development)	sanjel55@gmail.com
29	Dr. Lekhraj Dahal	Male	Department of Agriculture	Director General (Livestock Development)	lrdahal2003@gmail.com
30	Dr. Sabnam Shrivakoti	Female	Ministry of Agriculture and Livestock Development	Joint Secretary, MOALD	shabnam.shrivakoti@gmail.com
31	Mr. Anil Pokhrel		PPMO	SDE	anilpokhrel24@gmail.com
32	Mr. Dipak Bharadwaj	Male	Ministry of Agriculture and Livestock Development	SDE	niraula_dipak@yahoo.com
Honorables					
33	Prof. Dr. Shiva Raj Adhikari	Male	Vice President	NPC	shivaadhikari@gmail.gov.np
34	Dr. Bimala Rai Paudyal	Female	Member	National Assembly	bimalarp@gmail.com; info@bimalarp.com.np; mp.bimalarp@parliament.gov.np
35	Mr. Madhav Belbase	Male	Member	Public Service Commission	belbasem@gmail.com
Department of Water Resources and Irrigation (DWRI)					
36	Mr. Sanjeeb Baral	Male	Department of Water Resources and Irrigation	Director General	sanjeeb.baral@gmail.com
37	Mr. Mitra Baral	Male	Planning Program & Co-ordination Division	Deputy Director General	neaconsult@gmail.com
38	Mr. Dinesh Bhatta	Male	Multipurpose & Irrigation Division	Deputy Director General	dinesh.bhatt1983@gmail.com
39	Dr. Santosh Kaini	Male	Water Induced Disaster Management Division	Deputy Director General	santoshkaini@yahoo.com
40	Mr. Basudev Timilsina	Male	Irrigation Management Division	Deputy Director General	basutimilsina@gmail.com
41	Mr. Khilanath Dahal	Male	Ground Water & Geological Division	Deputy Director General	kndahal@hotmail.com
42	Mr. Ram Prasad Paudel	Male	Administration Section	Under Secretary	poudelramprasad003@gmail.com
43	Mr. Purushottam Khatiwada	Male	Act Law Consultation Section	Under Secretary	puru42@hotmail.com
44	Ms. Namuna Karki Dahal	Male	Economic Administration Section	Under Secretary	karkinamuna85@gmail.com

S.N.	Name	Gender	Name of Agency/Organisation	Position / Designation	E-mail
45	Mr. Premhari Parajuli	Male	Planning, Implementation and Monitoring Section	Senior Divisional Engineer	er.premhari@gmail.com
46	Mr. Prabin Shrestha	Male	Study, Design and Environment Section	Senior Divisional Engineer	Prabinshrest@gmail.com
47	Mr. Hari Bahadur Thapa	Male	Development Assistance and Provincial Coordination Section	Senior Divisional Engineer	haribahadurthapa@gmail.com
48	Mr. Keshav Prasad Adhikari	Male	Irrigation Section	Senior Divisional Engineer	adhikari.keshab@gmail.com
49	Mr. Bishnu Dev Yadav	Male	Purchases and Contracts Management Section	Senior Divisional Engineer	bishnu.yadav@gmail.com
50	Mr. Baburam Kharel	Male	Mechanical Management Section	Senior Divisional Engineer	kharel607@gmail.com
51	Ms. Ezee GC	Female	River Management Section	Senior Divisional Engineer	gcezee@yahoo.com
52	Mr. Prem Lasiwa	Male	Watershed management & Technology Development Section	Senior Divisional Engineer	prem.lasiwa@gmail.com
53	Ms. Sushma Chaudhary	Female	Emergency Management Section	Senior Divisional Engineer	sush.nec23@gmail.com
54	Ms. Pramila Shrestha	Female	Ground Water section	Senior Divisional Engineer	pramish05@gmail.com
55	Ms. Yojana Neupane	Female	Department of Geological Studies Section	Senior Divisional Engineer	yojana.neupane@gmail.com
56	Mr. Dipendra Laudari	Male	Landslide Management Section	Senior Divisional Engineer	dipu61@gmail.com
57	Mr. Raj Kumar Basnet	Male	Kaigandaki Tinau Diversion	Senior Divisional Engineer	rjkmbsnt@gmail.com
58	Mr. Nabin Raj Sharma	Male	IDSC	Engineer	nabinsdhungel@yahoo.com
59	Ms. Suchana Acharya	Female	Irrigation Management Division	Senior Divisional Engineer	acharyasuchana@gmail.com
60	Dr. Manju Sharma	Female	Institutional Development Section	Senior Sociologist	manjudoi@yahoo.com
61	Ms. Laxmi B.K.	Female	DWRI	Sociologist	laxmigr2009@gmail.com
62	Mr. Prajwol Prajapati	Male	Irrigation Management Division	Engineer	prajwolprajapati@gmail.com
63	Mr. Janak Panthi	Male	Irrigation Management Division	Engineer	janak.panthi2@gmail.com
64	Mr. Puskar Aryal	Male	DWRI	Engineer	puskararyal8@gmail.com
65	Ms. Jamuna Pariyar	Female	DWRI	Engineer	jamuna061@gmail.com
66	Ms. Shanti Satyal	Female	DWRI	Engineer	satyalshanti@gmail.com
67	Ms. Rhitika Lamichhane	Female	DWRI	Engineer	rhitikalamichhane@gmail.com
68	Ms. Grishma Acharya	Female	DWRI	Engineer	gr.acharya1@gmail.com
69	Ms. Anjana Khadka	Female	DWRI	Engineer	anjanakhadka37@gmail.com
70	Ms. Anjana Kumari Mahato	Female	DWRI	Engineer	
71	Ms. Sujata Gautam	Female	DWRI	Engineer	
72	Mr. Shankar Thapa	Male	DWRI	SDE	
73	Ms. Neha Kumari Singh	Female	DWRI	Engineer	

S.N.	Name	Gender	Name of Agency/Organisation	Position / Designation	E-mail
Water Resource Research Institute					
74	Mr. Dinesh Rajauriya	Male	Water Resource Research & Development Center	Executive Director	drajuria@gmail.com
75	Ms Manju Kawan	Female	Water Resource Research & Development Center	Senior Divisional Engineer	kawan.manju@gmail.com
76	Mr. Ananta Man Shrestha	Male	Water Resource Research & Development Center	SDE Geologist	anantageo@hotmail.com
Irrigation Projects					
77	Mr. Sushil Chandra Devkota	Male	Babai Irrigation Project	Chief/ Project Director	sushidev.25@gmail.com
78	Mr. Prem Raj Ghimire	Male	Rani Jamara Kulariya Irrigation Project	Chief/ Project Director	ghimireprem44@gmail.com
79	Mr. Rana Bahadur Bam	Male	Bheri Babai Diversion Multipurpose Project	Chief/ Project Director	ranbahadurbam@gmail.com
80	Mr. Badri karki	Male	Sunkoshi Marin Diversion Multipurpose Project	Chief/ Project Director	carkey.badri31@gmail.com
81	Mr. Raju Acharya	Male	Sikta Irrigation Project	Chief/ Project Director	raje084@yahoo.com
82	Dr. Yogendra Mishra	Male	Mahakali Irrigation Project	Chief/ Project Director	yogendra.dwri@gmail.com
83	Mr. Gopal Sharma	Male	Irrigation Modernization Enhancement Project	Chief/ Project Director	dhital.gopalsharma@gmail.com
84	Mr. Manoranjan Kumar Singh	Male	Disaster-affected water resources and irrigation restoration projects	Chief/ Project Director	manoranjanknsingh@gmail.com
85	Mr. Ishwari Pd Tiwari	Male			ieispdoi1@gmail.com
86	Mr. Ramesh Kumar Singh	Male	Bagmati Irrigation Project	Chief/ Project Director	urrameshsingh@gmail.com
87	Mr. Kushang Sherpa	Male	Naumure Multipurpose Project	Chief/ Project Director	kushangsherpa@gmail.com
88	Mr. Nabin Chandra Adhikari	Male	Kaligandaki Tinau Diversion Multipurpose Project	Chief/ Project Director	adhikarinc@gmail.com
89	Mr. Rabindra Thapa	Male	Priority river Basin	Chief/ Project Director	
90	Mr. Mohohar Kumar Shah	Male	Sunsari Mor ang Irrigation Project	Chief/ Project Director	manohashah08@yahoo.com
91	Mr. Ajay Raj Adhikari	Male			
92	Mr. Ganesh Marasini	Male	Tarai-Madesh Ground Water Irrigation Office		ganeshmarasini@gmail.com
93	Mr. Eka Raj Bhattacharai	Male	Koshi Pump, Chandra Canal Irrigation Management Office	Chief/ Project Director	ekrajbhattacharai@gmail.com
94	Mr. Birendra Kumar Yadhav	Male	Kamala Irrigation Management Office	Chief/ Project Director	biru4u.birendra@gmail.com
95	Mr. Santosh Kumar Chaudhary	Male	Landslide Risk Management Project, Lalitpur	Acting Project Director	sntschaudhary@gmail.com
96	Mr. Manoj Prasad Patel	Male	Narayani Irrigation Management Office	Chief/ Project Director	patelmanoj368@gmail.com
97	Mr. Tilakram Budhatokhi	Male	Nepal Gandak West Canal Irrigation Management Office	Chief/ Project Director	tilak.budhatokhi@gmail.com
98	Mr. Ramkrishna Ghorasaini	Male	Rajapur Irrigation Management Office	Chief/ Project Director	er_ghorasaini@yahoo.com

S.N.	Name	Gender	Name of Agency/Organisation	Position / Designation	E-mail
99	Mr. Pramod Timilsina	Male	Mahakali Irrigation Management Office	Chief/ Project Director	ptimsina2022@gmail.com
100	Mr. Abinashi Sigdel		Irrigation and Water Resources Management Project	Chief/ Project Director	absigdel@gmail.com
101	Mr. Binod Panta		Irrigation and Water Resources Management Project	Senior Divisional Engineer	link2binodpanta@gmail.com
102	Ms Palpasa Maharjan	Female	Irrigation Modernization Enhancement Project	Senior Divisional Engineer	mahpalpas@gmail.com
103	Mr Madhab Koirala	Male	Irrigation Modernization Enhancement Project	Senior Divisional Engineer	xpectus@gmail.com
104	Mr. Bal Bdr. Gharti Magar	Male	Irrigation Modernization Enhancement Project	Senior Sociologist	
105	Ms Sandeepa Rai	Female	Terai Madhes Ground Water Irrigation Office	Senior Divisional Engineer	shandipa_rai@hotmail.com
106	Mr. Narayan Krishna Ganesh	Male	Terai Madhes Ground Water Irrigation Office	Senior Divisional Engineer	ganeshnk38@gmail.com
107	Mr. Rajkumar Basnet	Male	Kaligandaki Tinau Diversion Multipurpose Project	Senior Divisional Engineer	rjkmbsnt@gmail.com
108	Mr. Keshav Das	Male	Rani Jamara Kulariya Irrigation Project	Senior Divisional Engineer	keshawdas77@gmail.com
109	Mr. Chakra Bikram Singh	Male	Naryani River Management Office	Senior Divisional Engineer	cbsingh200@gmail.com
			NENCID Nepal		
110	Ms. Jigyasha Rai	Female	NENCID Nepal	Representative	jigyasharai9@gmail.com
111	Dr. Bhes Raj Thapa	Male	NENCID Nepal	Representative	bthapa.ioe@gmail.com
112	Dr Prachanda Pradhan	Male	NENCID Nepal	Representative	pradhanpp@hotmail.com
113	Dr. Umeshnath Parajuli	Male	NENCID Nepal	Representative	
			International Water Management Institute (IWMI)		
114	Dr. Mark Smith	Male	IWMI	Ex. Vice President	mark.smith@cgiar.org
115	Dr. Mohsin Hafeez	Male	IWMI	SPD	M.Hafeez@cgiar.org
116	Dr. Manohara Khadka	Female	IWMI	CR	m.khadka@cgiar.org
117	Dr. Santosh Nepal	Male	IWMI	Researcher	s.nepal@cgiar.org
118	Dr. Nirman Shrestha	Male	IWMI	Researcher	n.shrestha@cgiar.org
119	Dr. Sata Fanaian	Female	IWMI	Researcher	s.fanaian@cgiar.org
120	Dr. Darshan Karki	Female	IWMI	Researcher	d.karki@cgiar.org
121	Dr. Anil Ayal	Male	IWMI	National Researcher	a.ayal@cgiar.org
122	Ms. Sumitra KC	Female	IWMI	National Researcher	s.kc@cgiar.org
123	Mr. Om Acharya	Male	IWMI	Office Manager	o.acharya@cgiar.org

S.N.	Name	Gender	Name of Agency/Organisation	Position / Designation	E-mail
			Institute of Engineering (IOE)		
124			Institute of Engineering (IOE)	Representative	
125			Institute of Engineering (IOE)	Representative	
			International Commission on Irrigation & Drainage (ICID)		
126	Dr. Marco Arcieri	Male	ICID	President	m.arcieri@icid.org
127	Dr. K Yella Reddy	Male	ICID	Former Vice President	yellark@gmail.com
128	Dr. R. K. Gupta	Male	ICID	Secretary General	sec-gen@icid.org; icid@icid.org
			Development Partners		
129	Mr. Mizuki Matsuzaki	Male	JICA	Chief Representative	Matsuzaki.Mizuki@jica.go.jp
130	Mr. Jongsoo Shin	Male	IRRI (International Rice Research Institute Nepal)	Regional Director for Asia, Acting Country Representative for India	info@irri.org;
131	Dr. Arnaud Cauchois	Male	ADB	Country Director	acauchois@adb.org
132	Mr Arun Shumser Rana	Male	ADB	Representative	arunrana@adb.org
133	Mr. Dipak B Singh	Male	ADB	Representative	
134	Mr. Ashish Bhadra Khanal	Male	ADB	Representative	ashishkhanal@gmail.com
135	Mr. Ken Shimizu	Male	FAO(Shrawan Adhikari)	Country Representative	fao-np@fao.org
136	Mr. David Sislen	Male	WB	Country Division Director for Maldives, Nepal, and Sri Lanka	
137	Ms. Rubika Shrestha	Female	WB	Representative	
138	Ms. Anu Joshi Shrestha	Female	ICIMOD	Country focal point	anu.shrestha@icimod.org
139	Ms Luna Purification	Female	Australian Embassy	Head of Development	Luna.Purification@dfat.gov.au
140	Ms Sofia Vaidya	Female	Australian Embassy	Programs and Strategic Communications Officer	Sofia.Vaidya@dfat.gov.au
141	Ms. Sara Alanen	Female	Embassy of Finland	Head of Cooperation	sara.alanen@gov.fi
142	Ms. Kamala KC	Female	British Embassy Kathmandu	Social Sectors Advisor, System and Services Team, Governance and Social Development Group	kamala.kc@fco.gov.uk
143	Dr. Saurav KC	Male	Center of Research for Environment, Energy & Water	Deputy Executive Director	saurav@creew.org
144	Ms Karuna Adhikaree	Female	World Food Program		karuna.adhikaree@wfp.org
145	Mr. Nawa Raj Dhakal	Male	AEPC	Executive director	nawa.dhakal@aepc.gov.np

S.N.	Name	Gender	Name of Agency/Organisation	Position / Designation	E-mail
			Provincial Secretary / Officials		
146	Mr. Pradip Bantawa	Male	Ministry of Water, Irrigation and Energy	Provincial Secretary Koshi Province	bantawa.pradip@gmail.com
147	Mr. Krishna Rajbanshi	Male	Ministry of Water, Irrigation and Energy	Division Head	krjbanshi@gmail.com
148	Mr. Ram Kumar Khang	Male	Ministry of Energy, Irrigation and Water Supply	Act. Provincial Secretary Madhesh Province	info.mowsed@madhesh.gov.np
149	Mr. Barun Kumar Karna	Male	Ministry of Energy, Irrigation and Water Supply	Division Head	info.mowsed@madhesh.gov.np
150	Mr. Mohan Kumar Shakya	Male	Ministry of Water Supply, Energy and Irrigation	Provincial Secretary Bagmati Province	shakyamohan@yahoo.com
151	Mr. Megh Raj Awasthi	Male	Ministry of Water Supply, Energy and Irrigation	Division Head	awasthimegh@gmail.com
152	Dr. Rajan Bhattarai	Male	Ministry of Energy, Water Resources and Water Supply	Provincial Secretary Gandaki Province	rajanbhattarai@yahoo.com
153	Mr. Hari Dutta Paudel	Male	Ministry of Energy, Water Resources and Water Supply	Division Head	hdpauldel@gmail.com
154	Mr. Vishnu Bhandari	Male	Ministry of Energy, Water Resources and Irrigation	Provincial Secretary Lumbini Province	moewri.lumbani@gmail.com
155	Mr. Krishna Bahadur BK	Male	Ministry of Energy, Water Resources and Irrigation	Division Head	moewri.lumbani@gmail.com
156	Mr. Indra Dev Bhatta	Male	Ministry of Water Resources and Energy Development	Provincial Secretary Kamali Province	mrwredskt@gmail.com; indrabimalajh@gmail.com
157	Mr. Padam Raj Devkota	Male	Ministry of Water Resources and Energy Development	Division Head	devkotapadam@gmail.com
158	Mr. Prem Dutta Bhatta	Male	Ministry of Energy, Water Resources and Irrigation	Provincial Secretary Sudurpaschim Province	mopidp7@gmail.com; erpdbhatta@gmail.com
159	Mr. Mohan Bd Kuwar	Male	Ministry of Energy, Water Resources and Irrigation	Division Head	mopidp7@gmail.com
			National Federation of Irrigation Water User's Association		
160	Mr. Sambhu Dulal	Male	National Federation of Irrigation Water User's Association (NFIWUAN)	Representative	shambhupddulal@gmail.com
161	Ms. Bindu Simkhada	Female	National Federation of Irrigation Water User's Association (NFIWUAN)	Representative	nfiwuan@gmail.com
			Panelists		
162	Mr. Ashutosh Tiwari	Male	SAFAL Partners, Nepal	Managing Director	ashu@safal-partners.com
163	Dr. Ganesh Raj Joshi	Male	CIAA commissioner	(Agri Economist) Former Secretary	grjoshi20@yahoo.com

S.N.	Name	Gender	Name of Agency/Organisation	Position / Designation	E-mail
			Retired / Special Guest / DGs		
164	Mr. Bhuwanesh Kumar Pradhan	Male			
165	Mr. Shiva Kumar Sharma	Male			shiv1301@gmail.com
166	Mr. Sharada Prasad Sharma	Male			spsharma21@gmail.com
167	Mr. Som Nath Poudel	Male			poudeln@gmail.com
168	Mr. Min Raj Dhakal	Male			m78dhakal@gmail.com
169	Mr. Shiva Kumar Basnet	Male			shivbasnet@yahoo.com
170	Mr. Rishi Ram Sharma Neupane	Male			neupaners@gmail.com
171	Mr. Basudev Lohani	Male			lohanibas@yahoo.com
172	Mr. Ashok Singh	Male			ashoksimha@hotmail.com
173	Mr. Sushil Chandra Tiwari	Male			sushitwari01@gmail.com
174	Mr. Madhukar Prasad Rajbhandari	Male			madhukar_64@hotmail.com
175	Mr. Krishna Prasad Nepal	Male			nepalkp35@gmail.com
176	Mr. Saroj Pandit	Male			sarojcp@yahoo.com
177	Mr. Rajendra Adhikari	Male			rpadhikary1008@gmail.com
			Others		
178	Mr. Bhim Prasad Dhungana	Male	Municipal Association of Nepal	President	bpddhading@gmail.com
179	Ms Laxmi Devi Pandey	Female	National Association of Rural Municipalities in Nepal (NARMIN)	Chairperson	laxmidivipandeyofficial@gmail.com
180	Dr Anushiya Shrestha	Female	South Asia Institute of Advanced Study (SIAS)	Research Director	anushiya.shr18@gmail.com
181	Usha Khadtwada	Female	Axis Consulting Pvt. Ltd.	Energy, climate, and Development	khatiwada.usha@gmail.com
182	Usha Maskey Manandhar	Female	MinErgy Nepal	Managing Director	usha.manandhar@minergynepal.org.np
183	Sruti Maya Kumal	Female	NEFIN	Vice-chair	Shrutikumalddb@gmail.com
184	Prajuna KC	Female	IDE	Country Director	Prajuna KC <pkc@ideglobal.org>
185	Ashma Vaidya	Female	Freelancer	WEFE and GESI	ashmavaidya@gmail.com
186	Amelia Midgley	Female	Senior Water Specialist	World Bank	amidgley@worldbank.org
187	Mr. Laxman Sharma	Male	Executive Director	ADPC	

S.N.	Name	Gender	Name of Agency/Organisation	Position / Designation	E-mail
			Poster Presenter		
188	Mr. Lalan Baitha				
189	Prof Dr. Vishnu Pandey				
190	Narayan Krishna Ganesh		Ground Water Division,		
191	IWMI (5)				
192	WRRDC				
193	Rajendra bir Joshi(1)				
194	Mahesh Yadav				
195	Ramesh Ranabhat				
196	Crimson Singh Negi				
197	Anish Pradah				
198	Saroz Karki				

Annex 5:

Photos



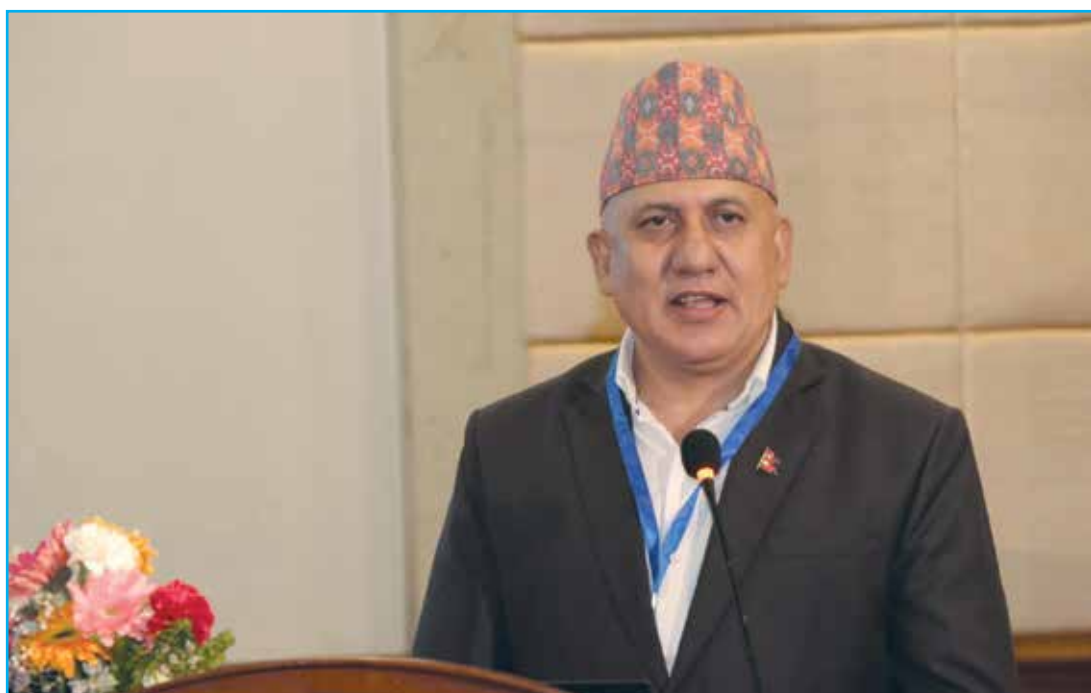
Welcome Remarks by DDG Mitra Baral



Opening Session of Irrigation Seminar 2025



Inauguration by the Honorable Minister



Keynote by **Prof Dr. Shiva Raj Adhikari**, Honorable Vice Chairman, NPC, Government of Nepal



Keynote by **Dr. Mark Smith**, Director General, IWMI



Keynote by **Dr. Marco Arcieri**, President, ICID



Remarks of Opening Session by **Dr. Govinda Prasad Sharma**, Secretary, MoALD



Remarks of Opening Session by **Hon'ble Dipak Khadka**, Minister, MoEWRI



Remarks of Opening Session by **Ms. Sarita Dawadi**, Secretary, MoEWRI



Remarks of Opening Session by **Mr. Madhav Belbase**, Hon'ble Member



Closing Remarks of Opening Session by Session Chair, **Mr. Sanjeeb Baral**,
Director General, DWRI



Token of Appreciation to the Keynote Speaker by **Mr. Sanjeeb Baral**, Director General,
DWRI



Poster Presentation



Poster Presentation



Group Photo after the **Introduction of poster sessions**



Session 1 [Panel Discussion]



Primer presentation of Session 1 [Panel Discussion] by **Mr. Tika Ram Baral**, Joint Secretary, WECS



Panelist on Session 1 [Panel Discussion] Irrigation for Food Security: Key Practices and Bottlenecks [Facilitator: Mr. Nabin Chandra Adhikari]



Group Discussion during Session 2 [Group Work]



Group Discussion during Session 2 [Group Work]



Group Discussion during Session 2 [Group Work]



Session 2 [Group Work]: [Facilitator: Dr Santosh Nepal, IWMI]



Session 3 [Panel Discussion]: Way Forward – Translating the Pathways (Developed in Group Work) into Action [Facilitator: Prof Dr Vishnu Prasad Pandey]



Panel discussion on Translating the Pathways (Developed in Group Work) into Action
Mr. Sanjeeb Baral, Director General, DWRI



Panel discussion on Translating the Pathways (Developed in Group Work) into Action
Panelists: **Dr. Sabnam Shivakoti**, Joint Secretary, MoALD



S.D.E. Birendra Yadv raising question during panel discussion



Participants raising question during panel discussion



Participants raising question during panel discussion



Participants raising question during panel discussion



Panelists and Facilitator of Session 3 after receiving Token of Appreciation Joint Secretary Shishir Koirala, MoEWRI



Remarks by Dr. K.Yella Reddy, Vice President , ICID



Reflections and Key Takeaways by Dr. Santosh Kaini, Deputy Director General, DWRI

Organized by:

