



The Water-Livelihoods-Gender Nexus to Advance Koshi Basin Management

24–25 March 2016, Kathmandu, Nepal



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The International Centre for Integrated Mountain Development, ICIMOD, is a regional knowledge development and learning centre serving the eight regional member countries of the Hindu Kush Himalaya – Afghanistan, Bangladesh, Bhutan, China, India, Myanmar, Nepal, and Pakistan – and based in Kathmandu, Nepal. Globalisation and climate change have an increasing influence on the stability of fragile mountain ecosystems and the livelihoods of mountain people. ICIMOD aims to assist mountain people to understand these changes, adapt to them, and make the most of new opportunities, while addressing upstream-downstream issues. We support regional transboundary programmes through partnership with regional partner institutions, facilitate the exchange of experience, and serve as a regional knowledge hub. We strengthen networking among regional and global centres of excellence. Overall, we are working to develop an economically and environmentally sound mountain ecosystem to improve the living standards of mountain populations and to sustain vital ecosystem services for the billions of people living downstream – now, and for the future.



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Workshop Report 2017

The Workshop on Water-Livelihoods-Gender Nexus to Advance Koshi Basin Management

24–25 March 2016, Kathmandu, Nepal

Organized by

International Centre for Integrated Mountain Development (ICIMOD)

Department of Irrigation (DoI), Government of Nepal

Department of Agriculture (DoA), Government of Nepal

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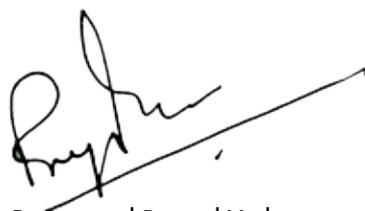
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Foreword

The Department of Irrigation (DoI) of the Government of Nepal (GoN) has been working tirelessly since its establishment in 1952 with an aim to support agricultural production and productivity by providing irrigation development and management in the country. The expansion of irrigation facilities has been largely responsible in protecting Nepal from food crisis. The DoI has made substantial improvement in irrigation infrastructures, human resources and institutional built-up in the public and private sectors. More efforts are needed in Nepal's irrigation sector to help boost agriculture with an ultimate goal of eliminating poverty. This calls for a coordinated effort of all stakeholders for the planning and implementation of irrigation activities in the years to come.

In order to keep track of the achievements, and also to explore future opportunities and challenges in the development of irrigation, DoI periodically organizes seminars and workshops to bring together national and international partners involved in the irrigation sector. On 24-25 April 2016, a two-day international workshop themed, "Water-Livelihoods-Gender Nexus to Advance Koshi Basin management," was organised to provide a common forum for like-minded people who are in the forefront of agriculture both on national and international levels. This proceeding report contains a collection of writings, which are the base of ideas presented during the event.

On behalf of DoI, I would like to express my gratitude to the DoA, ICIMOD, CSIRO, IWMI, CIMMYT, HELVETAS and FMIST for co-organizing this program. I would like to offer my special thanks to the Australian Ambassador to Nepal, Glenn White for gracing our workshop with his valuable presence. My sincere thanks goes to all the presenters for their commendable hard work. I am also grateful to all the participants for their active participation and lively discussions. Lastly, I would like to extend my appreciation to everyone who directly or indirectly contributed towards making this workshop a huge success.



Ramanand Prasad Yadav

Director General

Department of Irrigation, Jawalakhel, Nepal

Acknowledgements

The workshop organizers Department of Irrigation (DoI) and Department of Agriculture (DoA) of the Government of Nepal (GoN), ICIMOD's Koshi Basin Programme (KBP), Commonwealth Scientific and Industrial Research Organisation (CSIRO) and Farmer Managed Irrigation Systems Trust (FMIST) would like to thank officials from the Government of Nepal, panellists, session chairs, keynote speakers, session hosts and facilitators, and all participants for their contributions throughout the course of the conference. This workshop designed and implemented by ICIMOD and its partners contributes to the Sustainable Development Investment Portfolio and is supported by the Australian aid programme. We acknowledge the support from ICIMOD's core donors—the governments of Afghanistan, Australia, Austria, Bangladesh, Bhutan, China, India, Myanmar, Nepal, Norway, Pakistan, Switzerland, and the United Kingdom.

Acronyms and Abbreviations

ADB	Asian Development Bank		
AEPC	Alternative Energy Promotion Center	INGO	International Non-Governmental Organization
ANSISS	AN Sinha Institute of Social Studies	IWMI	International Water Management Institute
ARI	Argument-Representation-Implementation	IWRM	Integrated Water Resource Management
CBS	Center Bureau of Statistics	KBP	Koshi Basin Programme
CBT	Capacity Building Training	LS	Livelihood Strategy
CEAPRED	Center for Environmental and Agricultural Policy Research	LWF	Lutheran World Federation
CIMMYT	International Maize and Wheat Improvement Center	MDGs	Millennium Development Goals
CSIRO	Commonwealth Scientific and Industrial Research Organisation	MEDEP	Micro Enterprise Development Programme
DADO	District Agriculture Development Office	MIT	Micro Irrigation Technology
DFAT	Department of Foreign Affairs and Trade	MoAD	Ministry of Agriculture Development
DoA	Department of Agriculture	MoFALD	Ministry of Federal Affairs and Local Development
Dol	Department of Irrigation	MUS	Multiple Use Water System
DoLIDAR	Department of Local Development and Agricultural Roads	NDRI	Nepal Development Research Institute
DTWs	Deep Tube Wells	NEA	Nepal Electricity Authority
EGP	Eastern Gangetic Plain	NGO	Non-Governmental Organization
FAO	Food and Agriculture Organization	NMICS	Nepal Multiple Indicator Cluster Survey
FGD	Focus Group Discussion	NPC	National Planning Commission
FINNIDA	Finnish International Development Agency	NWCF	Nepal Water Conservation Foundation
FMIS	Farmer Managed Irrigation System	PAF	Poverty Alleviation Fund
FMIST	Farmer Managed Irrigation System Promotion Trust	PCA	Principle Component Analysis
FORWARD	Forum for Rural Welfare and Agricultural Reform for Development	PGVS	PragitiGrameenVikasSamiti
GESI	Gender Equality and Social Inclusion	PVAT	Poverty and Vulnerability Assessment Tool
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit (German Corporation for International Cooperation)	RFA	Riverbed Farming Alliance
GoN	Government of Nepal	SAPPROS	Support Activities for Poor Producers of Nepal
HHs	Households	SMIS	Sunsari Morang Irrigation System
HKH	Hindu Kush Himalaya	SPIP	Solar powered irrigation pumps
ICAR	Indian Council of Agriculture Research	STWs	Shallow Tube Wells
ICIMOD	International Center for Integrated Mountain Development	TAR	Tibet Autonomous Region
iDE	International Development Enterprises	VDC	Village Development Committee
INCLUDE	Inclusive Development of the Economy	VDPP	Village Development Periodic Plan
		V-WASH-CC	Village Water, Sanitation and Hygiene Coordination Committee
		WASH	Water, Sanitation and Hygiene
		WHH	Woman Headed Households
		WUMP	Water Use Master Plan

Message from Director General

It gives me immense pleasure to see these long-awaited proceedings of the regional workshop on “Water-Livelihoods-Gender Nexus to advance Koshi Basin Management” jointly organized by Nepal’s Department of Irrigation (DoI) and Department of Agriculture (DoA), the Commonwealth Scientific and Industrial Research Organization (CSIRO), HELVETAS Swiss Intercooperation, the International Water Management Institute (IWMI) and the International Maize and Wheat Improvement Center (CIMMYT).

The workshop was organized to improve the understanding of water in connection with livelihoods and gender in Koshi River basin. More than 75 people participated, representing a wide variety of backgrounds and interests, from policy to research. It was an excellent example of collaboration among multiple partners, and ICIMOD is thankful to all the participants for their efforts.

There are both critical challenges and untapped opportunities in the Koshi River Basin, one of most significant river basins of the Hindu Kush Himalaya (HKH). While we face growing water stress and inadequate energy supply, we also know there is significant potential for improved efficient use of water and land.

The water-food-energy nexus approach is a relatively new approach, but quickly achieving consensus among research and development initiatives. One significant aspect of the nexus is its focus on gender equity, specifically the role of women in the decision making processes. With increasing outmigration of men, women have a larger role in irrigation and agricultural development. Yet, their voices as decision makers and planners are often under-represented in related discussions.

ICIMOD is pleased to be part of this significant regional workshop, which created a valuable platform to discuss the pertaining knowledge gap in nexus thinking, key challenges, and seek the solutions on water-livelihoods-gender nexus in the Koshi Basin. Most importantly, it helped to bring the different key players during the event in an effort to synergize their efforts. This was an excellent example of collaboration among the research institutions, policy makers and developmental practitioners.

The workshop had several key messages. First, there is high dependency between upstream and downstream communities in the Koshi Basin for dry season water for domestic use, irrigation and hydropower. Linkages between these communities are critical from the perspective of food, water and energy security. Second, despite the Koshi Basin’s water surplus, people do experience water poverty in this area. To address this paradox, we need to understand suitable water management options for livelihoods improvement of the community. Third, with rising male outmigration there is an increasing pressure especially on women who are taking a larger role in farm-based livelihoods. Women’s changed roles in this context as decision-makers need to be understood and strengthened. Fourth, there is a need for policy-relevant action research at the local level focusing on gender equitable development that links evidence to policy with the aim of supporting livelihood strategies of local communities in the Koshi Basin. Finally, Nepal’s Department of Agriculture and Department of Irrigation have great interest to take forward the key recommendations from the workshop.

We are thankful to all the participants and collaborators of the workshop for their support and spirit of teamwork. We also extend sincere thanks to the team at Nepal’s Department of Irrigation and my colleagues at ICIMOD for their work to present the key messages and outcomes of the workshop in this report.

My appreciation to all the authors and co-authors for their contributions, and taking time to revise the manuscripts. I hope this report will be useful for the government of Nepal in designing future programs and projects for better management of water to improve the livelihoods of rural people.



David J Molden, PhD
Director General, ICIMOD

Executive Summary

Water is vital to human survival, livelihoods, the economy, and sustainable development. Poor access to water constrains livelihood activities especially agriculture, and shrinks economic opportunity. Empirical evidence demonstrates that there is an overall decline in water availability for domestic and agriculture uses in different parts of the Koshi Basin. Residents in this area now experience acute water scarcity for domestic and productive uses.

Rural outmigration and the amount of fallow land have increased in recent years. Despite these impacts on agriculture, people have access to limited adaptation options. The role of managing household water needs falls primarily of women, who find themselves increasing cast into more responsibility as men leave the country in search of paying work. This scenario is further complicated by climate change, and fluctuations in water availability and quality.

In this context, several groups organized a regional workshop on water, livelihoods, and gender in Kathmandu in March 2016. The organizing group included ICIMOD's Koshi Basin Programme (KBP), the Nepal Department of Agriculture (DoA) and Department of Irrigation (DoI), the Commonwealth Scientific and Industrial Research Organization (CSIRO), HELVETAS Swiss Intercooperation, the International Water Management Institute (IWMI), and the International Wheat and Maize Improvement Center (CIMMYT). The workshop received additional support from from the Sustainable Development Investment Portfolio (SDIP) of Australian Aid.

The objective of the workshop was to improve the understanding of water, livelihoods and gender Koshi River Basin. More than 70 participants from China, India and Nepal attended, representing academia, policy makers, and development institutions. The workshop provided a forum to discuss relevant issues for addressing future water, livelihood and gender challenges in the future.

The two-day workshop featured four technical sessions:

- Water and livelihood issues and challenges;
- Gender and water resource management;
- Improving livelihoods resilience; and
- Group work

Participants were asked to identify key water challenges. They produced the following list:

- Upstream-downstream relations;
- Drying springs;
- Access to drinking and irrigation water;
- Water-related disasters;
- Low agricultural productivity;
- Outmigration and increasing fallow-land; and
- Rising incidence of poverty, food and energy insecurity.

Those water challenges particularly impact vulnerable groups including the poor, women, and marginalized communities.

The workshop produced the following recommendations to enhance livelihoods, advance gender integration, and improve water management:

- Enhance the capacity of rural women and men, and local stakeholders in water management, through access to information, knowledge, gender-friendly technologies, and improved water infrastructure;
- Encourage participation of women at decision making levels for water and natural resource management. Evidence reflects low representation of women among water-related groups in spite of the fact that women have an increased responsibility to manage water for their households and agriculture;

- Strengthen farmer managed irrigation systems (FMIS), which are still a viable option for improving livelihoods and implementing climate change adaptations in the Koshi Basin. Women’s participation should be enhanced in decision making processes related to FMIS;
- Gender inclusive water user master plans (WUMP) and multiple water-use system MUS are considered key instruments for promoting livelihoods through local planning and implementation. These processes should be upscaled to accommodate considerations of upstream-downstream linkages; and
- Strengthen collective farming and riverbed farming as an option for women and marginal land holders.

The workshop included much discussion about the “silo-ing” (or separation) of gender from issues of water, livelihood enhancement, and sustainable development. That is, participants voiced concerns about gender being treated as a separate issue apart from natural resource management. On a related note, many participants noted that water livelihood activities and gender development appeared disconnected in development activities. They encouraged researchers, policy makers, and development practitioners to work more closely to tackle the water-livelihoods-gender nexus in the Koshi Basin for sustainable development of rural communities.

Participants also addressed the need to identify the research gaps. Ongoing and future research need to be customized in the water-livelihoods-gender framework where policy engagement is vital. Policy-relevant action research should be operationalized at the local level focusing on gender equitable development through better water resource management and use that evidence to support policy making. In this way, the Argument-Representation-Implementation (ARI) tool can be very useful to provide policy support by analyzing complex situations.

The DoA and DoI stated their support for such collaborative action research on the ground and affirmed their desire to use the findings to inform their policy making decisions. This was considered one of the key achievements of the workshop.

Chapter 1
Introduction

The Koshi River Basin is one of a major transboundary river basins in South Asia. The Koshi River originates on the Tibetan Plateau in China and flows through 27 eastern and central districts of Nepal, and 16 districts of Bihar, India, before joining the Ganges River. The Koshi supports livelihoods of nearly 10 million people in the upstream area and more than 30 million people downstream by providing irrigation, domestic water supply, and natural resources for economic development through hydropower generation.

Over 80 percent of the people in the Koshi Basin depend on agriculture for food, income, and employment. Major water users in the Basin include traditional agriculture combined with livestock. However, more and more farmers are turning away from subsistence agriculture toward cash crop cultivation, which has a higher water demand. As this trend continues, access to water will become more competitive. Compared to agriculture, a smaller portion of water is used in the Koshi Basin for domestic and industrial purposes.

Unlike other river basins, the Koshi faces twin challenges of too much and too little water. There is significant potential for ground water extraction. The issue here is not water scarcity but poor access, where infrastructure is under-developed. Rapid population growth, migration, landslides in the upstream, and frequent floods and droughts have added stress to rural livelihoods. Poor water access constrains livelihood activities, especially in agricultural sector, and shrinks the overall socio-economic well-being of the Koshi Basin-dependent people.

Throughout the Koshi Basin, women maintain a special linkage with water as they bear the burdens of collecting water for productive and domestic uses, in combination with regular household labor duties. The outmigration of men has only intensified this responsibility for women. Therefore, changes in water availability will also disproportionately affect women (Crow, 2001; Van Koppen and Koppen, 2002; Crow and Sultana, 2002).

Why is Water-Livelihoods-Gender Nexus Important?

Developing countries in South Asia face a general challenge in meeting the growing demands for food, water, and energy – access to which is complicated by climate change (Rasul and Sharma, 2016). The livelihoods of the Koshi Basin rely heavily on water access and water is a key entry point to address food, water and energy insecurities, and related socio-economic development issues.

But the water-food-energy (WFE) nexus is just one step. When considering the socio-economic implications of WFE alongside the elements of gender and livelihoods, it is worth exploring the water-livelihoods-gender nexus, which is equally dynamic and complex in nature (Wallace and Coles, 2005). This relationship has been poorly understood over the years and its significance has been overlooked in many cases. Undoubtedly, reliable access to water improves household production, nutrition, and access to employment opportunities (Namara et al., 2010). However, access to water alone is not a sufficient condition for sustainable development (Namara et al., 2010). Failure to understand the gendered nature of water access and how livelihoods intersect with water access means that women and other disadvantaged groups may not benefit from the gains of programmes and policies intended to address water access issues (Hazell, 2010).

Policy makers have attached much importance to gender issues in water-related projects, particularly in the wake of the 1992 Dublin Conference. In spite of this, many water-related projects from local to international have underestimated the role of women (Johansson, 2016). The Sustainable Development Goals (SDGs) have emphasized creating ensured water availability and the sustainable management of water and sanitation for everyone by 2030, where special emphasis on girls, women, and those in vulnerable situations. But poor sectoral coordination and institutional fragmentation undermine nexus concerns and pose a serious challenge for achieving SDGs goals in South Asia (Rasul, 2016).

In spite of significant effort to mainstreaming gender in water resource management and livelihoods improvement, formal water management institutions ranging from international to local continue to be male-dominated. Women's representation in water-related institutions has gradually increased in recent years, but they are still largely under-represented (CAP-NET, GWA 2006).

Opportunities to Improve the Water-Livelihoods and Gender Nexus

Improving linkages in the water-livelihoods-gender nexus contributes towards sustainable river basin management and simultaneously fosters economic development, and water is key to addressing poverty and gender issues (Saleth et al., 2003). Empirical evidence shows that if women have the same access as men to productive resources, such as water, they could increase yields on their farms by 20–30 percent. This would increase the total agricultural output in developing countries by up to 4 percent, which could in turn reduce the number of hungry people in the world by 12–17 percent (De Schutter, 2013). Similarly, a study conducted by Water Aid shows that a one dollar invested in water supply brings US\$3-\$34 in benefits. Such benefits can be even better distributed and assured if gender is taken into account creating multiplier effect on benefit (CAP-NET, GWA 2006).

Against this backdrop, a regional workshop on water, livelihoods and gender was organized in Kathmandu, Nepal from 25-26 March 2016 to focus on understandings the connections of water to livelihoods and gender in the Koshi River Basin.

The workshop created a platform for the policymakers, researchers, and development practitioners to interact on significant issues related to the water-livelihoods-gender nexus in the Koshi Basin (refer to Annex 1), finding the gap and paving the road ahead.

Structure of the Proceedings

We structure this proceedings in eight chapters:

- **Chapter 1** provides background information and summarizes the literature and theoretical frameworks for understanding water-livelihoods-gender dynamics.
- **Chapter 2** highlights key remarks from the guest speakers during the inaugural session.
- **Chapter 3** presents the first technical session and includes five research-based articles focusing on challenges and issues of water and livelihoods in the Koshi Basin.
- **Chapter 4** focusses on water resource management in connection with gender and livelihoods and includes three research article presentations.
- **Chapters 5 and 6** includes tools, solutions, and options to tackle the water problems and livelihoods improvement.
- **Chapter 7** presents the group work outcomes and provides suggestions on how to improve the policy related to livelihoods and how to create synergy among different actors in the Koshi Basin.
- **Chapter 8** provides the workshop conclusions and key policy messages for improving the water-livelihoods-gender nexus in the Koshi River Basin.

References

- CAP-NET, GWA. (2006). *Why Gender Matters: a tutorial for water managers. Multimedia CD and booklet*. CAP-NET International network for Capacity Building in Integrated Water Resources Management, Delft.
- Crow, B. (2001). *Water: gender and material inequalities in the global south*. UC Santa Cruz: Center for Global, International and Regional Studies. Retrieved from: <http://escholarship.org/uc/item/0rq308jc> on 28th March, 2017
- Crow, B. & Sultana, F. (2002). Gender, class, and access to water: Three cases in a poor and crowded delta. *Society & Natural Resources*, 15(8), 709-724.
- De Schutter, O. (2013). *Gender equality and food security: Women's empowerment as a tool against hunger*. Asian Development Bank, 114p.
- Hazell, E. L. (2010). *Gender, water and livelihoods in Mseleni: A case study*. School of Development Studies, University of KwaZulu-Natal.
- Johansson, K. (2016). *How integrated are women and gender in Integrated Water Resource Management?* Retrieved from http://stud.epsilon.slu.se/9271/1/johansson_k_160628.pdf on 28th March, 2017.

- Namara, R. E., Hanjra, M. A., Castillo, G. E., Ravnborg, H. M., Smith, L. & Van Koppen, B. (2010). Agricultural water management and poverty linkages. *Agricultural water management*, 97(4), 520-527.
- Rasul, G. & Sharma, B. (2016). The nexus approach to water–energy–food security: an option for adaptation to climate change. *Climate Policy*, 16(6), 682-702.
- Rasul, G. (2016). Managing the food, water, and energy nexus for achieving the Sustainable Development Goals in South Asia. *Environmental Development*, 18, 14-25.
- Saleth, R. M., Samad, M., Molden, D. & Hussain, I. (2003). Water, poverty and gender: an overview of issues and policies. *Water policy*, 5(5-6), 385-398.
- Van Koppen, B. & Koppen, B. C. (2002). *A gender performance indicator for irrigation: Concepts, tools and applications* (Vol. 59). IWMI.
- Wallace, T. & Coles, A. (Eds.). (2005). *Gender, water and development*. Berg.

Chapter 2
Inaugural Session
Speakers

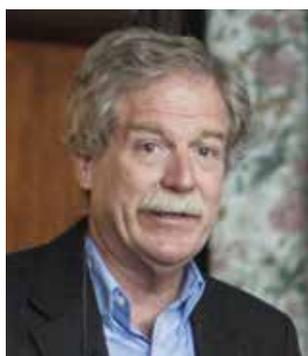
Speakers

Welcome Speech – David Molden, Director General, ICIMOD

Special Remarks – Glenn White, Australia’s Ambassador to Nepal

Remarks

- Surya Prasad Paudel, Deputy Director General, Department of Agriculture, Nepal
- Ashok Singh, Deputy Director General, Department of Irrigation, Nepal
- Bharat Pokharel, Country Director, HELVETAS, Swiss Intercooperation
- Tira Foran, Lead Social Scientist, CSIRO, Australia
- Shahriar Wahid, Programme Coordinator, KBP, ICIMOD



David Molden, Director General, ICIMOD

“Growing male outmigration has increased the burden on women but when it comes to decision making, women still have a very small role”

David Molden shared his experiences in Nepal and how much had changed over the decade, particularly in regard to urbanization and the role of women. Agriculture has transitioned largely from subsistence modes to more cash crops (commercial farming) and expansion of markets. Gender roles in the rural communities are changing due to increasing male outmigration, which impacts the agricultural sector. Statistics show that women spend more than three times the amount of time than men collecting water, but their membership in user associations is only 31 percent. Barely 10 percent of women feel that their voices are heard in meetings, while only 14 percent own agricultural land. Molden stressed that for these reasons, it is necessary to strike a balance between agriculture and water resources in the Hindu Kush Himalaya (HKH). To close, he posed these four questions:

- If migration is so important, how can we effectively use remittance?
- How can we provide better training to women farmers in the agricultural sector?
- What is the best way to develop the connections and networks between rural communities?
- How can we promote cash crops in certain regions?

Glenn White, Australia’s Ambassador to Nepal

“Such a platform is regularly needed for knowledge-sharing and this meeting was the first of its kind discussing research in critically important areas.”

Australian ambassador Glenn White started by sharing the old adage that ‘water is life’. But this adage, he suggested is complicated by major drivers such as market change, demographic change, migration, and climate change. He related Koshi Basin to Australia, where agriculture drives a large sector of the economy, providing livelihoods to rural populations. The Murray-Darling Basin, known as the bread bowl of Australia, has undergone profound changes over the past century. Rural communities have been threatened by drying conditions in an already drought-prone environment. The pressure on the environment has led to catastrophes such as solarisation, algal blooms, and acidic soils.

As a result, many farmers, White said, have sold their farms and migrated into urban areas seeking a better life. With this rapid outmigration, employment opportunities, education, and health care for rural areas continues to lag behind cities. In this context, there has been careful management of water resources, increased investment in water saving measures, and a renewed focus on farm productivity.



“I’ve known particularly that water is very important for the livelihood of women and girls, which is an important focus for the Australian aid program. It is encouraging to see regional participation, and Australia is committed in facilitating regional co-operation towards shared prosperity,” White told the gathering. Knowledge exchanges are needed in the region to provide support for planning and plan implementation in basin-sharing countries. White emphasised the importance of collaboration between the governments and knowledge centres such as ICIMOD, CSIRO and other organizations.



Surya Prasad Paudel, Deputy Director General, Department of Agriculture, Nepal

“A lot of research is needed to produce knowledge to create more livelihood programmes”

Food security and poverty reduction are two significant aims of DoA, according to Deputy Director General Paudel. DoA has been investing and working in the Koshi Basin for more than a decade, with a focus on agro-based activities including fish and vegetable farming. DoA has several ongoing research initiatives with different agencies, and Paudel said he hoped that the knowledge would produce improved livelihood programs.

Ashok Singh, Deputy Director General, Department of Irrigation, Nepal

“This workshop is key to produce knowledge for ensuring better management of the water-livelihoods-gender nexus not only in the Koshi Basin but also for other basins.”

The Nepal Department of Irrigation is responsible for developing irrigation facilities across the country in three major basins: Koshi in the east, Gandaki in the central part, and Karnali in the west. “We have felt that the availability of water for irrigation has reduced, which may be the effect of climate change and further aggravated by other local conditions,” Singh explained. Land fragmentation due to the existing rules [about] the transfer of land ownership from one generation to the next has complicated matters. In addition, unprofitable traditional farming has pushed Nepali farmers to either migrate or turn to more water-intensive cash crops.



During the 1980s, Nepal used to be an exporter of agricultural products, but now imports food grains. Nepal needs to import at least one-third of its national consumption of food grains from the international market. This has contributed to the migration of young people from rural areas to seek better opportunity in the cities and abroad. The migration has created a vacuum in the availability of young energetic adults, especially the male of the age group 18-45 years.

Rural areas are now predominantly inhabited by female, children, and elders. In this context, the responsibilities of agricultural work are shouldered by women weakening the bond of water-livelihoods-gender nexus. Singh said research is needed to enhance irrigation development for improvements in agricultural production. He hoped the workshop would help the participants develop concrete action in the following areas:

- Knowledge and tools to improve livelihood and gender development in the rural areas; and
- Policy recommendation for water-livelihoods-gender development.



Bharat Pokharel, Country Director, HELVETAS Swiss Intercooperation

“The whole idea of water-livelihood-gender nexus is to link the local with the central and national and international levels of policy making”

HELVETAS Country Director Bharat Pokharel shared how HELVETAS has always worked closely with Government of Nepal’s DoI and DoA, and ICIMOD on issues of water and forestry, which are interlinked. He gave an example of preparing local water use master plans (WUMP) as a very important tool for systematic, bottom-up planning for good governance around water. “This actually brings knowledge that is not only limited to water but also helps in building local forum for communities to practice local and direct democracy at village level, where there has been a vacuum of local government for many years,” Pokharel said.

HELVETAS is not only promoting water resource management but also trying to work with local communities about how to practice direct democracy while using water access as entry point for those discussions. These particular tools bring a strong bottom-up process at village level, where people negotiate, compromise, debate, discuss, and they ensure equity, gender equality, and social inclusion around many natural resources, not just water for irrigation or agriculture.

The approach of water-livelihoods-gender nexus is to link the policy making process from the local to the central and national and international levels. The plans are prepared with participation of local communities taking gender and social inclusion into consideration. The nexus approach brings local people and development practitioners together to help learn from one another. The research-policy interface is a key part of the local water planning process where people determine the sustainability of natural resources. Pokharel said that ICIMOD has been creating valuable forums to help generate and share knowledge. This workshop would help bring another dimension of water resource management, particularly for the Koshi Basin.

Tira Foran, CSIRO, Australia

“A workshop such as this provides forum to support reasoned argument, debate, and discussion among participants such as ourselves to improve the quality of livelihood relevant research”

Tira Foran from CSIRO shared a brief history of the organization, which is best known for developing Wi-Fi technology, global climate science, and river basin modelling and planning. In addition, CSIRO has contributed to social science with ideas for improving decision making around natural resources and rural development. The special focus of this foundation’s work is the use of participatory and multi-stakeholder methods.



“We are exploring the use of these methods in workshops like this one to support reasoned argument, debate, discussion among participants such as ourselves present here on how to improve quality of livelihood relevant research,” said Foran. He explained that the research generates the knowledge that decision makers could use, and was pleased to have seen the ideas for this workshop develop over the past years, into a very inclusive workshop agenda which has brought the participants together in the forum.



Shahriar M Wahid, Programme Coordinator, KBP, ICIMOD

“We need to improve the understanding of water management in socio-economic and livelihoods context with special focus on gender”

Knowledge sharing and creating platforms for evidence-based policy support are very important. Reviewing the objectives and overview of the workshop, KBP programme coordinator Shahriar M Wahid stressed the need to improve understandings of water in socio-economic and livelihoods contexts with special focus on gender. He said the workshop would discuss science outcomes of on-going research and provide policy recommendations based on co-learning among the stakeholders.

Wahid said the forum would address key issues and challenges like food security, adaptation and awareness, lack of collective action, land property rights, farmer-managed irrigation systems, and building the capacity of local institutions to address issues for gender equity. As an example of ICIMOD’s work related to these challenges, Wahid described recent research on springsheds in the middle hills which were drying up. The authors of that report suggested rehabilitating ponds for improved better water security. While the idea was important, he said that success would depend on partnering with the local community to ensure and sustain the success of the project.

The collaborative WUMP initiative by ICIMOD in partnership with HELVETAS is a significant process to improve livelihoods and security, in particular women and socially marginalised communities. Water management based on WUMPs is already underway and gaining momentum in selected VDCs (Saptari, Sindhuli, and Sindhupalchowk). There has been growing recognition of the values of the upstream downstream linkages, for which the Koshi Basin Programme has been also taking initiative in partnering with the Government of Nepal and local NGO partners and communities. Wahid talked about the importance of planning for the future with help of water modelling, which determines future water availability. As more data becomes available, this will be valuable tool for future water resource planning.





Chapter 3

Plenary Session I
Water and Livelihoods:
Issues and Challenges

Water and Livelihoods: Issues and Challenges

- Chair** – Golam Rasul, ICIMOD
- Moderator** – Shabnam Shivakoti, MoAD, GoN
- Presenters**
- Biplap Dhak, ANSISS, India
 - RC Bastakoti, IWMI, Nepal
 - Prachanda Pradhan, FMIST, Nepal
 - David Fleming, CSIRO, Australia
 - Xueqian Song, Chengdu University of Information Technology, China

Key Messages

- Different seasons have specific problems: Flooding is a major problem during the rainy season, while drought is a problem during winter. There is a strong need to strengthen irrigation and infrastructure development considering seasonal uncertainty due to climate change.
- Investment in education and rural infrastructure have helped in China's development progress.
- Rural employment can be enhanced by transforming agriculture to non-farm sectors.

Summary of Presentations

Biplap Dhak from ANSISS highlighted livelihood and food security issues from the Bihari part of the Koshi Basin. He shared a study that showed strong links of livelihoods with agriculture and livestock. More importantly, nearly 90 percent of households in the study area are landless who are mostly agricultural labours and depends on livestock as well for their subsistence. In the study area there was a high degree of vulnerability for recurrent flood and simultaneous drought. These were key contributing factors to increasing vulnerability, exacerbating an already precarious situation lacking in irrigation facilities and declining in agricultural productivity.

R. C. Bastakoti from IWMI highlighted on the impact of climate variability on livelihoods and its constraints on adaptation. He presented a case study of upstream and downstream areas of the Koshi Basin's midhill and the Terai regions. The frequency of drought has increased over the years, with a decline in yield, changes in cropping pattern, declines in the cropped area, and an agricultural shift to other farming activities. Factors constraining adaptation efforts include lack of financial means, low technical skills, low awareness and lack of collective action, and property right issues.

Prachanda Pradhan from FMIST described the importance of farmer managed irrigation systems (FMIS) in the Koshi Basin. FMIS is no longer only limited to institutional, physical, and technical concerns. Climate change impacts are causing water scarcity, and have become a major concerns for FMIS sustainability. The challenges facing FMIS include:

- Concerns about productivity and available resources;
- Reducing poverty and insecurity;
- People's dignity and empowerment;
- Farmer organization as social capital to be used for improvement;
- Innovation of farmers for their livelihood improvement, and
- Politics.

Participants asked Pradhan about the role of women in FMIS and the way forward. Pradhan said that women's roles had changed much over the past four decades regarding irrigation labour, operation, and management.

David Fleming from CSIRO presented a livelihood analysis and described its potential for regional planning and policy advice. He said the authors had analysed livelihoods strategies using quantitative data. Livelihood strategies in this study refer to patterns of productive activities that generate the means for survival and can be conceived of as a set choices that households make: short, medium, or long term. Short- and medium-term choices, Fleming said, constrain the subject to cultural, human capital, geography and market considerations. He shared preliminary

findings that showed how households are highly dependent on remittances in the Koshi Basin. This has generated an interesting pattern of change in behaviour and activities.

Xueqian Song from Chengdu University in China presented a paper on issues of adaptation in rural households in the upstream Koshi River, in a city called Shighaste. After 2008, Song reported, there was a significant increase in vulnerability. Education, cash, water storage and disaster preventions are the available options to reduce vulnerability.



Livelihoods and Food Security Issues in the Koshi River Basin, Bihar

D.M. Diwakar¹, Biplab Dhak¹ and Aviral Pandey¹

Abstract

Based on a field survey in 11 districts of Koshi Basin area in Bihar, this paper provides a situation analysis related to livelihood and food. The study found that the study area lacks livelihood resource base, thus affecting local food insecurity. The underlining factors include: lack of employment opportunities, unequal distribution of landholding, and recurrent flood and drought. The status of livelihood and food security is different in each region, based on the intensity of flood and the situation of embankment. The areas, considered to be protected by flood, is found to be relatively better off in terms of livelihood assets, and better food security as compared to non-protected area.

Introduction

It is inherent for people to develop strategies to use their resources to meet their basic needs, obligations, or to expand resources. The whole process coined as livelihood, however, is very complex. The livelihood framework neither describes a single resource endowment nor a single activity pattern. It comprises of various interlinked aspects differing from the notion of only income earning opportunities or the notion of employment. The livelihood approach describes a comprehensive picture of resource endowment, and how these are linked to various strategies and its resultant outcomes. Chambers and Conway (1992) defined livelihood as “capabilities, assets (including both material and social resources) and activities required for means of living. A livelihood is sustainable when it can cope with and recover from stress and shocks, and maintain or enhance its capabilities and assets both now and in the future, while not undermining the natural resource base”. This paper draws analytical framework from Chambers and Conway (1992). While the paper assesses an overall livelihood scenario of people living in the Koshi River basin area, a comparison throughout has also been made across the four regions, based on the flooding situation and the embankment built along Koshi River to protect from floods.

Data

The paper draws data collected in the Koshi River basin area under the project, “Socio-economic, livelihood and policy analysis in the Koshi River Basin, Bihar.” As part of the project, a field survey was conducted covering 1600 households across 11 districts of the Koshi River basin area using structured and non-structured schedule. The districts include Madhubani, Supaul, Araria, Purnia, Katihar, Madhepura, Saharsa, Darbhanga, Samastipur, Khagaria, and Bhagalpur. These are divided based on the intensity of floods and position to the embankments built along the Koshi River to protect villages from recurrent flood into four regions namely: (1) within the embankment, (2) outside the embankment, (3) without embankment, and (4) protected region.

Livelihood Status

Livelihoods comprise of various assets like human resources, physical, natural, and financial and social capital. In the study area, our finding showed that all types of capital were very negligible. There is high rate of Illiteracy. Health conditions are poor with high rate of morbidity and hospitalization. The conditions of the houses are also poor with most of them in dilapidated condition. The majority of houses in the study area are katchha (65.3 percent), which refers to a house built with low cost non-durable local materials like mud, unburnt bricks, thatch,

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leaves and bamboo. Around 89 percent of households are found to be defecating in the open field. Scarcity of natural resources is a serious concern. More than 90 percent of households are marginal landholders, with less than 1 hectare per household. Average landholding accounts to 0.36 hectares. Majority of households depend on livestock for their livelihood, used for milking and farming. Around 76 percent of households were found to own at least one livestock. There is an average 2.2 livestock per household.

Financial capital such as household savings, status of financial inclusion, indebtedness, access to remittances, etc. are exceptionally low. It is found that around half of households do not even have a savings bank account. The percentage of household with health and life insurance are only 6.0 and 9.5 percent respectively. About 27.9 percentage of households have outstanding loans. Around 36 percent of the households depend on remittance income, considered an important asset for people in the Koshi basin area. The average amount of remittances per household (only remittance receiving households) accounts to India Rupees (IRs) 41,783 in a year.

Social capital is defined as the feature of social organizations that facilitate co-ordination and co-operation for mutual benefit of the members and society as a whole (Putnam et al., 1994; Putnam, 1995; Putnam 2001), and the physical capital of an area influence the residences’ wellbeing. A person belonging to a neighbourhood with rich physical infrastructure is likely to experience ease in finding jobs, accessing market, health facilities, educational facilities and good communication etc. Those in turn will help positive linkages with livelihood. An estimate of social capital based on various physical infrastructures does not Figure out very impressive for the survey area. Nevertheless, it is a relative measure and it has not been compared with other area having no scope.

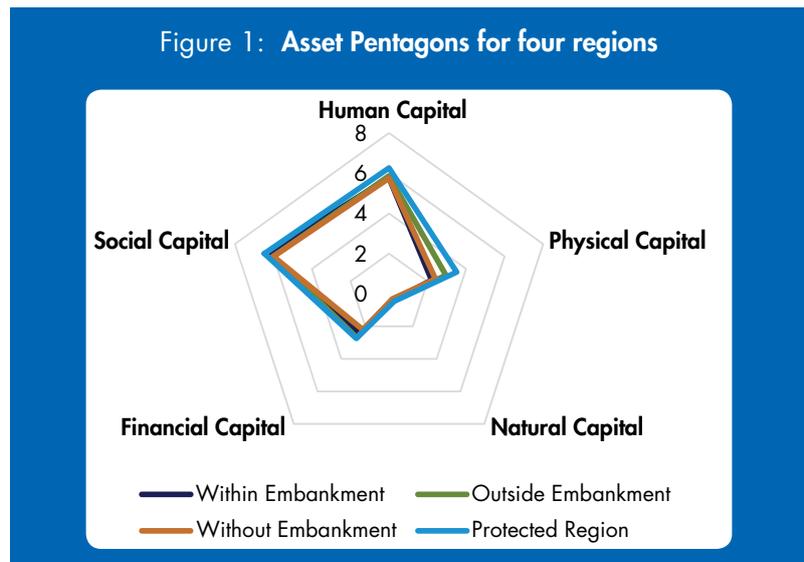
A comparison of livelihood assets across four divided regions is presented in Figure 1. It can be seen that the protected region is ahead of other regions as far as acquiring livelihood assets are concerned. This remains consistent across any type of asset. In contrast, the regions without embankment is at a disadvantage in terms of asset scores.

Livelihood Strategies

People adopt very dynamic and complex strategies based on individual/household/community asset base, and perceived risk, generated through past experiences. Although the economy of the area revolves mainly around agriculture, the income through agriculture or allied activities is not enough for the people to fulfil their needs. Engagement in multiple activities remains the characteristics of the area. Based on suitability, a particular individual adopt engagement in multiple activities throughout the year to cope up with seasonality. Again, diversification within a household amongst its members remains the usual pattern in the Koshi area. More importantly, people in general migrate to other places, mostly outside Bihar, as their livelihoods strategy.

The Work Participation Rate (WPR), which is defined here as the percentage of total workers to the total population, is 34.1 per cent. Workforce participation rates for males and females account 44.3 and 23.9 percent respectively. It is worth mentioning that female workforce participation is found higher with 24 percent in the Koshi area as compared to 19 percent of entire Bihar. This high female workforce participation is perhaps indicative of economic hardship of the study area and this higher rate is part of people’s strategy to counter hardship and maintain livelihood. There has also not been marked difference observed across four regions of the study area. It varies from 32.1 to 35.8 percent across regions. Amongst various economic activities of the workers, casual labour in the agriculture sector (40.4 percent) remains on the top followed by cultivators (24.8 percent), casual labour in non-agriculture activity (15.2 percent), business (5.9 percent) and others.

Figure 1: Asset Pentagons for four regions



Diversification of economic activities at both individual and household levels has been a common livelihood strategy for the people in the Koshi region. This is in general used as a risk aversion strategy or wealth accumulation strategy. Around 19 percent of working population are found to be engaged with at least two economic activities. Our qualitative data shows that involvement in multiple activities has been a very common practice irrespective of any region. In addition to one principal economic activity, maintaining livestock, collection of free goods like fodder, fire wood, fishing, etc., have been the usual practice of people living in the Koshi basin area.

Migration remains one of the most distinguished strategies of people living in the Koshi River basin area as an escape route from poverty. A large number of people are found to have adopted the strategy according to their convenience. People have either taken migration route seasonally or permanently. Again, it is either within the state or outside the state. Seasonal migration rate accounts as high as 9.4 for the entire study area. Long-term migration rate accounts around 38 percent of households in the study area, with at least one long-term migrant. The situation remains similar across the four study regions. The study shows that more than 85 percent of migration takes place due to employment-related reasons, either in search of employment or better employment or to take up employment. Other important reasons include business (10.4 percent), transfer of parents/earning members (2.1 percent), etc.

Livelihood Output: Food Security

Livelihood output shows how successful a household is in utilising assets, choosing appropriate strategies and how successful it is in meeting the desired ends. While target of any household are basic needs of food, shelter, water, health, and education, this paper focuses only on food security. Food security is analysed based on self-reported status on availability of food. Indicators are presented on Table 1. Around 90 percent of households reported being worried about availability of food or preferred food. Their worries extend for around three months in a year. The main reason why they worry is that around 12 percent of households reported of not getting enough food of any kind. In average, people reported of not getting enough food for around 52 days. Lack of food availability is also depicted in average number of meal taken in a day. Out of four times' meal (breakfast, lunch, tiffin and dinner) generally taken in India, people on average in the study area take meals only 2.8 times. It is observed that a major proportion of households survives by taking two times meals - lunch and dinner. A large proportion of households are unable to afford breakfast and tiffin. The regional pattern of food security is that the protected region is placed in advantageous position as compared to other regions.

Table 1: Indicators of Household Food Insecurity (reference last 1 year)

Indicators	Embankment				All
	Within	Outside	Without	Protected	
Percentage of remained worry for food	94.0	94.7	96.5	91.0	93.8
Average days of worried for food	92.9	92.6	101.3	83.9	92.1
Percentage of not eating preferred food it	92.8	93.0	94.0	92.2	92.9
Average days of not eating preferred food	72.3	71.6	75.7	72.1	73.0
Percentage of eating smaller meal	10.0	12.0	19.8	6.0	11.6
Average days eating smaller meal	51.7	53.3	51.7	50.1	51.7
Average number of meals taken in a day	2.9	2.8	2.6	2.9	2.8

Determinants of Food Security

To identify some important factors that determine household food security, consumption expenditure and income 'Ordinary Least Square' (OLS) method is adopted. Explanatory variables have been selected based on the experiences during the field work and prior experiences, which includes household size, percentage of working population, sex of household head, education of household head, household's average education level, landholding and migration status. Sex of the household head and migration status, i.e., whether a household has a least one migrant, are included in the analysis, given that around 38 percent of households had at least one

out-migrant. Due to migration or other reasons, 16 percent of households were found headed by females. These female-headed households were perceived to be in a disadvantaged situation in terms of their socio-economic status.

It is understood through the regression analysis that all selected variables, except the category on the sex and education level of the head of household were statistically significant in determining household food security. For other variables, while household size is negatively correlated, percentage of working population, educational level, and landholding are found positively correlated with food security (Table 2). Educational level of the head of household is found statistically non-significant. The status of migration is found significant as households with having migrants are likely to have advantages in securing food. People of the Koshi area adopts migration as a strategy of maintaining livelihood through the channel of remittances, and which is found to effective as far as regression result is concerned towards securing food.

Table 2: Determinants of food security

Variable	Food Security Index	
	Coefficient	t-statistic
Household size	-.051	-4.14**
Percentage of working population	.004	2.88**
Sex of household head	-.010	-.12
Year of education of head of the household	.006	.70
Average years of household education	.048	3.43**
Landholding (in hectare)	.199	16.85**
Household migration status	-.193	-3.38**
Constant	6.950	36.23**
Adjusted R ²	.206	
F	52.970	
N	1600.000	

Note: * indicates $p < .01$. Regions, religion and social groups are controlled

Conclusions

This paper concludes with the note that the Koshi River Basin area lacks livelihood resource, which leads to food insecurity. The main problem has been the lack of employment opportunities. Unequal landholding, and recurrent floods and drought also have negative impact on people's livelihoods. Marginal landholders cannot rely fully on agriculture and adopt migration as an escape route to poverty. Nonfarm employment opportunities are also very less. Agriculture sector is underperformed and it has linkages to incidences of recurrent flood and drought in the area. Similar picture appears when food security is analysed based on the perspectives of four regions. The area considered to be protected by flood is found to be relatively better off in terms of livelihood assets and food security as compared to non-protected area. Under development have also had linkages to the lack of irrigation facility/water management also. This problem seems to have intensified by huge outflow of people from the area discouraging technology adaptation and capital investment in agriculture.

References

- Chambers, R. & Conway, G. (1992). *Sustainable rural livelihoods: practical concepts for the 21st century*. Institute of Development Studies (UK).
- Putnam, R. D. (2001). *Bowling alone: The collapse and revival of American community*. Simon and Schuster.
- Putnam, R. D., Leonardi, R. & Nanetti, R. Y. (1994). *Making democracy work: Civic traditions in modern Italy*. Princeton University Press.
- Putnam, R. D. (1995). Bowling Alone: America's Declining Social Capital. *Journal of Democracy*, 6(1), 65-78.

Responding to Climate Change Impacts – Constraints and Potential Adaptation Options in the Koshi Basin

Ram Chandra Bastakoti²

Introduction

Past studies on adaptation practices to deal with climate change impacts show that in many instances, local community people practice a diverse set of autonomous adaptation options (Bradshaw et al., 2004; Adger et al., 2005; Naess et al., 2005; Lebel & Sinh, 2009; Holman and Trawick, 2011). A recent review of literature on climate change adaptation practices (Bastakoti et al., 2014) helped develop a typology of potential adaptation options. They can be grouped into: structural and non-structural measures, and further into technical, management, economic and regulatory measures.

This paper covers Nepal and Bihar parts of the Koshi Basin, which is one of the vulnerable basins originating in the Himalaya in terms of likely impact of climate change on water availability (Gosain et al., 2011; Bharati et al., 2012). While the downstream of the basin often has excessive flow of water, the upstream is water-stressed (Dixit et al., 2009). Recent studies in the Koshi Basin has shown seasonal variability in water availability (Bhatt et al., 2014; Agarwal et al., 2014; Bharati et al., 2014). Koshi River is also known for frequent occurrence of extreme events such as floods, drought and water shortages (Chen et al., 2013), which are likely to become more frequent in future due to the changing climate (Bharati et al., 2012).

It is important to note that any local adaptation initiatives could significantly be affected by broader social, economic and policy changes that shape local vulnerabilities (Smit & Wandel, 2006; Jones & Boyd, 2011), as well as other key factors such as access to weather information, household and agricultural production-related assets, and participation in local social institutions (Wood et al., 2014). In this context, the broader focus of this paper is to analyse adaptation options to deal with the climate change impacts. Specifically, it examines the factors constraining adaptation practices and potential adaptation options.

Study Area and Methods

Three representative case study sites (hill communities in Nepal, floodplains in Nepal Terai and flood-affected areas in Bihar) from across different agro-ecological zones of Nepal and Bihar, India were selected along the Koshi Basin gradient (Figure 2). The study districts are: Sankhuwasabha, Bhojpur, Saptari and Supaul.

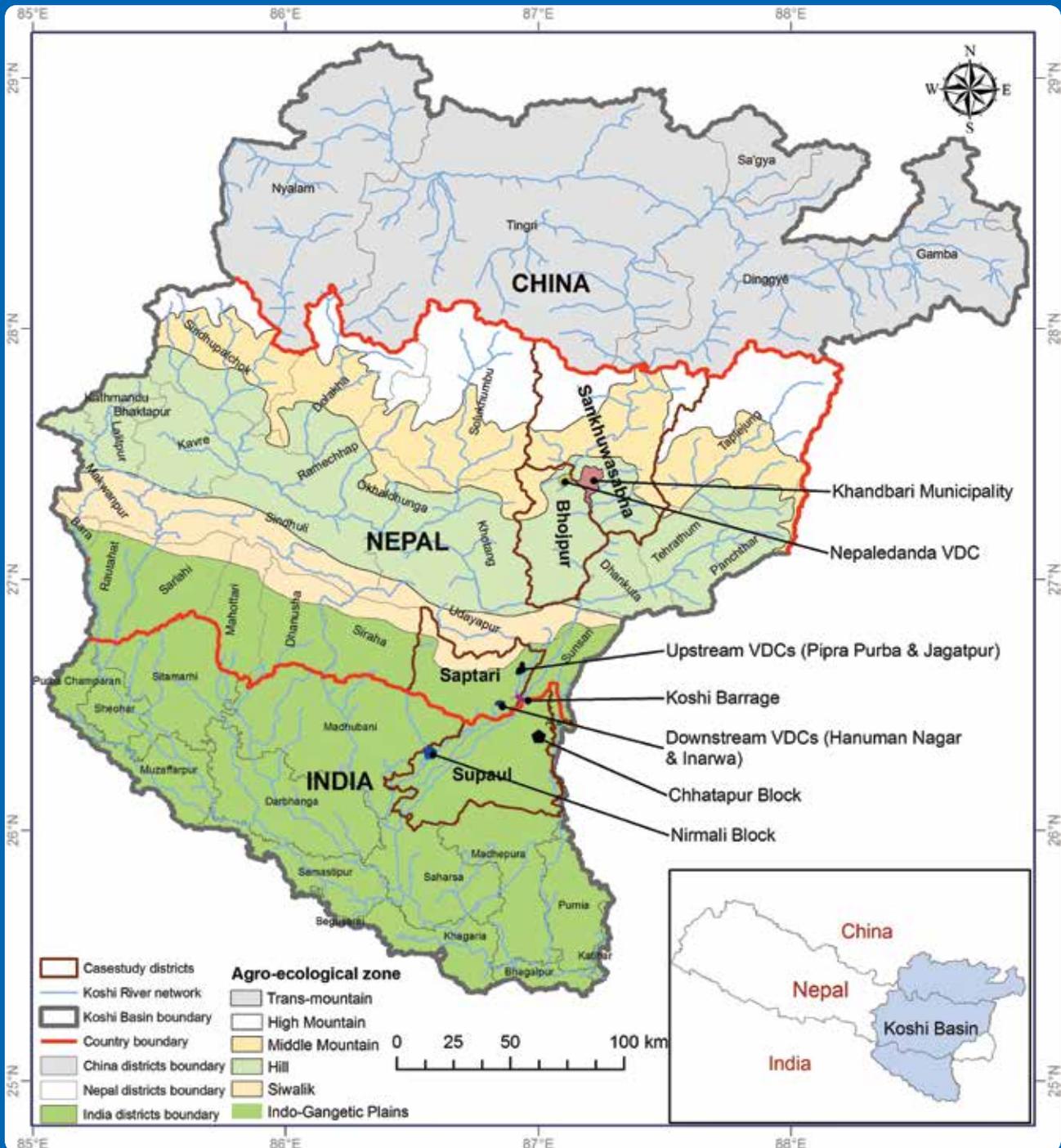
Hill communities in Nepal: Two communities on either side of Arun River in the upstream Koshi Basin were included to grasp the situation of hill communities. From Sankhuwasabha District, Tumlingtar plateau in Khandbari Municipality was included as study area. From Bhojpur District, Majhuwabesi village in Nepaledada village development committee (VDC) was included.

Floodplains in Nepal's Terai: Saptari District represents Koshi floodplains in the Terai of Nepal, where communities aligned to levees of Koshi River in both upstream and downstream of Koshi Barrage were covered. In the upstream, Pipra Purba and Jagatpur VDCs constitute study area [hereafter represented as 'Upstream of Koshi Barrage']. Likewise, in downstream, Hanuman Nagar and Inarwa VDCs constitute study area [hereafter represented as 'Downstream of Barrage'].

Flood-affected areas in Bihar: Supaul District of Bihar, India, represents plain Terai agro-ecological zone of Bihar, from where two blocks (Nirmali and Chhatapur) were selected covering communities diversely impacted by

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Figure 2: Study locations in Koshi Basin



flooding. Nirmali block represents communities displaced from inside the embankment [hereafter represented as 'Inside embankment']. It is situated at upstream to Koshi Bridge at NH 57 in Bihar. In Chhatapur block, study area is situated along Koshi's east main canal representing communities, severely affected by 2008 flooding after Koshi embankment breach in Kusahawa of Nepal [hereafter represented as 'Along East Main Canal'].

Data at local level were collected through a series of field survey done in selected sites using a combination of techniques. Focus group discussions (FGD) were conducted at village level to get an overview of communities especially on local level impacts and adaptation measures. Household (HH) surveys in study locations were done by randomly selecting a representative number of households in each study location.

Changes in Agricultural Practices in the Koshi Basin

Household survey results revealed that nearly half of the respondents in study areas of Nepal reported changes in cropping patterns, but, in case of Bihar, a large majority of respondents reported changes in cropping pattern during last 20-year period. A major shift in cropping pattern was noted in the form of adopting non-agricultural activities to diversify their livelihood portfolio (Figure 3).

Perceptions on Water Availability, Climatic Variability, Drought and Floods

The overall outcome of the field survey was a decline in water availability in different parts of the Koshi Basin in last 20 years. The climatic variability affected the water availability. The perceptions varied across study locations (Figure 4).

Many areas of the basin show water scarcity during different times of the year. The overall view of a majority of the people in different parts of the Koshi Basin was that the drought is a major problem (Figure 5) with increase in the frequency of drought occurrence in last 20 years.

Further, except in hill communities, a large majority of the people in the Koshi Basin reported flooding (volume and frequency) as a major problem (Figure 6). However, varying opinions existed regarding changes in frequency of occurrence of floods during the last 20 years.

Figure 3: Shifts in cropping pattern in the Koshi Basin

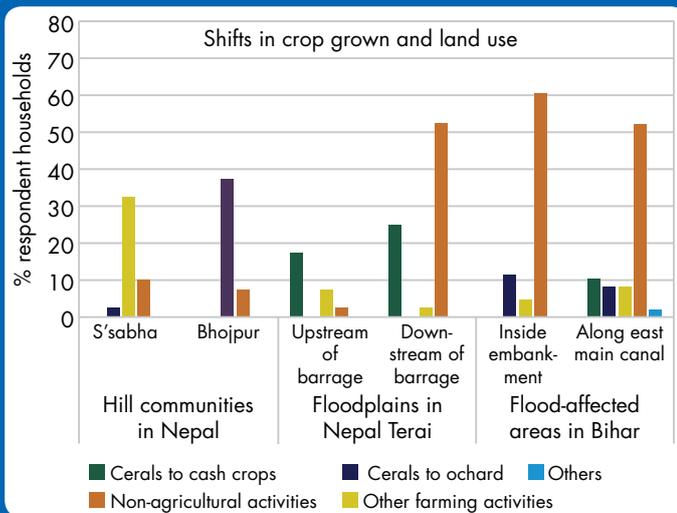


Figure 4: Perceived changes in water availability in the Koshi Basin

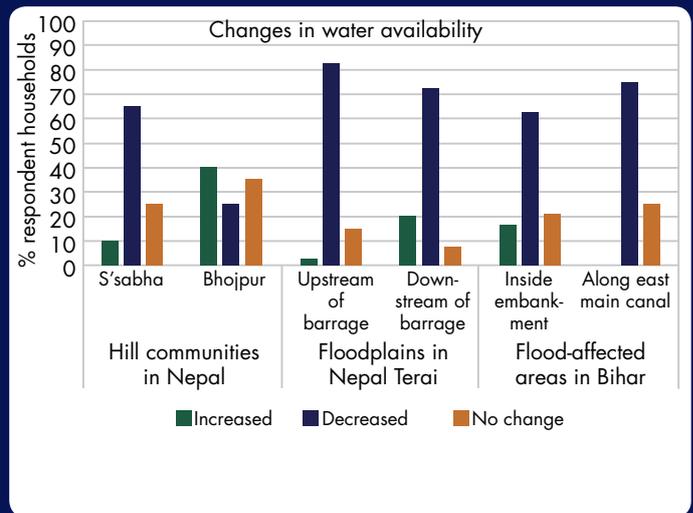


Figure 5: Perceived view about drought as major problem in the Koshi Basin

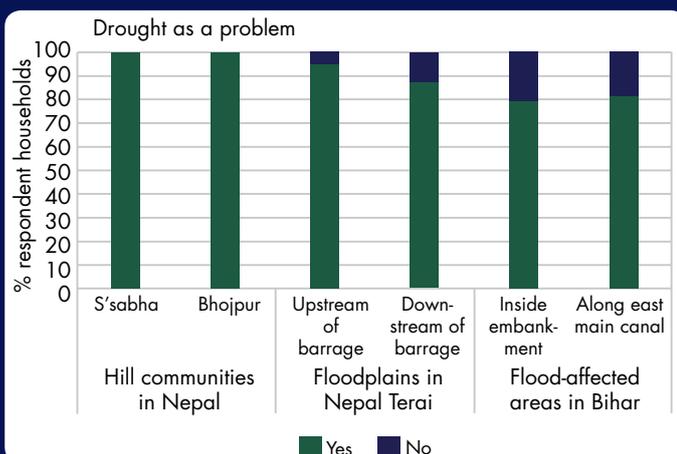
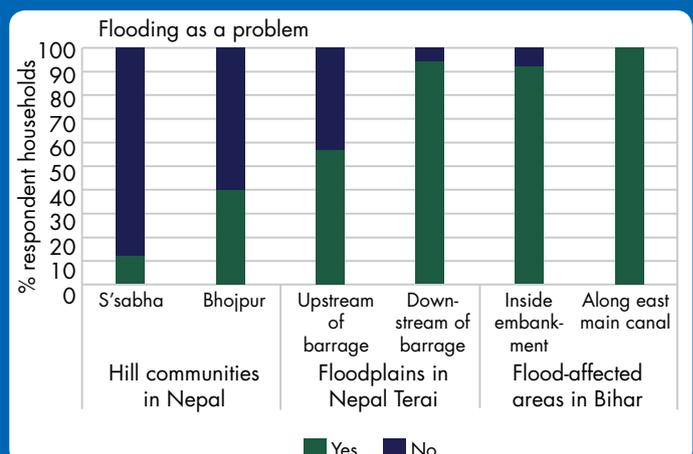


Figure 6: Perceived view about flooding as major problem in the Koshi Basin



Adaptations and Constraining Factors

Result showed that people have been practicing different measures to deal with both drought and flood risks. But, it was also noted that in many cases they do not adopt several potential adaptation measures. Even if some measures are practiced, in most of the cases only few people have benefitted from such measures. The result reveals that several factors constrain the adaption practices, which can be grouped into some meaningful categories: financial; technical knowledge; lack of awareness; lack of collective action, property rights; and ineffective role of state agencies. The lack of investment capacity of community was found as one of the major constraining factors. The affected communities were not able to adopt any structural measures because of this reason.

Another closely related constraining factor that limits adoption of structural measures is lack of financial support from concerned authorities. The effectiveness and sustainability of community level efforts are also constrained by lack of funds. For example, in many cases, local communities have formed management committees, but such committees are not able to perform their activities, like operation and maintenance work, due to lack of funds. In such a situation, they have not received any external assistance. In addition, the management-related measures have not been effective due to lack of any substantial attention and support from related higher authorities.

Some structural and economic measures were not adopted by the community due to lack of investment capacity at household level. For example, people with small land-holding size find it difficult to install STWs, even though they know that it could help solve water stress. In some cases, installed Shallow Tube Wells (STWs) are not working effectively as the water level has decreased that required deepening of the tube wells. But many farmers are not able to afford the cost. Likewise, people are aware that migration abroad could help generate supplementary income, but they cannot invest to support their travel abroad.

In case of most of the non-structural measures, lack of awareness and technical knowledge among the communities was found to be the major reason. For example, in most of the areas, they were not aware of the availability of either drought-tolerant or flood-tolerant crop varieties or types. In addition, the concerned authorities are not putting necessary efforts in providing the technical support as well. For example, communities mentioned that they did not have any technical knowledge about the new methods of cultivation. In many instances, some community-level measures have not been effective. For example, management committee exists both in dealing with water stress and flood risks. But people have not benefitted much, as the committees do not work properly. Likewise, sometimes people are not able to maintain even small-scale water management-related infrastructure. Lack of collection action among the beneficiaries was reported as the main reason.

Lack of technical knowledge and capacity of community people also constrain the effectiveness of some measures. For example, in the study areas, people reported on the existence of flood forecasting mechanism but mostly, it was found ineffective. Such systems were introduced by external agencies that require high level of technical knowledge, but local communities lack any such knowledge. The result reveals that in general, farmers are not aware about any insurance schemes to deal with either drought or flood risks. But even with the knowledge of such schemes, the farmers would be unable cover the insurance premium due to their low income status. The fact is that the local communities are not receiving any information, awareness or support from any of the government or non-government agencies about the insurance schemes.

Another factor that could constrain adoption of some measure is related to the property right issue. For example, people in Hanuman Nagar VDC reported that they have not been able to use the community ponds as the available ponds are under the ownership of the Government of Nepal and local farmers do not have control over its use. The role of state agencies and other higher level agencies could be crucial in facilitating the adoption of several measures, especially the regulatory adaptation measures. The required attention is however lacking in such cases.

Possible Adaptations Options

Based on adaptation measures practiced by local community, the factors that constrain adaptation and the potential adaptation measures, we can propose a set of potential adaptation measures that could be helpful to deal with climate risks. The potential options include: crop diversification; improved on-farm water management; livelihood diversification; capacity building including collective action; and improved access to credit and market facilities.

Crop diversification could help to deal with both drought and flood risks. In the areas affected by frequent water stress, such as in the mid-hill communities, it could be better to cultivate more than one species of crop rather than mono-cropping. It could make the farming system resilient to total crop failure. Another option of crop diversification could be to cultivate perennial species rather than just focusing on seasonal crops.

Improved on-farm water management could help reduce long fallow period. In order to deal with water stress, farmers could practice mulching and similar measures so that the residual soil moisture can be utilized for next season crop cultivation. In addition, farmers could also adopt on-farm water harvesting option or use non-conventional irrigation techniques that require less amount of water.

Livelihood diversification could help to deal with the negative impacts of climate risks. In some study areas, it was noted that community people are completely displaced from their main occupation -- agriculture. It seems almost impossible for them to again rely on same option as the previous land has become uncultivable, whereas it is difficult to purchase or rent large parcel of land in new resettlement areas. Some of them are already relying on other diverse livelihood options such as seasonal migration. In such cases, the community people could start other small-scale off-farm income generation activities. Such activities could be done either individually or could be even more effective in groups.

The efforts on community capacity building and facilitating the collective action could be crucial for effectiveness of several community-level measures. In many instances, we can observe that local communities have started some measures but remained ineffective because of low level of knowledge and capacity of the people. Sensitization of local communities on the importance of collective action through capacity building trainings could help improve such situation.

One of the key factors that constrained adaptation was lack of investment capacity at different levels. Easy access to institutional credit facilities with low interest rate could encourage community people to invest on small-scale adaptation measures. At the same time, the individuals also could finance some measures such as migration or external input use if the credit is easily available. In addition, farmers could generate higher income through agriculture if their production is properly linked to the market.

Conclusions

Investigation at local level showed changes in agricultural patterns in the last 20 years. The major changes were the decline in total cultivated areas and shifts towards non-agricultural activities as major part of livelihood option. The result revealed overall decline in water availability for agricultural use in different parts of the basin. The change in water availability was perceived as mainly affected by climate change. The delayed onset of monsoon, increased post monsoon rainfall, and overall, the erratic rainfall pattern negatively affected water availability. The result revealed increasing number of drought and flood events in recent period. Drought was more severe in upland communities while flooding was main problem in the downstream basin.

Despite severe impacts on agriculture and livelihood options, the people have practiced only limited adaptation options. The adaptation efforts are constrained by several factors that include: financial, technical knowledge, lack of awareness about adaptation options, lack of collective action, unclear property rights, and ineffective role of state agencies. In order to improve the situation, the focus could be given on: crop diversification, improved on-farm water management, livelihood diversification, capacity building including collective action, and improved access to credit and market facilities.

References

- Adger, W. N., Arnell, N. W. & Tompkins, E. L. (2005). Successful adaptation to climate change across scales. *Global environmental change*, 15(2), 77-86.
- Agarwal, A., Babel, M. S. & Maskey, S. (2014). Analysis of future precipitation in the Koshi river basin, Nepal. *Journal of Hydrology*, 513, 422-434.
- Bastakoti, R. C., Gupta, J., Babel, M. S. & van Dijk, M. P. (2014). Climate risks and adaptation strategies in the Lower Mekong River basin. *Regional environmental change*, 14(1), 207-219.
- Bharati, L., Gurung, P. & Jayakody, P. (2012). Hydrologic characterization of the Koshi Basin and the impact of climate change. *Hydro Nepal: Journal of Water, Energy and Environment*, 11(1), 18-22.
- Bharati, L., Gurung, P., Jayakody, P., Smakhtin, V. & Bhattarai, U. (2014). The projected impact of climate change on water availability and development in the Koshi Basin, Nepal. *Mountain Research and Development*, 34(2), 118-130.
- Bhatt, D., Maskey, S., Babel, M. S., Uhlenbrook, S. & Prasad, K. C. (2014). Climate trends and impacts on crop production in the Koshi River basin of Nepal. *Regional Environmental Change*, 14(4), 1291-1301.
- Bradshaw, B., Dolan, H. & Smit, B. (2004). Farm-level adaptation to climatic variability and change: crop diversification in the Canadian prairies. *Climatic Change*, 67(1), 119-141.
- Chen, N. S., Hu, G. S., Deng, W., Khanal, N., Zhu, Y. H. & Han, D. (2013). On the water hazards in the trans-boundary Koshi River basin. *Natural Hazards and Earth System Sciences*, 13(3), 795-808.
- Dixit, A., Upadhyay, M., Dixit, K., Pokhrel, A. & Rai, D. R. (2009). Living with water stress in the hills of the Koshi Basin, Nepal. *Living with water stress in the hills of the Koshi Basin, Nepal*.
- Gosain, A. K., Rao, S. & Mani, A. (2011). *Hydrological modelling: a case study of the Koshi Himalayan basin using SWAT*. CABI Publishing. Wallingford.
- Holman, I. P. & Trawick, P. (2011). Developing adaptive capacity within groundwater abstraction management systems. *Journal of environmental management*, 92(6), 1542-1549.
- Jones, L. & Boyd, E. (2011). Exploring social barriers to adaptation: insights from Western Nepal. *Global Environmental Change*, 21(4), 1262-1274.
- Lebel, L., Sinh, B., Garden, P., Hien, B. V., Subsini, N., Tuan, L. A. & Vinh, N. T. P. (2009). Risk reduction or redistribution? Flood management in the Mekong region. *Asian Journal of Environment and Disaster Management*, 1(1), 23-39.
- Næss, L. O., Bang, G., Eriksen, S. & Vevatne, J. (2005). Institutional adaptation to climate change: flood responses at the municipal level in Norway. *Global Environmental Change*, 15(2), 125-138.
- Smit, B. & Wandel, J. (2006). Adaptation, adaptive capacity and vulnerability. *Global environmental change*, 16(3), 282-292.
- Wood, S. A., Jina, A. S., Jain, M., Kristjanson, P. & DeFries, R. S. (2014). Smallholder farmer cropping decisions related to climate variability across multiple regions. *Global Environmental Change*, 25, 163-172.

Challenges and Opportunities for Farmer Managed Irrigation Systems (FMIS) in Koshi Basin, Nepal

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Abstract

By management type, the farmer managed irrigation systems (FMIS) are owned, invested and managed by the farmers themselves. Such systems have 70 percent share in irrigation systems of Nepal. These systems ensure food security and rural livelihoods. They provide job opportunities in the rural areas and contribute towards poverty alleviation. They reflect local knowledge, local skill and technology. The Koshi Basin districts have also many farmer managed irrigation systems drawing water from different sources. They are now changed from what they used to be. The identification of the features of then and now provides a basis to rethink about research priorities, planning of irrigation development, investment and monitoring and evaluation of FMIS.

General Characteristics of FMIS

By management type of irrigation systems, FMIS has, by and large, been invested and managed by the farmers themselves. Hence, they are called FMIS. Previously, such systems are called village irrigation systems, or community irrigation systems or local irrigation systems or traditional irrigation systems. Since 1980s, these systems have been termed as FMIS by the criterion that the farmers manage these systems. These systems got recognition by government in the 1980s. Nepal has a rich tradition of community effort in natural resource management. They include water resources, forestry and pastures. State policies and practices have historically been conducive for the promotion of such community effort. FMIS are national heritage. They cover about 70 percent of irrigated agriculture of Nepal.

Role of Community in Promotion of FMIS

Wherever water resources are available in the hills and the Terai, people make effort to bring water through channels for cultivation. Looking at the history of irrigation developments in Nepal, one would come across three types of ownership of the systems: a) Rajkulo, under the supervision of the state and usually constructed by the kings of those days, b) Systems constructed by the Guthis (people's trust) or by the community of farmers like FMIS, and c) Lineage type of system constructed by individual or by a family and water right is reserved within the family. However, many of them are community or farmer managed systems. The systems are also different by terrain like hill irrigation system, river valley irrigation systems and the Terai or plain area irrigation systems (Pradhan, 1989, p. 9-16). The characteristics of these systems would be different in water acquisition, allocation, distribution, maintenance and management.

Importance of FMIS

These systems ensure food security and rural livelihood. They provide job opportunities and contribute towards poverty alleviation. They reflect local knowledge, local skill and local technology.

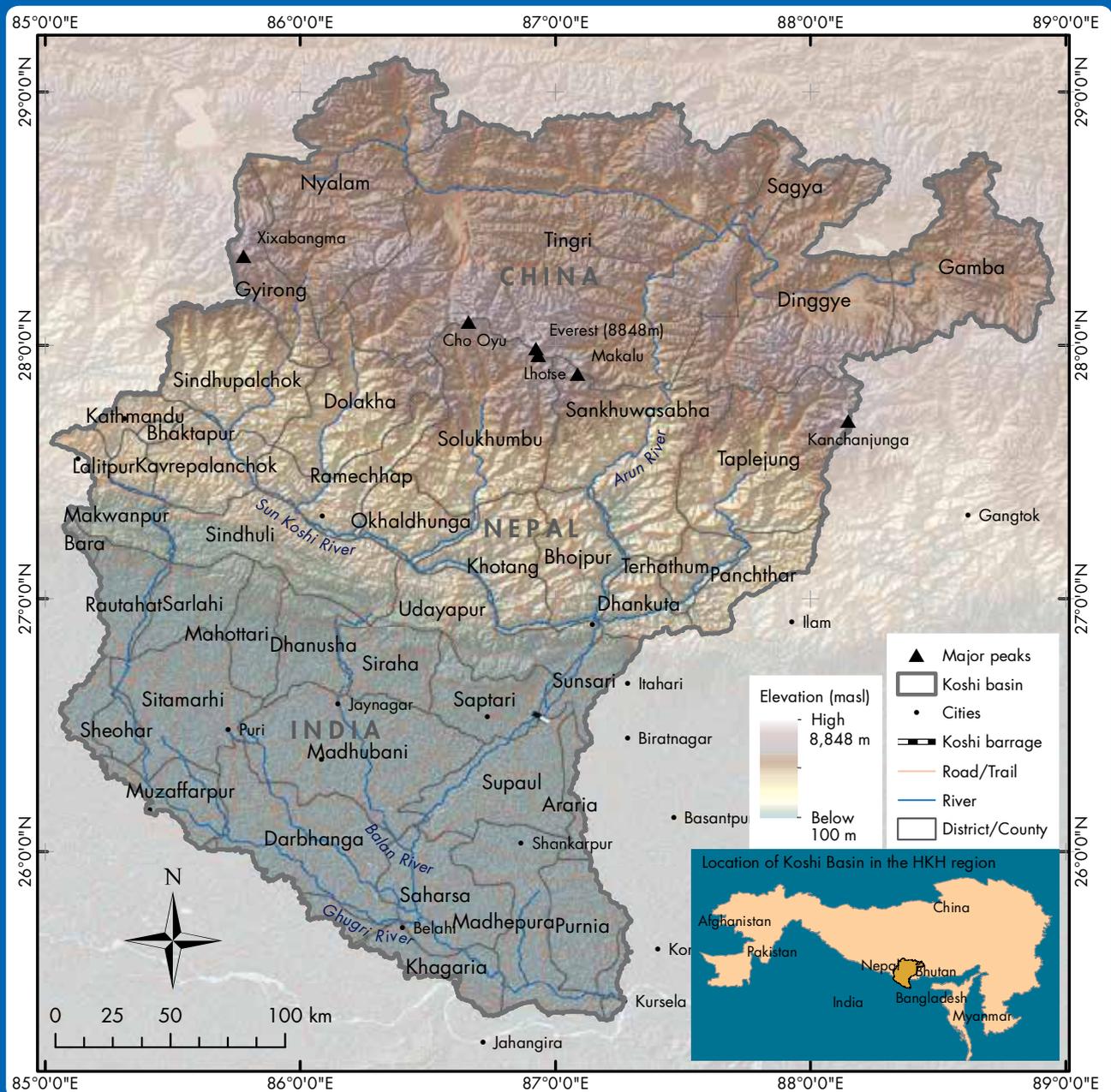
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FMIS in Koshi River Basin

Many farmer managed irrigation systems exist in these Koshi Basin districts. About 16 districts of Central and Eastern development regions fall in this basin (Figure 7). Indrawati sub-basin, a tributary of Koshi in Sindhupalchowk district (1986), within 200 m³, 119 systems were identified with 2100 ha (Ostrom et al., 2011.p.51). An inventory of irrigation systems in Dolakha and Okhaldhunga districts has reported to be 237 and 292 units of systems respectively (FMIST, 2001). Many changes have been taking place in the farmer managed irrigation systems in Nepal including in Koshi River basin districts (Pradhan, 2000).

Department of Irrigation (DoI) has partial record of WUA registration by the districts. They are only those systems, which have received assistance from the government for rehabilitation. There are many other systems, which are not

Figure 7: Koshi River Basin District Map



Source: <http://www.icimod.org/?q=21808> date: 9 Aug. 2016

yet recorded. One of the challenges that is being faced now is about the preparation of inventory of this important resource – FMIS systems. There has been effort by HELVETAS Swiss Intercooperation at ICIMOD to promote WUMP at the VDC and district levels. It is reported that information about use of water in irrigation systems is also collected but such information is not shared either with DoI or DoA. WUMP could be useful for decisions among these different organizations.

Assistance to these Systems

There was provision of assistance to these systems for a time if the community effort alone could not rebuild those damaged structures. Recently, government as well as donors recognized the contribution of FMIS in national economy, and started providing assistance for rehabilitation and strengthening to these systems. A number of donor-driven projects have provided assistance for rehabilitation of the FMIS in the Koshi Basin districts. They are SINKALAMA, Sector Irrigation Project I (SIP I), Second Sector Irrigation Project (SSIP), Community Managed Irrigated Agriculture Sector Project (CMIASP), CMIASP-AF, KHARDEP etc. World Bank and ADB had area demarcation for FMIS assistance (Khanal, 2015, p. 279-289). Hence, Asian Development Bank (ADB) looks after the assistance program of Central and Eastern Region districts of Nepal.

Water Sources of these Systems

The water sources of these systems are generally from the tributaries of Koshi River. Water scarcity in these tributaries has become a big challenge in water management in these systems (Dixit et al., 2009). The climate change has also impact on these irrigation systems in water availability, timing of rainfall, temperature change, change in cropping pattern and productivity. In eastern part of Nepal, FMIS diverting water from big rivers do not exist like in Rani, Jamara and Kulariya irrigation systems of Kailali and Rajapur of Bardiya drawing water from Karnali River in Western Nepal. Within the Koshi Basin, only a few systems have water source in Koshi River or in bigger tributaries like Sunsari-Morang Irrigation System (SMIS) and Chandra Nahar from Triguga River, tributary of Koshi or Koshi Pump Irrigation system in Saptari. In this process of constructing big systems, many FMIS from local rivers were merged into big systems.

Ground Water Utilization in Eastern Terai

In the Terai of Nepal, big community or individual ponds were constructed for multi-purpose including for irrigation (Sarrazin, 2015, p. 151-161). Shallow Tube Wells (STWs) and Deep Tube Wells (DTWs) were promoted in the 1970s by Agriculture Development Bank (Aubriot, 2015, p 327-334). Later on, IFAD and ADB also implemented groundwater project called Community Groundwater Irrigation Support Project (CGISP) in 12 Terai districts of eastern Nepal.

Challenges of FMIS

FMIS are no longer only institutional, physical and technical concerns. Climate change impact causing water scarcity has become one of the major concerns of FMIS sustainability.

The challenges of FMIS are focused more on: a) concerns on productivity of available resources, b) reducing poverty and insecurity, c) people's dignity and empowerment, d) farmers organization as social capital to be used for improvement, e) innovation of farmers for their livelihood improvement, and f) "politics" something to be dealt with.

Changes have come in FMIS then and now

Then	Now and future
Indigenous system Self-reliance Community focus Traditional management Peripheral	Changing system Globalization National and International Economics Management transfer Mainstream/ central
Subsistence orientation Labor allocation Community Focus Farmers less educated Climate variable Water relatively predictable Agriculture main focus	Commercial orientation Access to resources Labor scarcity and saving Efficiency Economics Farmers more educated Climate unreliable
Water as key factor Water as resource Water allocation and distribution Government - a distant phenomena Cannot depend on it	Livelihoods as focus All resources are critical Water as natural resource Water productivity increase per unit Government is weaker –willing to help Migration Change in role of women Impact of climate change Need to look at irrigation systems at sub-basin level or watershed level.

Future Direction

The identification of characteristics of then and now provides a basis to rethink about research priority, planning of irrigation development, investment and monitoring and evaluation of FMIS.

References

- Aubriot, O. (2015). *Small scale irrigation: The dynamics of water management, strategies to access water in Terai Farmer Managed Irrigation Systems*. In Pradhan, P., Gautam, U. & Joshi, N. (Eds.). *Small scale irrigation systems: Challenges to sustainable livelihood*. Kathmandu: FMIST.
- Dixit, A., Upadhya, M., Dixit, K., Pokhrel, A. & Rai, D. R. (2009). *Living with water stress in the hills of the Koshi Basin, Nepal*. *Living with water stress in the hills of the Koshi Basin, Nepal*.
- FMIST (2001). *Irrigation inventory of Dolakha and Okhaldhunga*. Kathmandu: FMIST.
- Khanal, A.B. (2015). *Review of major donor assisted projects in FMIS*. In Pradhan, P., Gautam, U. & Joshi, N. (Eds.). *Small scale irrigation systems: Challenges to sustainable livelihood*. Kathmandu: FMIST.
- Ostrom, E., Lam, W. F., Pradhan, P. & Shivakoti, G. (2011). *Improving irrigation in Asia: Sustainable performance of an innovative intervention in Nepal*. Edward Elgar Publishing, UK.
- Pradhan, P. (1989). *Patterns of irrigation organization in Nepal: A comparative study of 21 farmer-managed irrigation systems* (No. 1). IWMI.
- Pradhan, P. (2000, May). *Farmer managed irrigation systems in Nepal at the crossroad*. In *8th biennial conference of the International Association for the Study of Common Property*, in Bloomington, Indiana, USA.
- Sarrazin, C. (2015). *Role and place of irrigation ponds in a context of change: A case study of Sunsari and Saptari Districts the Eastern Terai, Nepal*. In Pradhan, P., Gautam, U. & Joshi, N. (Eds.). *Small scale irrigation systems: Challenges to sustainable livelihood*. Kathmandu: FMIST.

Empirical Livelihood Analysis and Its Potential for Regional Planning and Policy Advice

David Fleming⁴

Abstract

The quantitative analysis of livelihood strategies has gained important attention in the development literature. The main interest of researchers to apply such analysis is its capacity to capture different dimensions of household characteristics and vulnerability into a grouping system that allow identification of key factors that explain household choices and constraints. In this note, we construct over past quantitative analysis of livelihood strategies with the aim to design an approach that could be used for the analysis of data captured across Nepal in the 'Poverty and Vulnerability Analysis Tool' survey. Thus, we consider the limitations and potentials of such technique, and the data, to inform better poverty and planning policies across rural Nepal.

Introduction

A livelihood strategy (LS) can be defined as a set of activities and/or decisions that household members make to survive, grow and develop. These activities include productive activities, investment and coping strategies, reproductive choices, etc. (Ellis, 1998). Although in the development economics literature, the livelihoods approach has evolved without exemption from critics (van Dillen, 2002), it has been nonetheless used many times in developing country contexts to analyse vulnerability and advocate development policies and strategies for poverty alleviation (Ellis & Mdoe, 2003; Jansen et al., 2006; Ansoms & McKay, 2010).

Across different studies employing quantitative analysis of LS, one important consideration highlighted by researchers is that livelihoods analysis should use a diversity of indicators to assess sources of income and/or income-earning strategies, and that these sources should be considered from a combination of assets, activities and others (Barret et al., 2001). Thus, in some studies, a major emphasis is given to a conceptualization of household LS as managing portfolios of different types of assets (Ansom & McKay, 2010), while other focus more on activities and short-term decisions (Jansen et al., 2006). Is this late approach the one we use in this analysis, as households in developing countries many times have no ability in the medium term to change their asset portfolio, being in such way constrained by their asset endowments (including a household location)? This means that a household LS, from our point of view, is more likely to emerge as a set of decisions implemented, considering the household's bundle of available assets in the short to medium terms.

What an empirical LS approach allows is to group households into a number of categories that have in common the implementation of specific productive activities, which can be useful to policy makers as LS can enable them to better target households with certain common characteristics and in this way supporting a better use of public investment strategies and other planning and policy measures. A robust definition of LS can also help in directing technology transfer programs toward intended beneficiaries (Jansen et al., 2006).

Approach and Methodological Considerations

Following the approach used by Jansen et al. (2006), of the many different ways to design livelihood strategies, in this paper we proposed to design them based on the short to medium-term activities that households implement to survive, grow and develop. Thus, one key and relevant empirical step in such analysis is to consider what type of final variables (activities/decisions) need to be included to define LS in an empirically robust way. Once a set of variables is defined, principal component analysis can be used to obtain factors that can then be easily plugged into cluster analysis.

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To apply the empirical livelihood strategy approach in the context of rural Nepal, we used household data coming from the “Poverty Vulnerability Assessment Tool” (PVAT) survey, implemented by ICIMOD, and Nepal Development Research Institute (NDRI) in 2012 and 2013. The data consists of 6,142 observations (households) distributed across different regions of Nepal. To test the LS empirical approach, we initially analyse data for the whole country, without zoning or sub-sampling households in particular regions or river basins, such as the Koshi Basin.

Following our proposed approach, from the PVAT data, we selected variables that reflected short-term activities – decisions – that households made. As discussed, these need to reflect household decisions regarding productive and/or income generation activities. From the PVAT data set, we selected all variables that captured these type of activities and transformed them in order to make them useful for empirical analysis.* The list of final in the initial LS analysis, along their definition and sample average is shown in Table 3. To this set of 12 different variables, we applied principal component analysis, from which we derived principal components that were then used in a hierarchical clustering analysis.

The use of principal component analysis (PCA) allows the researcher to estimate principal component scores, which permit a data reduction process by capturing the information of a set of several variables into a reduced number of principal components that can then be used in cluster or similar analyses. This method of substitution also solves the problem of high correlations between the original variables (Hair et al., 1998), which may increase endogeneity in empirical analysis. Another option is to use factor analysis instead of PCA, which output (factors) in the presence of large data sets (such as the PVAT) should capture similar information than the principal components of PCA, although the latter is much easier to be mathematically performed and therefore less prone to errors.

The clustering analysis allows us to group data into different ‘clusters’, which in our case are given by groups of households pursuing similar productive activities – pursuing a particular ‘livelihood strategy’. In this initial case, we defined five different LS, given by the formation of five clusters that can be categorized based on their distinctive productive activities. In our case, the households were grouped in groups that we defined as: household engaging less in agriculture, household with high rate of self-employment, households with high rate of non-agricultural employment, households engaging in fishery activities and households with high rates of remittances (For more details, see Fleming, 2016).

As seen, from the empirical LS analysis the initial output to obtain is given by a subdivision of households into different categories, defined in this case by activities and decisions made by households in the short to medium terms. With the definition of LS established, the next analysis to be carried out is to identify whether household vulnerability vary across groups. Thus, if a particular group of households show higher levels of vulnerability than the rest, we can suspect that particular LS is not supporting poverty alleviation in the context analysed. Once LS are defined and their respective vulnerability or poverty incidence assessed, a third step involves the analysis of what influences the use of a particular LS by households. Thus, by employing probit econometric models or similar, the analysis of what determine a household to be in one of the LS groups can be implemented. The LS determinants

Table 3: Variables used in preliminary analysis

Variable name	Definition	Mean over total sample (n=6,142)
Diversity in staples production	Index, from 0 to 5	2.80
Diversity supplementary production	Index, from 0 to 5	2.50
Diversity in cash crops	Index, from 0 to 5	1.50
Fishery activity	Binary variable	0.04
Collection activity	Index from 0 to 5	1.95
Non-ag employment	Binary variable	0.48
Self-employment	Binary variable	0.37
Food dependant on own production	Binary variable	0.38
Remittances share of income	Percentage share	17
Household members involved in Ag production	Percentage share	47
Household share migrated	Percentage share	12
Stall feeding for cattle	Index, from 0 to 6	1.50

Source: own elaboration with data from PVAT survey

* All steps used to modify data and create variables, as well as for the implementation of principal and cluster analyses, are available from the author upon request.

analysis can provide insightful information for policy making by providing a better understanding of what factors affect the decision of a household to pursue a particular LS. These factors will be given by medium and long-term decisions as well as by other more 'external' factors such as location, geography and weather.

Conclusions

Although the concepts of livelihood strategies (LS) have gained important attention of researchers, it is an empirical analysis that requires feedback and consultation in order to produce robust and coherent results. In particular, the critical step on this sort of analysis is what type of initial information (variables) need to be included when designing an empirical approach to define LS. The workshop on "Water-livelihoods-gender nexus to advance Koshi Basin Management" was an important space where to discuss and receive feedback on this matter.

Following previous studies, in this research, we propose to create an empirical LS analysis based on principal and cluster analysis, using the PVAT data available from ICIMOD. Although in this short paper, we provide mainly a discussion of the methodological aspects of livelihoods analysis, the empirical approach discussed has proved to be useful in past literature as it can provide interesting information on how households pursue different LS. Thus, the outputs of the empirical LS approach show how households can be identified across different groups, which can provide important policy advice for the targeting of public investment. In addition, the analysis of the determinant of LS can also provide important information for regional planning, and policy by highlighting the main factors driving the use of particular LS by households. Thus, by using a quantitative livelihoods strategy analysis, data from household surveys can be analysed in such a way that allow researchers to identify groups of households with particular characteristics that later can be targeted with particular policies. In this way, if for instance, the LS analysis determines that a particular group of households pursuing a particular livelihood strategy is more prone to vulnerability risks than other groups of households (the other livelihood strategies), then policy interventions can be planned in order to foment the more vulnerable household to move from their current livelihood strategy to one that could allow them to reduce their vulnerability risk.

References

- Ansoms, A. & McKay, A. (2010). A quantitative analysis of poverty and livelihood profiles: The case of rural Rwanda. *Food Policy*, 35(6), 584-598.
- Barrett, C. B., Reardon, T. & Webb, P. (2001). Nonfarm income diversification and household livelihood strategies in rural Africa: concepts, dynamics, and policy implications. *Food policy*, 26(4), 315-331.
- Ellis, F. (1998). Household strategies and rural livelihood diversification. *The journal of development studies*, 35(1), 1-38.
- Ellis, F. & Mdoe, N. (2003). Livelihoods and rural poverty reduction in Tanzania. *World Development*, 31(8), 1367-1384.
- Fleming, D. (2016). Empirical livelihood analysis and its potential for regional planning and policy advice. Power-point presented at the Water-livelihoods-gender nexus to advance Koshi Basin Management.
- Hair, J.F., Anderson, R. E., Tatham, R. L. & Black, W.C. (1998). *Multivariate data analysis*. Prentice Hall.
- Jansen, H. G., Pender, J., Damon, A., Wielemaker, W. & Schipper, R. (2006). Policies for sustainable development in the hillside areas of Honduras: a quantitative livelihoods approach. *Agricultural economics*, 34(2), 141-153.
- Van Dillen, S. (2002). Book review: Rural livelihoods and diversity in developing countries. *Journal of Development Economics*, 70(1), 248-252.

Adaptation Against Rural Household Vulnerability in the Up Reaches of Koshi River

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Abstract

Households are the basic units of production and consumption in rural communities. Analyzing vulnerability at the household level can help in identifying the threats that households face and potential coping and adaptation approaches, especially in view of the increasing vulnerability to the impacts of climate change. We developed a household-based model for assessing rural household vulnerability in Shigatse Prefecture in Tibet Autonomous Region of China using time series survey data. The assessment took four main aspects of vulnerability into account: the subsistence condition (food supply), development condition (education and income), accessibility of water resources (variability in rainfall), and threat of water disaster (area affected by drought and floods). Rural household vulnerability decreased overall between 1986 and 2012 but with considerable fluctuation over time. Up to 2000, the main drivers of vulnerability were knowledge (basic education), access to sufficient food, and reliable access to water, in that order. After the early 2000s, knowledge (basic education) is also the most important driver, followed by cash income, and again reliable access to water. The increase in importance of education and income is linked to the transformation of focus of rural households from subsistence to sustainable development. The impact of variability in water resources appears to be becoming more important as a result of climate change. The most effective strategies for reducing rural household vulnerability and improving adaptive capacity to climate change are likely to be accelerating the development of education in rural areas, promoting an incremental increase in the income of farmers and herdsmen, constructing rural irrigation infrastructure, and establishing agricultural disaster prevention and mitigation systems.

Background Information

Vulnerability is a concept that is applied in various disciplines, including engineering, ecology, economics, psychology and sociology. It is mostly used to indicate the potential for human response and adaptation to environmental, social, and economic changes (Angeon & Bates, 2015; Wilson, 2012; Yoo, Hwang & Choi, 2011; Adger, 2006; Gallopin, 2006). However, the ordinary use of the term vulnerability is the capacity and degree to be wounded of a system owing to exposure to a hazard (Turner II et al., 2003). As Adger (2006) has pointed out, the exposure, sensitivity, and adaptive capacity are three critical elements of vulnerability. In fact, this concept of vulnerability provides a powerful analytical tool for describing states of human susceptibility to harm, hazard fragility, capacity for adaptation in different systems and has attracted wide attention from government, decision-makers, and practitioners (Bardsley & Wiseman, 2012; Vogel, Moser, Kasperson & Dabelko, 2007).

There is an increasing consensus that climate change, economic development, and human wellbeing are inextricably linked (McMichael, Butler, & Dixon, 2015; Hitz & Smith, 2004). Objectives for adaptation to some significant impacts of climate change have been framed at various national and regional levels, and even at community, household, and individual scales. Thus measuring and assessing vulnerability has become a growing field of research (El-Zein & Tonmoy, 2015; Binita, Shepherd & Gaither, 2015; Lardy, Bellocchi & Martin, 2015; Hameed, Holzer, Doerr, Baty & Schwartz, 2013; Bardsley & Wiseman, 2012; Füssel, 2007; Metzge, Leemans & Schröter, 2005; Downing & Patwardhan, 2004).

Most economic and social activities are carried out at the household level. Rural households as basic units of production and consumption are highly exposed to climate change because farming and livestock breeding activities directly depend on climatic conditions. Analyzing the vulnerability of rural households can help in

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identifying the threats they may face and potential coping approaches (Moser, 1998, 2007). It can also deepen our overall understanding of who is susceptible to environmental stresses and hazards and why, especially in view of the increasing vulnerability to the impacts of climate change.

Method

We developed a household-based model for assessing rural household vulnerability in Shigatze Prefecture in Tibet Autonomous Region of China (the up reaches of Koshi River, Figure 8) using time series survey data. The farmers and herdsmen of the Qinghai-Tibetan Plateau are particularly vulnerable because of the extreme elevation, harsh climatic conditions, and high dependence on natural resources. They have a limited capacity to cope with climate variability and extreme events, and even relatively small changes may lead to greatly increased pressures on agriculture and livestock production. The assessment took four main aspects of vulnerability into account: the subsistence condition (food supply), development condition (education and income), accessibility of water resources (variability in rainfall), and threat of water disaster (area affected by drought and floods). Overall rural household vulnerability was quantified using 10 key indices as shown in Table 4.

We use the equal weight accumulation method to acquire the composite index. The composite vulnerability can be written Equation 1:

$$CVI = \Sigma(FV + KV + CSV + WV + WHV) \quad (1)$$

Where CVI is the index of composite vulnerability, FV is the index of food vulnerability, KV represents the index of knowledge vulnerability, CSV is the index of cash vulnerability, WV is the index of water vulnerability, (Figure 8) and WHV represents the index of water hazards vulnerability.

Figure 8: Map of the study area

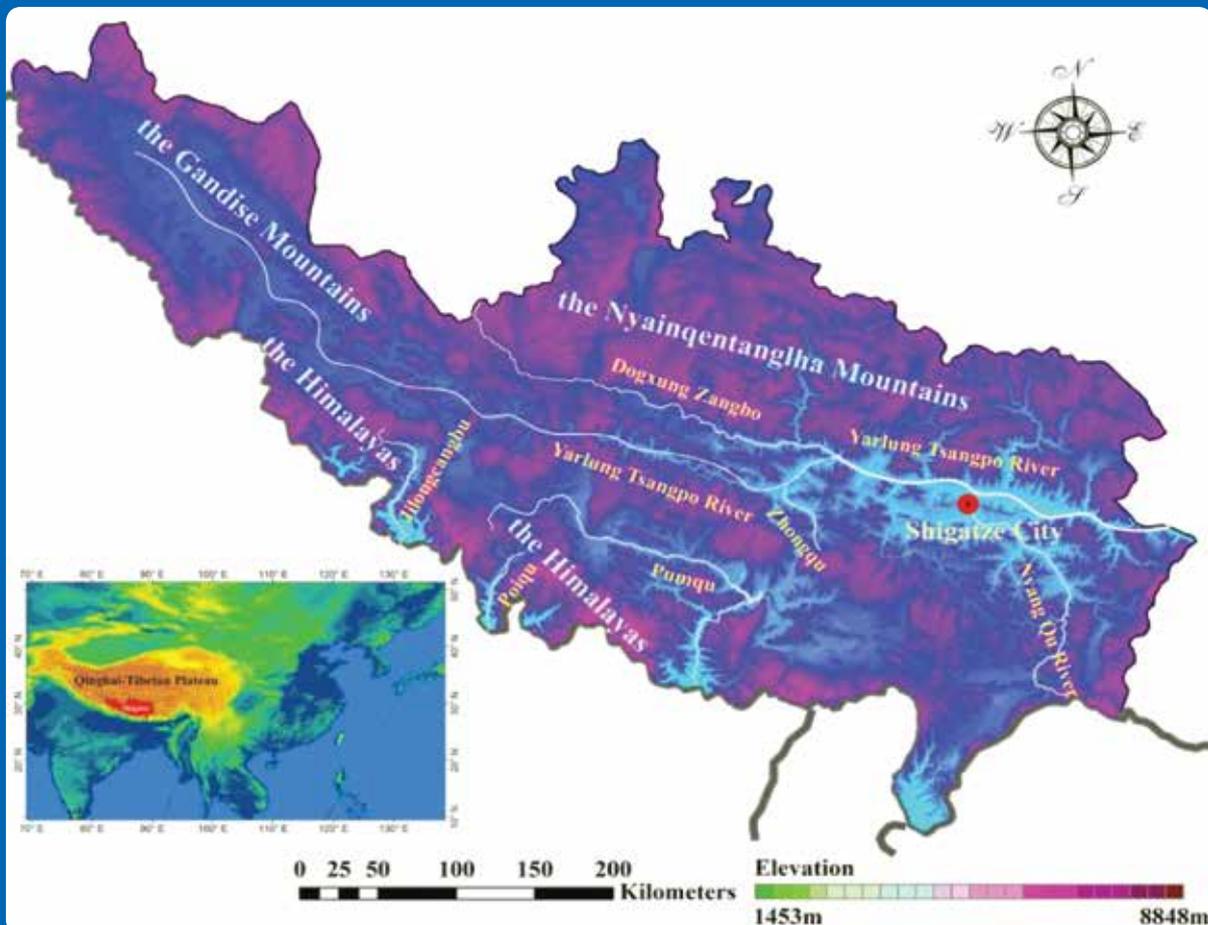


Table 4: Indicators and measures of rural household vulnerability

Objective	First-level indicators	Second-level indicators	Measures
Subsistence condition	Food vulnerability	Grain production per capita (kg/person)	The coefficient of variation is defined as the ratio of the standard deviation to the mean. The coefficient of variation was used to describe the food variability in relation to the mean of the population.
		Meat production per capita (kg/person)	
		Dairy products per capita (kg/person)	
Development condition	Knowledge vulnerability	Per capita education expenditure (yuan ^a /person)	The dimensionless indices of per capita education expenditure $(x_{\max} - x_i) / (x_{\max} - x_{\min})$ and illiteracy rate $(x_i - x_{\min}) / (x_{\max} - x_{\min})$ were used to describe the educational level of rural households.
		Illiteracy rate of labor force (%)	
	Cash vulnerability	Per capita cash income (yuan ^a /person)	The difference between the per capita cash expenditure and per capita cash income was used to show the deficit level of rural households.
		Per capita cash expenditure (yuan ^a /person)	
Water accessibility	Water vulnerability	Precipitation variability during growing season of grassland and crops (%)	The coefficient of variation is defined as the ratio of the standard deviation to the mean. The coefficient of variation was used to describe the variability in precipitation during the growing season of grassland and crops.
Water hazards	Water hazards vulnerability	Drought area (hm ²)	The dimensionless indices of drought area and flood area $((x_i - x_{\min}) / (x_{\max} - x_{\min}))$ were used to describe the likelihood of natural hazards occurring.
		Flood area (hm ²)	

^a 1 yuan (CNY) = USD 0.1584 in 2012

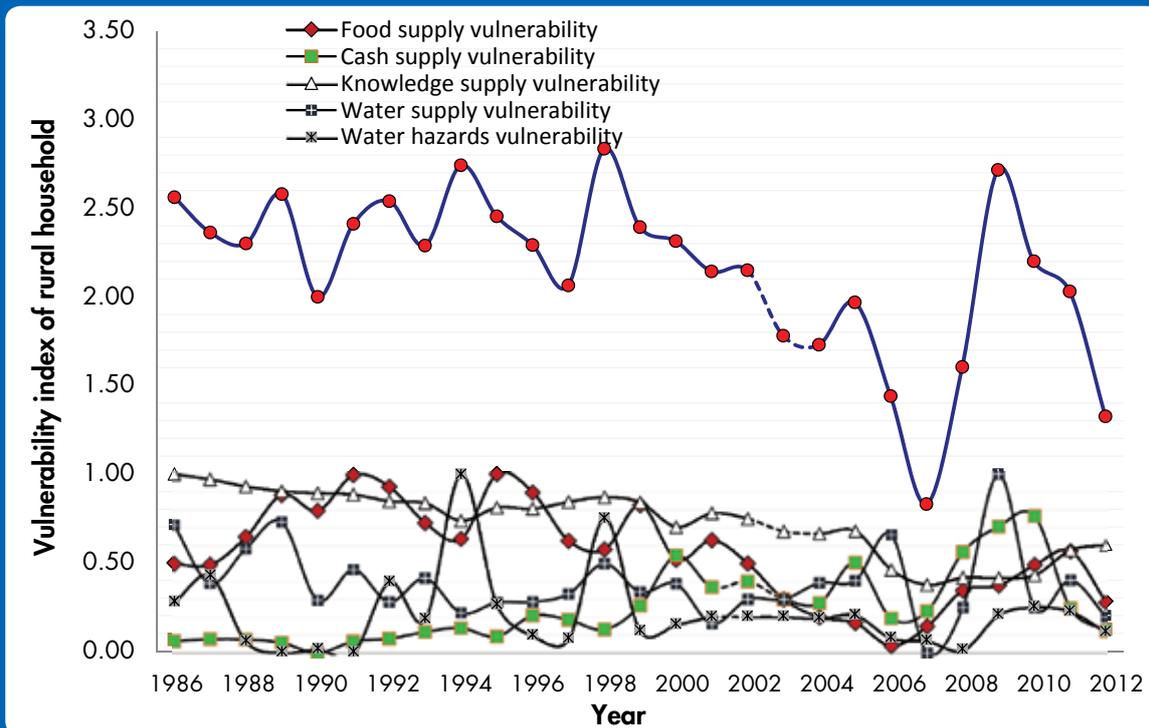
Findings

The results show that rural household vulnerability decreased overall between 1986 and 2012 but with considerable fluctuation over time (Figure 9). Up to 2000, the main drivers of vulnerability were knowledge (basic education), access to sufficient food, and reliable access to water, in that order. After the early 2000s, knowledge (basic education) is also the most important driver, followed by cash income, and again reliable access to water.

The increase in importance of education and income is linked to the transformation of focus of rural households from subsistence to sustainable development. The Chinese Government has committed itself to markedly raising educational levels in ethnic minority areas, and has issued a series of policies and reform measures. The education level of ethnic minorities is consistently increasing. However, the quality of education in rural areas is still significantly lower than in urban areas as a result of both the educational infrastructure and the level of qualification of staff. It is necessary to extend compulsory education from nine years at present to 12 years. Over the past 50 years, the central and TAR governments have issued several policies aimed at increasing the income of farmers and herdsmen. These initiatives are increasing the benefits from agriculture. However, the difference in income between rural (agricultural) and urban households remains large. Suggested activities include developing agriculture and livestock breeding base; diversifying off-farm opportunities through skill training; use of high-value cash crops and agricultural tourism to generate cash income for farmers and herdsmen; accelerating the development of specialized cooperative organizations; and enhancing service organizations for farmers and herdsmen.

The impact of variability in water resources appears to be becoming more important because of climate change. The government of TAR has set ambitious targets to provide access to safe drinking water and basic sanitation facilities to 100 percent of farmers and herdsmen by 2015. Many projects played an important role in improving access to water for household and agricultural use, and improving sanitation and reducing the spread of epidemics, but progress in urban and rural areas is uneven. The irrigation infrastructure is still very weak in some rural areas and multi-scale combined investment is needed. The best chances of success appear to be offered by accelerating the construction of control projects to ensure reasonable allocation and efficient use of runoff water resources in the key agriculture and livestock breeding areas; developing small reservoirs and ponds to enhance water storage

Figure 9: Rural household vulnerability and change in Shigatze Prefecture[#]



[#] The data were taken from two surveys of rural households carried out by the Shigatze Statistics Bureau in 1986-2001 (120 rural households investigated annually) and 2004-2012 (390 rural households investigated annually).

capacity in the rainy season for farmers and herdsmen; repairing and renovating motor-pumped wells, pump stations, and irrigation facilities for farmers and herdsmen; and improving water infrastructure in pasture areas.

In recent years, increasing attention has been paid to disaster prevention. However, climate change has increased the frequency of weather extremes and, in some regions, led to serious damage in agriculture. The harsh environmental conditions on the Qinghai-Tibetan Plateau reflect the reality of the vulnerability of agriculture, especially grassland-based animal husbandry. Suggested activities include strengthening emergency management capacity; enhancing information connectivity and traffic accessibility; improving accessibility to pre-disaster forecasts; developing better horizontal and vertical co-ordination and linkages among different levels of disaster management.

Conclusions

The evaluation of vulnerability is complicated by the fact that household approaches can be very different. However, the assessment system of rural household vulnerability based on food, education, income, water resources, and water disasters reflects the close relationship between the basic requirements of rural households in the harsh plateau environment, less developed regions and vulnerability. Up to 2001, the main drivers of rural household vulnerability in Shigatze Prefecture were basic education, access to sufficient food, and reliable access to water. After 2004, the main drivers became education, cash income, and reliable access to water, reflecting some significant structural changes. Variability in water resources appears to be becoming more important in the light of climate change, while the transformation of focus of rural households from subsistence to development means that education and income are gaining importance. The most effective strategies for reducing rural household vulnerability and improving adaptive capacity to climate change are likely to be accelerating the development of education in rural areas, promoting an incremental increase in the income of farmers and herdsmen, constructing rural irrigation infrastructure, and establishing agricultural disaster prevention and mitigation systems in the context of climate change.

References

- Adger, W. N. (2006). Vulnerability. *Global environmental change*, 16(3), 268-281.
- Angeon, V. & Bates, S. (2015). Reviewing composite vulnerability and resilience indexes: a sustainable approach and application. *World Development*, 72, 140-162.
- Bardsley, D. K. & Wiseman, N. D. (2012). Climate change vulnerability and social development for remote indigenous communities of South Australia. *Global Environmental Change*, 22(3), 713-723.
- Downing, T. E., Patwardhan, A. (2004). Assessing vulnerability for climate adaptation. In Lim, B., Spanger-Siegfried, E. (Eds.) *Adaptation policy frameworks for climate change: Developing strategies, policies, and measures*. Cambridge University Press, Cambridge (Chapter 3).
- El-Zein, A. & Tonmoy, F. N. (2015). Assessment of vulnerability to climate change using a multi-criteria outranking approach with application to heat stress in Sydney. *Ecological Indicators*, 48, 207-217.
- Füssel, H. M. (2007). Vulnerability: a generally applicable conceptual framework for climate change research. *Global environmental change*, 17(2), 155-167.
- Gallopin, G. C. (2006). Linkages between vulnerability, resilience, and adaptive capacity. *Global environmental change*, 16(3), 293-303.
- Hameed, S. O., Holzer, K. A., Doerr, A. N., Baty, J. H. & Schwartz, M. W. (2013). The value of a multi-faceted climate change vulnerability assessment to managing protected lands: Lessons from a case study in Point Reyes National Seashore. *Journal of environmental management*, 121, 37-47.
- Hitz, S. & Smith, J. (2004). Estimating global impacts from climate change. *Global Environmental Change*, 14(3), 201-218.
- Binita, K. C., Shepherd, J. M. & Gaither, C. J. (2015). Climate change vulnerability assessment in Georgia. *Applied Geography*, 62, 62-74.
- Lardy, R., Bellocchi, G. & Martin, R. (2015). Vuln-Indices: Software to assess vulnerability to climate change. *Computers and Electronics in Agriculture*, 114, 53-57.
- McMichael, A. J., Butler, C. D. & Dixon, J. (2015). Climate change, food systems and population health risks in their eco-social context. *Public health*, 129(10), 1361-1368.
- Metzger, M. J., Leemans, R. & Schröter, D. (2005). A multidisciplinary multi-scale framework for assessing vulnerabilities to global change. *International Journal of Applied Earth Observation and Geo-information*, 7(4), 253-267.
- Moser, C. O. (Ed.). (2008). *Reducing global poverty: The case for asset accumulation*. Brookings Institution Press.
- Turner, B. L., Kasperson, R. E., Matson, P. A., McCarthy, J. J., Corell, R. W., Christensen, L., ... & Polsky, C. (2003). *A framework for vulnerability analysis in sustainability science*. Proceedings of the national academy of sciences, 100(14), 8074-8079.
- Vogel, C., Moser, S. C., Kasperson, R. E. & Dabelko, G. D. (2007). Linking vulnerability, adaptation, and resilience science to practice: Pathways, players, and partnerships. *Global environmental change*, 17(3), 349-364.
- Wilson, G. (2012). *Community resilience and environmental transitions*. Routledge.
- Yoo, G. Y., Hwang, J. H., Choi, C. (2011). Development and application of a methodology for vulnerability assessment of climate change in coastal cities. *Ocean & Coastal Management* 54(7): 524–534.



Chapter 4
Plenary Session II
Gender and Water
Resources Management

Gender and Water Resources Management

- Chair** – Prachanda Pradhan, FMIST, Nepal
- Moderator** – Manohara Khadka, Swiss Agency for Development Cooperation
- Presenters**
- Tira Foran, CSIRO, Australia
 - Srijana Shrestha HELVETAS, Swiss Intercooperation
 - Neeta Thapa, independent consultant
 - Binod Sharma, NWCF, Nepal

Key Messages

- Argument-Representation-Implementation (ARI) framework can be useful for improving policy formulation and implementation.
- Water use master plans (WUMP) for promoting gender equity and social inclusion can be scaled out by the Government of Nepal.
- Socioeconomic and practical changes brought by WUMP to local communities are well documented. Training on gender aspects of water management and hydrology should be provided to enhance the roles of women.
- Reviving springs and rehabilitating recharge ponds are key for managing water supply, and it is important to study local water resource use. The institutional process for water use planning needs further study.

Summary of Presentations

Tira Foran presented on improving policy advice that emanates from livelihoods research. Policy advice in Eastern Gangetic Plain (EGP) is still abstract, he said. Foran highlighted the importance of policy recommendations and how they can be effective. He chose three studies conducted in the EGP that used the Argument-Representation-Implementation (ARI) framework and described how ARI can support effective policy making. Foran was asked how best to implement ARI and who has that responsibility. In response, Foran said that though ARI framework is at very early stage, framework will be very useful to explain policy process by answering what to incorporate, how to incorporate and how to implement the policy in the ground. Researchers, policy makers and implementers can equally be benefitted from the ARI framework.

Srijana Shrestha discussed gender equality and social inclusion issues at the institutional level while Neeta Thapa described how water use master plans (WUMP) had changed between 1998 and 2014. The presenters explained that issues of gender equality and social inclusion can be incorporated during WUMP planning and implementation. Thapa said, even with the progress, there is a big room for improvement in WUMP execution. In remote Bajhang district in far west Nepal, the drinking water situation was very poor, and women walked long distances to fetch drinking water. After WUMP was implemented, the situation of drinking water and sanitation has greatly improved and reduced women's work burdens.

Binod Sharma presented on the effectiveness of recharge ponds to protect drying springs. He shared findings of their research from 2013 in Darauni Pokhari of Kavre district through action research by an NWCF in partnership with ICIMOD KBP.

Session chair, Prachanda Pradhan, remarked that the ARI framework was very important to make a successful jump from policy making to implementation. He remarked that gender equity and social inclusion were being successfully promoted through the WUMP initiative. Besides tremendous efforts for gender mainstreaming, only 10 percent and five percent of women in the hill and the Terai have landownership right. Hence, large number of women are still deprived of land ownership both in the hills and the Terai which needs a serious attention of the policy makers.

Prachanda said that WUMP has brought tremendous change in the community and to social relationships, which has positive policy implications.

He concluded that water harvesting is an important aspect and there was a need for more research about water availability and demand.



Argument-Representation-Implementation: Improving the Policy Advice that Comes from Livelihoods Research

Tira Foran⁸, Kuntala Lahiri-Dutt⁹, Fraser Sugden¹⁰, Nilhari Neupane¹¹

Abstract

Development research often struggles to provide sound and implementable advice. This problem stems partly from complexity and contestation over the issues of representation and values, and partly from insufficient attention to challenges of policy implementation. We present a systematic tool to improve the specificity of such advice. The Argument-Representation-Implementation (ARI) framework joins political discourse analysis with Ostrom's institutional analysis and design framework. The framework was applied to analyse and refine the advice emerging from three recent empirical studies in the transboundary Koshi river basin, focusing constraints and opportunities facing rural women. The analysis reveals relatively abstract policy advice, despite cogent issue representation converging on exploitative gender, class, and caste relations. We argue that the ARI framework can help deliver robust, specific and salient advice to advance a socially inclusive, climate-resilient development agenda.

Introduction

This paper engages with the problem of abstract policy advice, which is contained in much development research. We offer a tool that may help improve specificity of policy advice, the "Argument-Representation-Implementation" (ARI) framework. We demonstrate the framework in a comparative analysis of three important studies. The studies focus on gendered vulnerability to change, in Nepal Koshi Basin and Eastern Gangetic Plains (EGP).

A notable aspect of social change in South Asia consists of male outmigration from rural Nepal, Bihar, and other less favoured states of India. This transition is important for its implications in multiple dimensions, ranging from gender relations, nutrition and health, and agricultural productivity. In the Gangetic Plains, a region which ranks high at the global level for its concentration of poverty (Erenstein et al., 2010, Rodgers et al., 2013), such changes are crucial to understand from a gendered perspective. Based on empirical studies in the eastern Gangetic Plains, a literature on gendered vulnerability to global change and its multiple stressors exists (Khadka et al., 2014; Lahiri-Dutt, 2014; Sugden et al., 2014; Bhattarai et al., 2015; Sunam & McCarthy, 2016).

This literature has contributed to an emerging policy agenda which advocates for inclusive, engendered, climate resilient development. This rural development agenda is "intersectional" in the sense that it calls for action to address deprivation and injustice caused by the intersections of multiple social processes. Key intersecting mechanisms include class-based processes (resulting in vertical inequality) and gendered processes (considered a fundamental and pervasive cause of horizontal inequality) (Kabeer, 2015). In the EGP, additional "horizontal" processes include exposure to flooding, water logging and climate change (Sugden et al., 2014).

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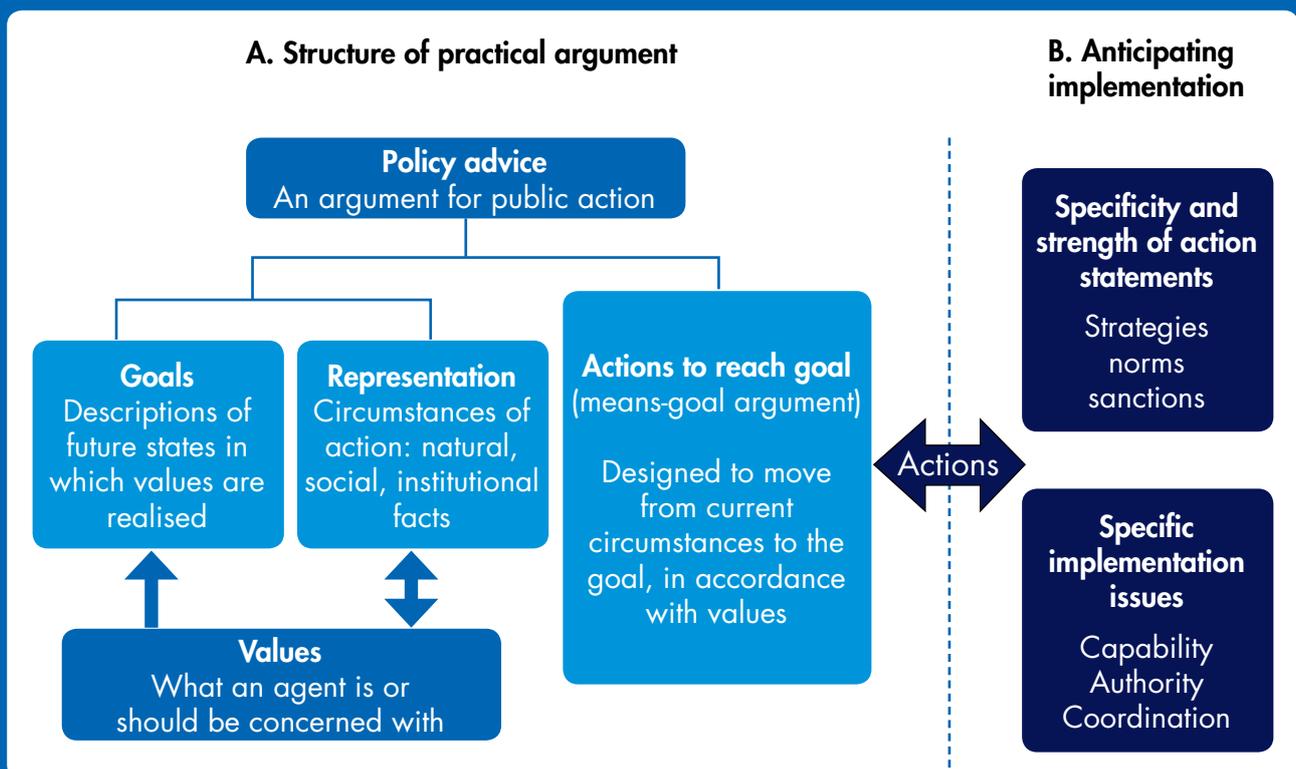
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With notable exceptions, the intersectional development literature has had only modest impact on development activity on the ground in South Asia. The relative lack of policy response could be attributed to a range of factors, beginning with the relative novelty of this literature, the thinness of research for development capacity in Bihar (Rodgers et al., 2013: 2017), and the lack of power of social change advocates (Bennett, 2008: 197). In Nepal, as a result of democratization, societal demands expanded in the 2000s, however a lack of institutional and bureaucratic capacity exists to process those demands (Bennett, 2008: Table 8.1).

Informal institutions perpetuate gender-based and caste-based discriminations, and elite resistance to the radical changes -- which have been promulgated -- can be detected (Bennett, 2008). Thus, the intersectional development agenda, which calls for inclusive, engendered, and climate resilient development, faces resistance, which is both structural and cognitive.

This paper focusses on cognitive sources of resistance. We show how the intersectional development agenda can be analysed as a policy argument – that is, a claim for public action – and deploy a novel conceptual framework, which is designed to improve the soundness of policy argument. The framework, which we call “argument-representation-implementation” (ARI) is designed to improve understanding of development analysts to how arguments for policy intervention are constructed (Foran et al., 2015, Nelson et al., In prep.). The ARI framework (Figure 10) allows essential components of a sound policy argument to be identified and refined through deliberation, both by specialists and by a wider set of stakeholders.

Figure 10: Argument-representation-implementation framework



Source: Adapted from Foran et al. (2015).

Framework and Methods

Argument

According to Fairclough and Fairclough(2012), practical arguments consist of four components: (1) values, which are statements about what matters (or should matter) to an actor; (2) circumstances, that is representations of the problem or issue; (3) goals, which are descriptions of desired future states, in which values are realized; and (4) means-to-goal arguments, i.e. actions designed to move the situation from current circumstances to the goal, in accordance with the actor's values.

Considering these components explicitly allows different claims for action to be compared and debated, for example, in terms of the different values or circumstantial representations upon which they are based, or the different formulation of goal statements. It also allows sequences of actions (that is, means-goal arguments) to be further studied. The institutional grammar literature (Crawford & Ostrom, 1995, Basurto et al., 2010) offers additional concepts to describe the specificity of policy argument. Based on this literature, we define a "strategy" as combinations of goals, substantive actions, agents (i.e. responsible actors), and references to policy processes (e.g. participatory processes) or instruments (e.g. subsidy, tax, regulation). In addition, concepts of "norms" and "rules" in Crawford and Ostrom (1995) allow the analyst to describe the prescriptive strength of a discourse: norms refer to normative language that may be in policy discourse, such as an actor "should," or "must" perform a certain action. Rules here refer to sanctions that apply if an action is not performed (i.e. language such as "or else").

Representation

Representation, the next concept in the ARI framework, directs analysts to focus on how discourse frames or narrates issues. For example, what aspects of the political economy of rural livelihoods in South Asia are defined as problems, and for which of these aspects is policy advice being offered? This concept extends the sub-component of argument referred to as "circumstances" or "context" by Fairclough and Fairclough (2012). Circumstances include knowledge-based propositions (i.e. epistemic arguments) of natural, social or institutional "facts." We prefer the word "representation" to emphasize the crucial importance of the social construction of meaning. Representation directs attention to identifying which particular issues are represented (i.e., framed or narrated) as problems of development, and implies that comparative analysis between different representations of complex problems is important (Foran et al., 2014). Thus, in contrast to Fairclough and Fairclough (2012), we elevate representation as a concept, whose analysis requires ongoing reflection on how knowledge is produced, rather than treat it as merely a sub-component of political discourse or practical argument.

From any non-positivist tradition of explanation, values influence representations (Fairclough & Fairclough, 2012: 47). For example, the mainstream development community attaches positive value to market-oriented food supply chains. Based on this set of values, net-deficit smallholder production is represented as problematic. The problem could be further represented as one of institutional or structural reforms, e.g., cooperatively re-designing food supply chains so as to improve returns to poor farmers, or how to provide non-agricultural employment options so that non-competitive smallholders can exit. By contrast, an alternative, critical agrarian studies community attaches value to equity and smallholder sovereignty. Based on this set of values, capitalist agricultural development is represented as productive but necessarily socially divisive (Akram-Lodhi, 2013). Representations invoke concepts such as capitalistic exploitation, or dispossession of smallholder farmers, when the entry of some farmers into capitalist market relations causes socio-economic differentiation and displacement for others (Foran et al., 2014).

The above examples illustrate why we would expect plural representations of a development situation, linked to multiple values. Representation can therefore be analysed against the topics of one – or more than one – substantive theoretical framework. Using more than one theoretical framework directs the analyst towards interdisciplinary and synthetic explanation. In this paper, as a step towards such analysis, we use the sustainable livelihoods framework (Ellis, 2000) as a heuristic framework to analyse issue representation in the three gendered vulnerability studies.

Implementation

Implementation refers to statements describing relations required among agents (responsible actors) as well as between agents and beneficiaries, in order to translate higher-level means-goal arguments into specific, administratively-effective action. It is the third component in the ARI framework because from the perspective of “rational” policy formulation, questions of implementation should follow a deliberative exploration of values, representations, goals, and higher-level means-goal argument. In the terminology of Fairclough and Fairclough, it is the finest level of means-goal argument. Implementation covers issues such as coordination, capability, financial resources, and use of information and knowledge, and structural issues of authority and responsibility. Conceptual frameworks relevant to implementation include the Institutional Analysis and Design framework (Ostrom, 2007). The IAD framework includes several types of “rules” that define an action situation. For example, position and aggregation rules define the positions held by participants, and the hierarchies within which these positions operate. Development discourse that anticipates implementation will need to refer to these kinds of topics, although the specificity of coverage will vary depending on the aim of the discourse.

Studies analysed

Our selection criteria for literature to be analysed using the ARI framework consisted of recently published, independently designed studies, with findings based on quantitative and gendered livelihoods data. We selected studies commissioned by International Centre for Integrated Mountain Development (ICIMOD), International Water Management Institute (IWMI), and Australian Council for International Agricultural Research for review (Khadka et al., 2014, Lahiri-Dutt, 2014, Sugden et al., 2014).

Policy Advice in Three Studies

Issue representations

Overall, the three studies offer compatible and complementary issue definitions. Khadka et al. (2014) describe Koshi as a river basin with complex social (caste) and physical stratification. Based on a multidimensional poverty index (Gerlitz et al., 2014), they find that people in the plains (Terai) are generally more deprived than hill or mountain groups, and that lower caste people and Muslims are more deprived than higher caste people. Approximately 50% of deprivation comes from lack of access to electricity, improved drinking water, and improved sanitation (Khadka et al., 2014: Figure 2). One of the objectives of the Khadka et al. (2014) study was to review Nepal’s climate change adaptation policies. The authors find that Nepal’s National Adaptation Programme of Action lacks specific strategies to include women, or ensure that women benefit, from areas prioritized for adaptation (such as agriculture and food security). Nepal’s national climate change policy states that women, the poor, and marginalized groups need to participate in implementing relevant programs, but the authors found no clear mechanisms in the policy to benefit marginalized groups (2014: 16-17).

In her study of woman-headed households (WHH), Lahiri-Dutt (2014) attributes the feminization of agriculture to a combination of globalization and environmental change, resulting in livelihood diversification and male outmigration. Labour shortages impact all women-headed households. A woman’s household chores limit the time available for agricultural production, resulting in some cases in unattended children, or children pressed into agricultural or domestic work and unable to attend school (Lahiri-Dutt, 2014: 23, 29). Landless WHH (or those with marginal access to land) are most severely impacted by shortages of human capital: on the one hand, they are unable to rent out land, and on the other hand, they may lack sufficient labour to enter into a tenancy or sharecropping arrangement with a landowner (Sunam & McCarthy, 2015). Lahiri-Dutt emphasizes the fact that time constraints on land-poor WHH lead to a lack of capacity to diversify livelihoods (2014: 7, 55), a point echoed by Sugden et al. (2014).

Informed by a critical political economy perspective, Sugden et al. (2014) emphasize the importance of class and caste in conditioning vulnerability to climate change and ongoing socio-economic change. Class is evidenced by inequality in land holdings, and the marginal size of land holdings. For example, in the districts surveyed the

proportion of households (n=99) classified as either landless or having access to <0.5ha of land ranged from 67% to 81% (2014: Table 2). Sugden et al. (2014: 262) argue that economic surplus is appropriated from this “marginal farmer, tenant, and labouring class” through relations such as paying approximately 50 percent of the harvest as land rent (sharecropping) as well as usury (including high cost of pumped irrigation water, required for subsistence production [2014:265]). Marginal and tenant farmers diversify their livelihoods through wage labour and male outmigration. Outmigration (whether longer term or during the dry season) is not, however, accompanied by immediate remittance benefits (because of time lags in receiving remittances) and is thus a possible cause of household grain shortages, and a certain cause of increase in women’s farm labour burdens and stress.

Informed by compatible sets of values and representations, the three studies have compatible overarching goals. Khadka et al. (2014) refer to empowering women, Sugden et al. (2014) refer to climate justice, and Lahiri-Dutt (2014) refers to delivering gender-equitable resilient development projects.

Policy Advice

Table 5 shows an array of recommendations in the three studies, in increasingly transformative order with respect to the status quo. The distribution of recommended actions is shown against components of the sustainable livelihoods framework. Sugden et al. (2014) emphasize changing institutions and social relations, including implementing fundamental reforms. Khadka et al. (2014) focus on policy processes aimed at institutional reform. The recommended actions in Lahiri-Dutt (2014) are distributed relatively widely across the livelihoods framework. Sugden et al. (2014) emphasize changing institutions and social relations, including implementing fundamental reforms. All three studies contain abstract policy advice, with a recurrent focus on reforming institutions and social relations (Table 5).

Table 5: Means-Goal arguments

Khadka et al. (2014)	Sugden et al. (2014)	Lahiri-Dutt (2014)
(1) Understand and recognize differential vulnerability & adaptation [policy process] AND (2) Integrate gender & social dimensions into climate change policies [policy process] AND (3) Monitor outcomes using gender-disaggregated data [institutions] AND (4) Recognize NRM knowledge of rural women, local people, indigenous people [institutions] AND (5) Facilitate access to knowledge & technologies [human capital] AND (6) Change governance systems to enhance access & entitlement of women & socially marg groups to resources [institutions]	(1) End discriminatory laws [institutions] AND (2) Help women “engage in bureaucracy” [institutions + gender] AND (3) Improve access to low-cost irrigation (for women & young men) [physical capital + gender + age] AND (4) Provide subsidies for agricultural inputs [physical capital] AND (5) Reduce risks in agriculture [institutions] AND (6) Experiment with new social relations of production (such as co-op farming and collective access to infrastructure) [social relations] AND (7) Undertake land reforms to dismantle pre-capitalist inequalities [social relations]	(1) Enhance social capital [social capital] AND (2) Support small livestock development [physical & natural capital] AND (3) Make timely field labour available [human capital] AND (4) Improve access to information, markets and transport [markets + physical capital] AND (5) Recognize difference in women’s needs based on land ownership [policy process + class] AND (6) Build capacity of women-headed households [human capital] AND (7) Mainstream gender in all agricultural development projects [organisations] AND (8) Enlist male support for greater resources, benefits & responsibilities for women[gender] (9) Enhance understanding of role of remittances [policy processes]

Source: Authors; emphasis added.

Note: items in brackets from sustainable livelihoods framework.

Improving Policy Advice

One way to improve argument is to reduce unnecessary abstraction. The recurrent use of abstraction raises the question of under what circumstances abstract policy recommendations are better than specific recommendations. In some policy arenas, overly specific recommendations may not be accepted as sound argument. This could arise in situations where responsible actors (e.g. state agencies) are relatively closed to external input, in which case overly prescriptive specifications could be refuted as incorrect. It could also arise in contested settings where actors cannot agree on entire courses of action or on ultimate ends, but can only agree on intermediate actions. In such circumstances, if a loss of legitimacy may ensue to the research provider less concrete recommendations would be preferable.

In contexts where multiple social structures and contemporary institutions intersect to discriminate against women, casting a broad net that implicates many institutions and actors may be a necessary first step, although it is clearly not sufficient. Sound policy argument is provided when plausible outputs to outcome pathways (i.e., specific means-goal arguments) are supplied. To improve the specificity of such advice, it will be necessary to specify the role of government (what can governments do to induce action, given that capacity of governments is limited); identify responsible non-state actors; identify effective policy processes and instruments; and importantly, identify opportunities to link with existing policy or development interventions in the region. One of the goals of this workshop is to provide participants with an opportunity, through focus group discussion, to improve specificity of policy advice related to gender equitable water resources development, based on the ARI framework.

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References

- Akram-Lodhi, A. H. (2013). *Hungry for Change: farmers, food justice and the agrarian question*. Fernwood Publishing, Halifax, Canada
- Basurto, X., Kingsley, G., McQueen, K., Smith, M. & Weible, C. M. (2010). A systematic approach to institutional analysis: Applying Crawford and Ostrom's grammar. *Political Research Quarterly*, 63(3), 523-537.
- Bennett, L. (2008). Policy reform and culture change: Contesting gender, caste, and ethnic exclusion in Nepal. *Inclusive States*, 197–224. The World Bank, Washington, DC.
- Bhattarai, B., Beilin, R. & Ford, R. (2015). Gender, agrobiodiversity, and climate change: A study of adaptation practices in the Nepal Himalayas. *World Development*, 70, 122-132.
- Crawford, S. E. & Ostrom, E. (1995). A grammar of institutions. *American Political Science Review*, 89(03), 582-600.
- Ellis, F. (2000). *Rural livelihoods and diversity in developing countries*. Oxford university press.
- Erenstein, O., Hellin, J. & Chandna, P. (2010). Poverty mapping based on livelihood assets: A meso-level application in the Indo-Gangetic Plains, India. *Applied Geography*, 30(1), 112-125.
- Fairclough, I. & Fairclough, N. (2013). *Political discourse analysis: A method for advanced students*. Routledge.
- Foran, T., Butler, J. R., Williams, L. J., Wanjura, W. J., Hall, A., Carter, L. & Carberry, P. S. (2014). Taking complexity in food systems seriously: an interdisciplinary analysis. *World Development*, 61, 85-101.
- Foran, T., Nelson, R. & Bourgoin, J. (2015). *Argument – scope – implementation. An analytical framework to support participatory development of food security policy*. Second Global Food Security Conference, Cornell University, Ithaca, NY, 11–14 October 2015

- Gerlitz, J. Y., Banerjee, S., Hoermann, B., Hunzai, K., Macchi, M. & Tuladhar, S. (2014). *Poverty and vulnerability assessment—A survey instrument for the Hindu Kush Himalayas*. Kathmandu: ICIMOD.
- Institute for Human Development (New Delhi, & Rodgers, G. (2013). *The challenge of inclusive development in rural Bihar*. Institute of Human Development, Manak Publications.
- Kabeer, N. (2015). Gender, poverty, and inequality: a brief history of feminist contributions in the field of international development. *Gender & Development*, 23(2), 189-205.
- Khadka, M., Rasul, G., Bennett, L., Wahid, S. M. & Gerlitz, J. Y. (2015). Gender and social equity in climate change adaptation in the Koshi Basin: an analysis for action. In *Handbook of Climate Change Adaptation* (pp. 1049-1076). Springer Berlin Heidelberg.
- Lahiri-Dutt, K. (2014). *Experiencing and coping with change: women-headed farming households in the Eastern Gangetic Plains*. Australian Centre for International Agricultural Research, Canberra.
- Nelson, R., Foran, T., Bourgoin, J. (in prep.). *Policy pathways for food security in West Africa I: An analytical framework to support participatory policy development*. CSIRO Land and Water Flagship, Canberra.
- Ostrom, E. (2007). Institutional rational choice: An assessment of the institutional analysis and development framework. In Sabatier, PA (Ed.). *Theories of the policy process*, pp 29–71. Westview, Boulder
- Sugden, F., Maskey, N., Clement, F., Ramesh, V., Philip, A. & Rai, A. (2014). Agrarian stress and climate change in the Eastern Gangetic Plains: Gendered vulnerability in a stratified social formation. *Global Environmental Change*, 29, 258-269.
- Sunam, R. K. & McCarthy, J. F. (2016). Reconsidering the links between poverty, international labor migration, and agrarian change: critical insights from Nepal. *The Journal of Peasant Studies*, 43(1), 39-63.

Promoting Gender Equality and Social Inclusion in Water Decision Making Process: The Case of Water Use Master Plans in Nepal, 2015

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Abstract

Gender equality and social inclusion (GESI) responsive intervention in the water sector is a key thematic areas for sustainable and equitable development of Nepal's water resources. The approaches and strategies in a water use master plan (WUMP) have provided improved opportunities for women, the poor and disadvantaged groups to gain equitable benefits and have a greater stake in contributing meaningful participation for designing and implementing water resource schemes at the Village Development Committee (VDC) level.

The 'inclusive provision' introduced through Nepal's interim constitution, policies, bills, and ordinances have mandated proportional representation of women, the poor and disadvantaged from local to central level committees for their meaningful participation in development work. An encouraging trend has been noted in WUMP initiatives that place high emphasis on inclusive representation of these groups in project planning, implementation, monitoring and evaluation. On the other hand, many major national acts and policies related to water management need to be updated from GESI perspective and ensure its implementation to promote meaningful participation and gainful ownership in water plans.

However, the role of and greater voice of the women, poor and disadvantaged, access and control on water resource are yet to be a reality for the country's sustainable water management. The time has come for the Government of Nepal (GoN), local communities and development partners to work in a coordinated manner to achieve the inclusive target of WUMP to maximize the socioeconomic wellbeing of community through equitable distribution and use of water resource from the policy to implementation.

Background

ICIMOD's Koshi Basin Programme (KBP) and HELVETAS Swiss Intercooperation Nepal initiated a collaborative action research to develop WUMP starting in 2014. This is a pilot research project aiming to improve understanding of water issues and the need for participatory and inclusive water use planning at the local level (ICIMOD / AusAid 2012). A study to "Review the Processes of Water Use Master Plan from Gender Equality and Social Inclusion Perspective" was commissioned by ICIMOD (from June 2015 to February 2016) in order to make WUMP more GESI responsive. The focus of the study was to explore how GESI is mainstreamed into WUMP formulation and implementation processes.

GESI-responsive interventions are one of the main contributing thematic areas for sustainable and equitable development of water resource management in Nepal. The inclusive provision introduced through new constitution, policies, bills and ordinances have mandated proportional representation of women, poor and disadvantaged³ groups in local and central level committees for meaningful participation in development work (HELVETAS, 2013). This encouraging trend has also been noticed in WUMP, which espouses high emphasis on inclusive representation of women, poor and disadvantaged in project planning, implementation, monitoring and evaluation.

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The WUMP is locally prepared as a five-year strategy for all water-related issues including irrigation, drinking water, sanitation and hygiene, ecology and environment. This includes disaster risk reduction and water strategy aiming to improve safe water access and ensure equitable water distribution. The VDC is the legislative body to plan and implement the WUMP at the VDC level. Whereas, HELVETAS Nepal is a pioneer organization to develop and implement WUMP. Since 1998, a total of 108 WUMP have been developed and implemented in 17 districts. Since 2014, ICIMOD KBP and HELVETAS have been working together for a collaborative action research to develop WUMP. This is a pilot research project aiming to improve understanding of water issues and the need of participatory and inclusive water use planning at the local level representing three agro-ecological zones-the plains, hills and the mountains (ICIMOD/HELVETAS, 2014).

Method

A study to “Review the Processes of Water Use Master Plans since 1998 to 2014 from Gender Equality and Social Inclusion Perspective” was commissioned by ICIMOD to make WUMPs more GESI- responsive. The focus of the study was to explore how GESI is mainstreamed in the entire WUMP formulation and implementation process (Goodrich et al., 2017).

The study incorporated qualitative and quantitative methods to gather information and data. A total of five districts (Achham, Bajhang, Doti, Parbat and Sindhupalchowk) covering three development regions (central, west and far-west) and different WUMP formulation periods were selected for the field study. Study did not undertake any quantitative data collection but gathered existing sources of information from ICIMOD, HELVETAS and its partner organizations and at a sample of districts and field locations. Qualitative data was gathered using interactive meetings, field observations, semi-structured interviews and focus group discussions with a range of stakeholders at the central, district and the community levels

WUMPs developed during the period 1998 – 2014 have basically followed WUMP preparation guidelines 2001, 2007 and 2012, This study has thoroughly reviewed the above three guidelines to examine how sensitive they were towards GESI issues. As WUMP are prepared for long-term planning (up to five years, and updated after five years), it is important that the WUMP document itself is GESI-responsive. Thus, the contents of 12 WUMPs were examined and analysed from the GESI perspective.

Findings

The research findings suggest that inclusive decision making through an equitable participatory process is crucial to increase access to and for managing water resources. Moreover, it is important to reform the water-related national policies and acts, which have largely focused on the technical aspects with limited emphasis on gender equality and social inclusion (Goodrich et al., 2017). The policies and acts need to be updated from GESI perspective, which ultimately provide the enabling environment to promote GESI culture in Nepal’s water management sector. Appropriate policies are needed to strengthen institutions for enabling organizational changes and promoting equitable provisions and affirmatives actions for equal participation of women, poor and disadvantaged groups. The local authority, implementing agencies and concerned stakeholders have a crucial role to play in WUMP’s successful implementation with GESI perspective through their commitments and priorities.

Strengths of the WUMP

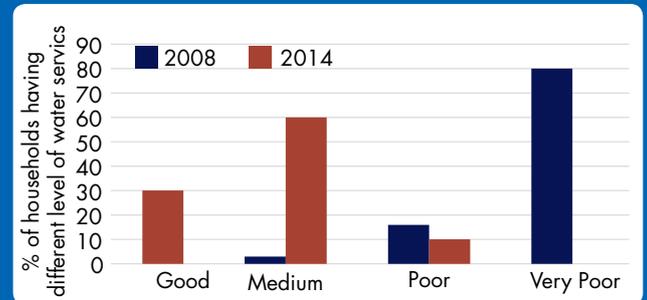
Support to participatory planning process

WUMP gives emphasis to participatory and inclusive planning processes through multiple consultation meetings and workshops at the village ward and VDC levels. Women, poor and disadvantaged are focused on their participation and play a key role in WUMP implementation. Inclusive WRM committees have paved the way to reduce political influence in the distribution of water resources, and have supported the implementation of projects emanating from the participatory planning processes (Bhatta, 2011).

Improved sanitation, hygiene and water services

WUMP interventions have generated significant positive results at the community level (Figure 11). Awareness and sensitization on health and hygiene have played a crucial role in positive behavioural changes in sanitation and health practices. Gradual reduction of waterborne disease and seasonal epidemic due to better water services, decreasing rate of child death are reported by majority of the stakeholders. Open defecation free areas, multiple use of water for livelihood approach, synergies between water and agriculture extensions services are the best examples from WUMP practising VDCs of Nepal's midwest and far west regions (Rautanen et al., 2014; RWSSP-WN, 2014).

Figure 11: Percentage of HHs having different level of water services in Koiralakot VDC, Bajhang



Extensive improvement in the level of water service in communities is evident where WUMPs have been implemented. Even the most scattered and remote settlements of the WUMP VDCs have access to improved water services through improvement/repair of water sources and its redistribution.

Community ownership for WASH interventions

WASH interventions have garnered high degree of community ownership which has been instrumental in enhancing their functional efficiency and sustainability. User committees of water schemes are functional and committee members are vibrantly involved in maintaining a fund for operation and maintenance.

Inclusive representation

Mandatory requirement of 50 percent women and proportional representation of other disadvantaged groups have ensured inclusive representation in WASH-related committees. In all the five districts we visited for field study, stakeholders confirmed proportional representation of women and other disadvantaged groups. There is still a long way to go towards achieving meaningful participation, the significant increase in their representation has provided them opportunities to become water managers and decision makers in the days to come.

Women's leadership role

There are several evidence of improvement in women's leadership role due to their presence in WASH committees. Women started to take a part in community intervention in-front. Examples are also visible in many VDCs of the increasing trend of women demanding resources from the VDC's secretary to improve water access. Despite their low number, some of the women in leadership positions have improved their capacities to interact and negotiate with local government agencies and other stakeholders.

Changing attitude and gender role

Women have expressed willingness to participate in community decision-making processes as it provided them opportunities to evade the traditional subordinated status. This can be capitalized on to advance social mobilization of women for community development. Further, with water point available close by, water fetching has become a common work for women and men moving away from the traditional notion of water fetching as only a woman's job. Although gender roles are slowly being confronted, we observed that gendered status quo is still maintained.

Critical Issue/Enabling Environment for Mainstreaming GESI in WRM

GESI mainstreaming in Water Resource Management (WRM) aims to bring about transformation in terms of access and control over water resources and inclusive decision making through meaningful participation of both women and men, especially from the poor and disadvantaged groups (Machado, 2010). The government existing policies and practices also equally provide enabling environment to mainstreaming GESI in WRM and WUMP. Some critical issues for mainstreaming GESI in WUMP are:

GESI perspective and provisions are not explicitly incorporated in acts and regulation

GESI-responsive policy framework is the first step to reveal commitment to redress inequality. Nepal's acts and policies related to water resource management are governed by the Water Resource Act and Regulations (1992/93), which are viewed as umbrella legal documents. Some of the acts/regulations espouse community participation but have not explicitly incorporated GESI perspective. For example, the Environment Act and Regulation, 1997 is more focused on technical matters, while the Local Self Governance Act (1999) focused more on welfare approach rather on strategic interest.

GESI objectives have not been articulated in WUMP document explicitly

Although the objectives of WUMP are based on Equity, Efficiency and Ecological Integrity Principles, GESI is not accorded central focus in the WUMP preparation guideline. As a result, WUMPs lack in-depth analysis of the GESI perspectives in formation and implementation (Goodrich et al., 2017).

Primarily, objectives of WUMP are expressed in GESI-neutral terms, which miss out on conveying a clear message that WUMP is a GESI-responsive plan. Articulating an ambition - in the form of specific GESI objectives – will help build an understanding in the WUMP formulation team on what to look into, and on what is to be achieved from the GESI perspective.

Specific GESI analysis with adequate disaggregation needed at all levels

While attempts have been made to conduct GESI analysis in the WUMP process, specific geographic, socio-cultural and economic issues (such as gender-based violence, lack of land ownership, cultural and traditional malpractices, water as an economic viability, power politics in water and its negative consequences to women and disadvantaged groups, and issues related to water conflicts) of the community are yet to be studied adequately. Although there is an ongoing practice to use disaggregated data for GESI analysis, a rigorous and comprehensive data disaggregation and presentation varies across the WUMPs. The use of specific GESI analysis in a disaggregated way at all levels to address the water issues in a strategic way is necessary. These issues and learning should be shared among all actors for future program updates.

Women's representation and their voice in decision making need to be improved

Though ample opportunities for inclusive participation are provisioned for, the current situation indicate that there is still a long way to go in terms of achieving transformation given that the strategic focus remains the same.

The government has existing provision of forming district and VDC WASH members, and mainly its key positions could be one of the hurdles to improve women and disadvantaged leadership in water management. The key body of WUMP committee is automatically formed at VDC level chaired by the VDC secretary, member secretary from Health Post in-charge, and other members of representatives from political parties, community forest groups, mother groups, children's groups, school head masters, Female Health Care Volunteers (FCHVs), and local NGO representatives. The provision of formulation of WUMP committee at VDC level itself looks inclusive to make participation from active agencies at VDC level. Unfortunately, most of the key positions of these agencies have been held by men except in few women-related agencies.

At the VDC level, the trend of women in leadership positions seem to be weak. This suggests that the government should take a lead role in reforming the provision to empower women and disadvantaged groups in leadership in key positions at local-level institutions. However, in the village ward level, women's inclusiveness and leadership seemed much better in position. More than 40 percent women's participation were found at the ward-level WUMP committees in general.

Need stakeholder's capacity building to mainstream GESI in WUMP

Capacity development is an integral element of the WUMP process. However, the current capacity building training (CBT) initiative is not designed to develop capacity of participants to carry their work in a GESI-responsive manner (e.g., Sindhupalchowk, Saptari and Sindhuli districts). Another concern is that the training curriculum and timing has been based on a blanket approach irrespective of the diversity based on the capacity of participants. Some participants of CBT (such as FCHV, Ward Citizen Forum coordinators, and representatives of women, Dalit and indigenous nationalities) have not benefitted much due to low capacity in comprehending the training course and delivery methods in comparison to other community based leaders such as teachers, head teachers and local politicians (in all VDCs). The GESI capacity building and social mobilization cost has been affected negatively after the reduction of WUMP cost to make it more economic-based on the recommendation of DoLIDAR and MoFALD. Currently, HELVETAS Nepal has been focusing on providing technical assistance (TA) for WUMP development in few prioritized schemes, where it has been supporting for the implementation. The implementing agencies, government and funding organizations have to ensure that adequate budget is allocated for interventions to integrate GESI concerns.

Poverty should be considered while deciding community contribution

Although, there is a practice in place for ranking performance during implementation of WUMP scheme, the disadvantaged groups have faced hardship in eking out contribution at par with better-off people. Specific measures to address the need of poor people during the WUMP implementation are not specified. Many of the poor communities have little options but to contribute in terms of unpaid labor missing out on their daily earnings vital to support their livelihood needs.

Need to enhance ownership by VDCs in newly implemented districts

VDC selection criteria for WUMP support also includes: i) scarcity of drinking water and irrigation facilities/ infrastructure or lack of equitable water distribution, and ii) presence of poor and socially excluded group in the VDC. Thus, right from the outset, WUMP strives to promote pro poor and inclusive approach. Given that the VDC needs to assume the central role in the entire WUMP formulation and implementation processes, its complete ownership of WUMP and willingness to mainstream GESI gains prime significance.

Although WUMP development process began with demand by VDCs, ownership of WUMP by VDCs is impacted by structural challenges in some of the VDCs. These challenges include: absence of elected local representatives, political influence, frequent transfer of VDC secretaries, appointment of the VDC secretary in multiple VDCs, absence of VDC secretary in the designated VDC, budget scarcity at VDC level, lack of efficient monitoring mechanism to measure outcome, less capacity to plan and implement the WUMP, and absence of GESIP perspective (Goodrich et al., 2017).

These challenges can be resolved through policy reforms and robust compliance mechanisms. Appreciable feature of ongoing interventions is that sensitization and capacity development of VDC WASH coordination committees are happening on a regular basis. WUMP is one of the key components of the Village Development Periodic Plan (VDPP). Thus, linkage of WUMP monitoring with Minimum Condition and Performance Measure (MCPM) mechanism will contribute to increase the efficiency of WUMP and ownership of local agencies.

Conclusions

Over the past two decades, the WUMPs have evolved with growing emphasis on inclusive participation in its formulation and implementation processes. Greater achievements have been made in improved water services and enhanced ownership of WASH interventions at the community level. The WUMPs have given opportunity to increase the roles of women, poor and disadvantaged as leaders in water resource management. One of the notable examples is that women are equally participating in removing undue local political influences in distribution of resources in the villages with WUMP interventions (RWSSP-WN, 2014).

Despite these significant progresses, enhanced roles of women, poor and disadvantaged groups in water management committees for setting priorities and decision-making are yet to be significantly enhanced. Many are still not in a position to exercise voice and influence in decision-making. Their capacity development in technical and managerial roles is vital for the sustainability of water initiatives. Therefore, GESI incorporation should be key a priority in the entire process of WUMP. GoN, Communities and Development Partners need to work in a coordinated manner to achieve the inclusive target of WUMP to maximize the socio economic wellbeing and empowerment of disadvantaged community through equitable distribution and use of water resource.

Areas for Improvement

Advocacy to reform policies

Formulation of appropriate policy is the first step forward for GESI mainstreaming, as this is when a government reveals its commitment to redress inequality. As the drafting of Umbrella Act and Regulation on WASH and WUMP preparation guideline is in process at the Ministry of Water and Sanitation (initially started by the Ministry of Urban Development, December 2015), it is necessary to accelerate joint coordination action and evidence based advocacy to effectively mainstream GESI into relevant national policy areas.

Institutional strengthening

There is a need to step up constructive engagement with the government to strengthen institutional capacity of local bodies for effective implementation of GESI policies and provisions. These include the GESI Policy of the Ministry of Federal Affairs and Local Development (2010), and the GESI Operation Guideline of Ministry of Urban Development currently taken over by the newly formed Ministry of Water and Sanitation in December, 2015.

Implementing GESI responsive budgeting

GESI-responsive budgeting examines how budgets affect women and girls differently than men and boys of diverse socio-economic group and advocates deliberate steps to correct disparities. As the Ministry of Federal Affairs and Local Development (MoLD) has already formulated a GESI responsive budget guideline for local bodies (district, municipalities and village development committees), advocacy should focus on ensuring that VDC initiate GESI responsive budgeting of WUMP.

Focused approach

Effective mainstreaming of GESI requires its full integration within the WUMP preparation guideline. This implies that GESI is appropriately considered at all planning, implementation, monitoring and re-planning levels and stages. High-level commitment for GESI integration calls for articulation of GESI objectives and allocation of special resources for gender-sensitive initiatives at the local, district and national levels is required.

Capacity development

Capacity development of stakeholders is an integral element of the WUMP formulation and implementation processes. Specific results related to capacity development need to be clearly stated in two aspects:

- Are all actors in the concerned WUMP being capacitated to mainstream GESI?
- Are women, poor and disadvantaged capacitated to exercise their voice and influence?

Capacity development plan need to be developed with tailor-made capacity development curriculum and methods in alignment with the level of understanding of the participants. Capacity development plan should be carried through participatory discussion, training, exposure, community reflection, orientation and sharing to political representative, joint planning, implementing, monitoring, reporting and share learnings within and between WUMP VDCs. The learning documentation will be one of the best materials for the capacity development. All concerned actors should focus on institutionalising the WUMP practices at the same pace.

Flexible time and approach

Participatory tools need to be flexible in terms of the number of events, venue, time, and language etc. Where necessary, separate and/or joint sessions for men and women and for disadvantaged/excluded groups (including Dalits, girls in age of menstruation, disable, and elders) are required to fully understand their specific needs, and to create an enabling environment for consensus-building among diverse groups.

Involvement in decision making

Continuous, coordinated and effective involvement of women, poor and disadvantaged groups in decision-making should be taken as a key process of WUMP. The mechanism should be established to ensure that women, poor and disadvantaged have meaningful participation, voice and share in WUMP. Moreover, key issues of gender-based violence, economic perspective of water, issues related to water politics and power, conflict on water sources, work burden of women, how the landless also benefit from water resources, women and disable friendly technologies and mechanisms for equitable distribution and redistribution of water should be sufficiently discussed.

Equitable provision

It is essential that equitable provisions and affirmative action should be followed during implementation of water schemes taking into consideration the poverty and disadvantaged conditions of different groups. The most noticeable point here is how water is perceived as political power of men and elites group. This backward and gender-insensitive patriarchal thought and practice should be transformed institutionally into the practice that “water is the fundamental right of an individual”. The water politics within the family at the household level, water war between elite and poor at community level, and water disputes at the border level among different communities and politics should be addressed by WUMP.

Research and analysis

Advocacy work should always be grounded on a strong base of evidence. Thus, GESI-sensitive data collection, research and analysis are important for formulating accurate policies and programmes and for assessing the equity of development outcomes. This calls for more than just disaggregating data by sex, but also contextual analysis of gender relation and social power structure.

Over the past 17 years, the WUMPs have evolved with growing emphasis on inclusiveness and that has a direct benefit for local communities. In the WUMP VDCs, there has been relative positive improvement noticed in water services and enhanced community ownership of WASH interventions. As the GoN with complement of development partners introduced the mandatory provision, the WUMPs have been given opportunity to increase the roles of women, poor and disadvantaged as leaders in the WUMP-implementing districts. Many VDCs have implemented the WUMP and many others are in the process to own the WUMP, although the numbers of women’s leadership in water activities are not large, there is still need for a positive impact to change the social attitude towards the women, poor and disadvantaged. One of the notable examples is that women are equally participating in removing local political influences in distribution of resources in villages with WUMP programs.

Despite many significant progresses of inclusive practices, there are still initiatives needed to increase the enhanced roles of women, poor and disadvantaged groups in water management committees for setting priorities and decision-making. Many are still not in a position to exercise voice and influence in decision-making. Their capacity development in technical and managerial roles is vital for sustainability of water management. Therefore, GESI incorporation and ensuring in practice in water plan should be in key priority in WUMP as per the GESI policy of GoN.

GESI policies of HELVETAS Nepal and ICIMOD are in line with Nepal's GESI policy (ICIMOD, 2013). The research findings show that it is important to reform the water-related national policies and acts as well as WUMP policy, which have largely focused on the technical aspect with limited emphasis on gender equality and social inclusion aspect. Appropriate policies are needed to strengthen institutions for enabling organisational changes and promoting equitable provisions and affirmatives actions for meaningful participation for women, poor and disadvantaged groups. The implementation agencies, stakeholders and government authorities have a crucial role to play in WUMP's successful implementation with focus on GESI perspectives through their commitment and priorities. The significant achievement of WUMP is recognition by central and local government authorities.

References

- Bhatta, M. R. (2011). *Experiences of Water Use Master Plan in Nepal* 6th Rural Water Supply Network Forum.
- Goodrich, C.G, Udas, P.B., Gurung, M.B., Thapa, N., and Shrestha, S. (2017). *Gender Inclusive Water Planning: Lessons from Water Use Master Plan Practices in Nepal* (In publication), ICIMOD, Kathmandu, Nepal.
- Government of Nepal [GoN] (1997). *Environment Act and Regulation 1997*. Nepal Law Commission, Kathmandu, Nepal.
- Government of Nepal [GoN] (1999). *Local Self Governance Act 1999*. Ministry of Law and Justice, Kathmandu, Nepal.
- Government of Nepal [GoN] (2015). *Interim Constitution of Nepal, 2007. Constitution of Nepal, 2015*.
- HELVETAS (n.d.) *WUMP Preparation Guideline 2001, 2007, 2012*. HELVETAS Nepal, WUMP documents, training curriculums.
- HELVETAS Swiss Intercooperation Nepal. (2013). *GESIP policy and implementation guideline*
- ICIMOD/AusAID. (2012). *Koshi Basin Programme – Phase I, Project Design Document, Version: December 2012*.
- ICIMOD/HELVETAS. (2014). *First progress report, Pilot Study on Local Level Water Use Master Planning in selected districts of the Koshi Basin* (Nepal). A collaborative study of ICIMOD and HELVETAS Swiss Inter-cooperation, Nepal.
- ICIMOD. (2013). *Gender Equity Policy*. Kathmandu: ICIMOD.
- Machado, N. (2010). *Mainstreaming gender perspective in the integrated water resource management policies, Gender and Water Alliance*
- Rautanen, S. L., van Koppen, B. & Wagle, N. (2014). *Community-driven multiple use water services: Lessons learned by the Rural Village Water Resources Management Project in Nepal. Water Alternatives, 7(1)*.
- RWSSP-WN. (2014). *Rural Water Supply and Sanitation Project in Western Nepal Phase II, Rural Village Water Resources Management Project Phase II*.

Recharge Ponds for Protection of Springs in the Mid-hills of Nepal: Experience from a Pilot Study in Kavre

Binod Sharma¹⁵

Abstract

An action research carried out by NWCF in partnership with ICIMOD in two pilot study sites in Kavre district indicated that the shortage of domestic water created by drying up of springs in the mid-hills of Nepal could be ameliorated by following proper conservation and management practices. A number of old unused ponds were rehabilitated to function as recharge ponds and the behaviour of the springs they influenced were constantly monitored. The result was encouraging and it was decided to upscale and scale out the findings to other nearby areas. Capacity building of the local people, especially the women, and incorporation of spring protection and recharge pond construction activities in the local level government plans were the major components of the out-scaling phase of the project. As a result of this effort, a number of such initiatives were identified by the local government bodies as priority projects and were included in their formal annual plans. Observation of the effects of the big earthquake of 25 April 2015 on the springs provided some evidence of enhanced resilience of the springs supported by recharge ponds in comparison to the others.

Background

When we talk of water resources in Nepal, we generally refer to big rivers and lakes, snow and glaciers and abundance of water, but in reality, people in the mid-hills have very little access to these sources for meeting their daily requirements. Most of the settlements in the hills and mountains are located on or near the tops of the hills and the rivers flow several hundreds of meters below, so that hauling water manually is extremely laborious and time consuming and lifting it by using pumps is very expensive and not always feasible. So, most of the mid-hill communities must depend on the springs that occur on the hill slopes. Lately, many of those springs all over the country were found to be drying up at an alarming rate.

Very little systematic knowledge and information on springs and their management are available, and construction and use of ponds is promoted only as a means of controlling soil erosion, commercial exploitation like fish farming, or religious and recreational purposes. Their role in supporting springs have not been appreciated much but some experts and researchers believe that use of such recharge ponds is the only way to revitalize the drying springs (Upadhyaya, 2009). The concept is that strategically placed ponds help capture rainwater and allow it to infiltrate into the ground, and replenish the ground water that feeds the springs. Extensive work done by Advanced Center for Water Resources Development and Management (ACWADAM) in Sikkim (ACWADAM, 2011), which is an area quite similar to Nepal's mid-hills, has already proven the effectiveness of recharging ponds in sustaining springs. The Department of Local Development and Agricultural Roads (DoLIDAR), in collaboration with the Finnish International Development Agency (FINNIDA) supported Water, Sanitation and Hygiene (WASH) program, recently prepared a handbook for construction of recharge ponds to be used in the districts where their program has been implemented (DOLIDAR, 2013).

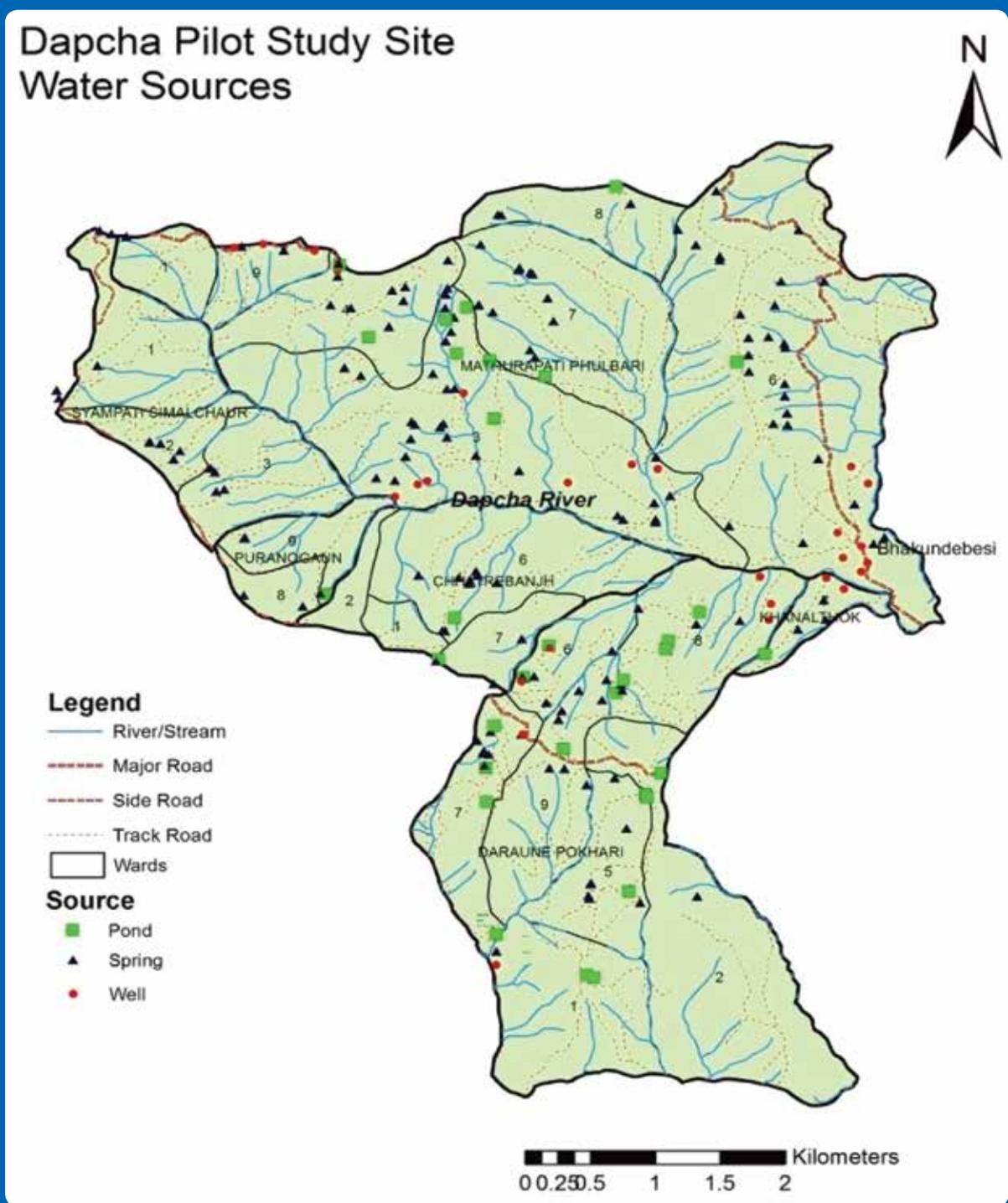
The Action Research

This action research work undertaken by NWCF in partnership with ICIMOD, now in its third year of implementation, attempted to test this hypothesis with a pilot study in two small areas in Kavre district: Tinpiple in

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Panchkhal Municipality and Dapcha/Daraune Pokhari in Dapcha Kashikhanda Municipality. During this study, we found a fairly high number of springs scattered over the hill slopes. In Dapcha alone, there were as many as 174 springs in an area of about 25 square kilometres, but almost 30 percent of those springs were dry (Figure 12). The size and behaviour of the springs varied depending on several hydro-geological factors like rock types, level of ground water, location of the spring outlets, rock fractures, and soil porosity. The functioning springs were found to have different characteristics like high or low discharge, continuous or seasonal flow, etc.

Figure 12: Springs and ponds in Dapcha



In the course of the study, it was observed that springs lying below natural water bodies, like the big ancient pond in Daraune Pokhari VDC, performed better than in other similar areas without a pond (Figure 13). The Thulo Dhara spring lying downstream of this pond is a permanent spring, which has a fairly large discharge and is used for domestic purposes by about 250 households of Dapcha area.

Relevant and useful findings and observations of the study were shared with the local community, and with their help, several sites were identified for construction of new recharge ponds or rehabilitation of old unused ponds with an objective of revitalizing springs lying below them. Three such recharge ponds each, were constructed/ rehabilitated in both sites (Tinpihle and Dapcha), and their behaviour and flow of water in springs likely to be influenced by them were regularly monitored over the next two years. The results in both places were quite encouraging as the spring registered conspicuously increased flow after the construction of the ponds (Figure 14).

Figure 13: Daraune Pokhari Pond and Thulo Dhara in Daraune Pokhari, Dapcha

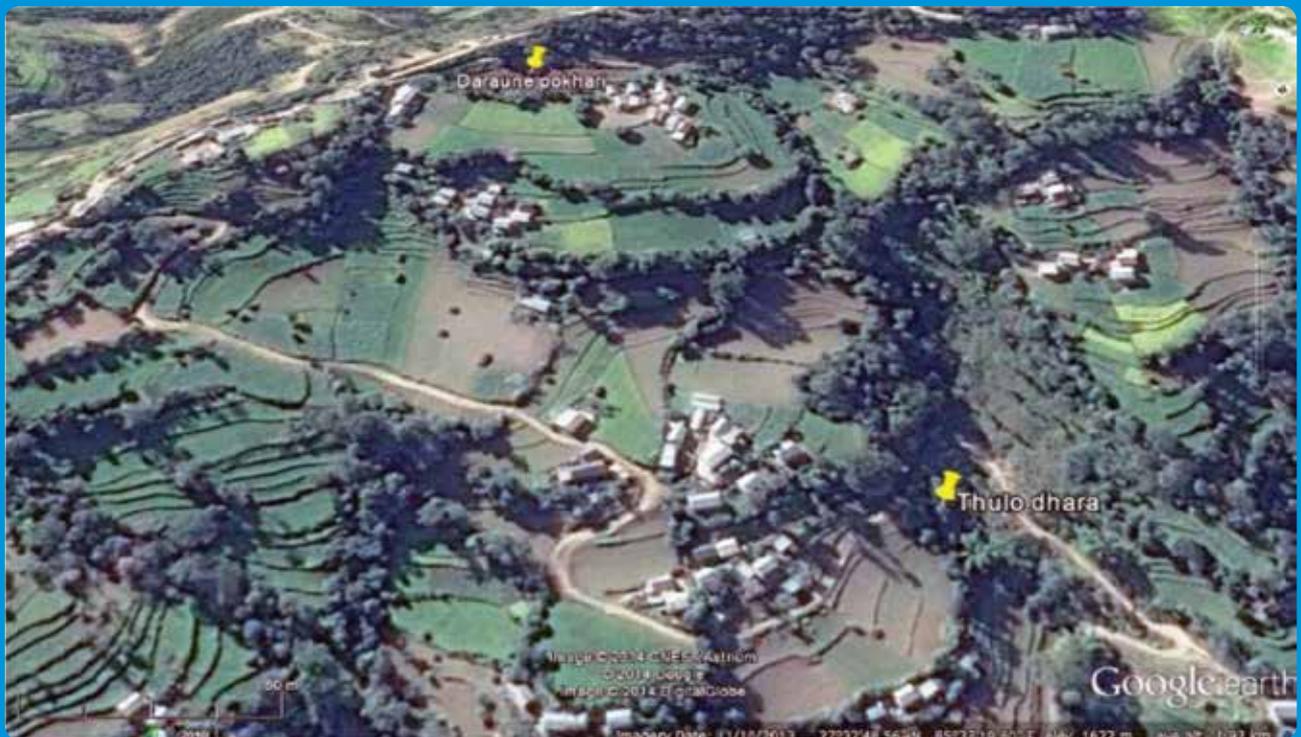
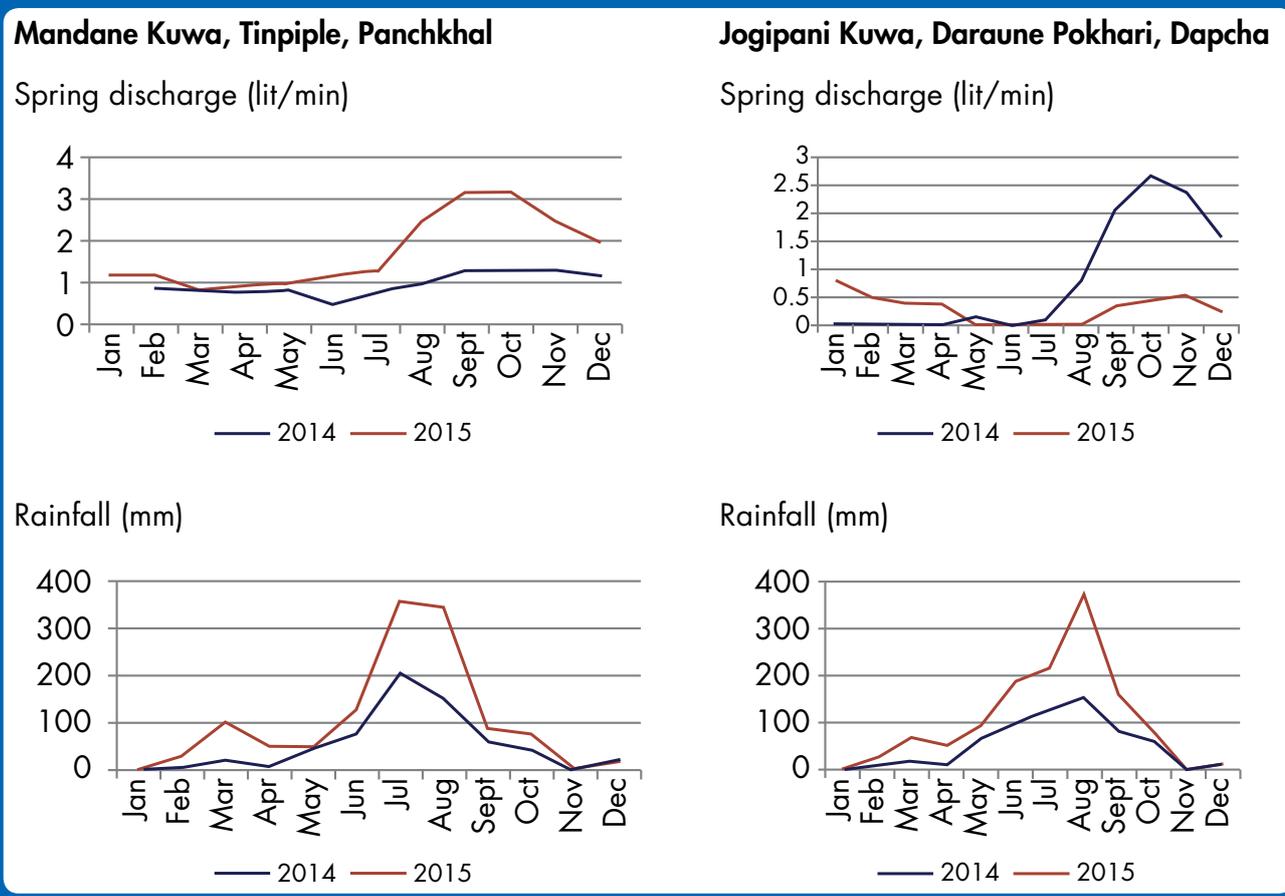


Figure 14: Pond rehabilitation in Barbot, Daraune Pokhari, Dapcha



The great earthquake of 25 April, 2015 had a profound effect on the springs. Some springs dried up, some had reduced discharge and a few had alarmingly high discharge. But soon, the discharge started to decrease, and many of the springs that had been very reliable in the past were now almost on the verge of drying up. However, a positive observation was that the springs influenced by recently rehabilitated ponds seemed to have a better chance of survival than others as seen in the Jogipani Kuwa and Jogipani pond. The Jogipani pond, which had become non-functional for many years, was rehabilitated in June 2014 with technical support of NWCF and voluntary labour contribution of the local community. The spring, called the Jogipani Kuwa lying downstream of it, had been completely dry and unused for several years. During the monsoon, following its reconstruction, the pond filled up and the spring had a good discharge. Both the pond and the spring dried up after the earthquake, but the next monsoon rainfall was fairly good and the pond filled up and the spring also started to yield water, although with a reduced discharge (Figure 15).

Figure 15: Monthly discharge measurements and rainfall distribution



We learned through our experience that to ensure the community’s cooperation, it is extremely important that they perceive the project as favourable for them. For instance, when they realized that the construction of the recharge pond is crucial to the protection of their springs, they participated wholeheartedly in the rehabilitation work.

Social Survey and Gender Perspective

Following the completion of the physical survey and inventory, a social survey of the springs was conducted to learn about their use and management by the community. A number of springs were selected based on several parameters such as their discharge, seasonality, number of households using them and geographical distribution.

All the users that came to a particular spring to collect water from 5AM-5PM were interviewed using a pre-designed questionnaire. Some of the findings of this survey and gender-related aspects derived from it are briefly presented below.

Male to Female Demography

According to the CBS population census data (CBS, 2012), the male to female population ratio in Daraune Pokhari VDC is 44:56. But when it comes to collecting water from the springs, 76 percent women were found to bear this laborious task in comparison to only 24 percent of men. It seems that fetching water is almost exclusively a task assigned to women (Figure 16).

Distance and Time to Collect Water

In Daraune Pokhari, the time taken to travel from home to the spring varied from less than five minutes to nearly one kilometre, depending on the distance. On the other hand, time to fill a pot with a capacity of 15 liters was more or less the same for all the springs and took near about five minutes. On the whole, it was observed that time required to travel to the spring was much greater than the time taken to fill the pot.

This has some implication on the health of women when they have to travel a fairly long distance several times every day carrying a heavy load of water. So, it is obvious that any reduction in time of travel to and from the spring, possibly by revitalizing springs nearby using recharge ponds, can have considerable positive impact on the health of women.

Perception of Change in Water Availability Over the Long Term

When inquired about their perception on how the availability of water had changed over a decade or so, an overwhelming majority of the community members reported a marked decrease of flow in their springs. The next most common response was that of “no change” and very few said that availability of water from some springs had increased.

Purpose for Which Water is Used

Water available from the springs is used for a variety of purposes. It seems that livestock consumes the largest proportion of water. In households that have livestock in Dapcha, people report that their animals consumed almost 45 percent of the water. The next largest proportion is used for drinking which accounts for about 30 percent of total use. The use of the remaining water is distributed more or less equally for the purposes of washing dishes, house cleaning, washing clothes, and for sanitation.

Women’s Participation in Different Project Activities

There has been a very good participation of women from the local communities in all the activities of the project (Table 6). Obviously, the highest participation of women was seen in the social survey of the springs because the purpose of the survey was to interview those who came to fetch water, and it was mostly the women who participated. However, women showed up in surprisingly high numbers (over 50%) for contributing labour in ponds construction. This shows the level of urgency women feel about any activity that may enhance the availability of

Figure 16: Male to Female Demographics in Daraune Pokhari, Dapcha: Total Vs Population Engaged in Water Collection

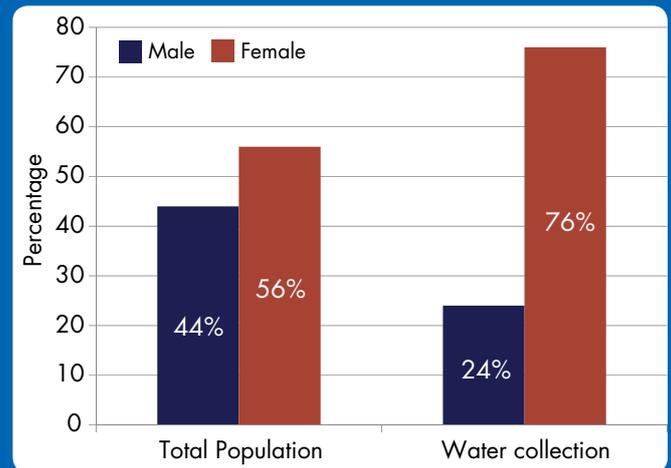


Table 6: Women's participation in project activities

Activity	Participation of women
FGD/KII	25%
Social survey of springs	75%
Labor contribution in recharge pond construction	>50%
Planning meeting at Bhakundebsi	30%
VDC/Municipality level planning	40 - 50%
Capacity building	30 - 45%
Training/Knowledge park visit	50%
Donors' visit/interaction	50%

domestic water. They also showed up in good numbers for different types of interactions, whether it was for interaction with international donors or for local level planning meetings in which their participation ranged from 40 to 50 percent. Women also participated enthusiastically (30-40%) in capacity building activities, which included brief theoretical background on springs and ponds as well as hands-on exercises involving scientific methods of measurement of spring water discharge as well as climatic parameters like temperature and rainfall.

Conclusions

This study provided an opportunity to learn important lessons regarding water use and management by the communities in general, and the springs and ponds in particular. The first phase of the study was basically an exploratory work to understand the science of springs and ponds, their behaviour under different circumstances, their use and management by the community, and factors affecting their sustainability. Special efforts were made to work in close collaboration with the local community in all aspects of the work. Capacity-building was an important component in both the first and the second phases of the project. After completion of the first phase, emphasis was given to out-scale the finding of the study to adjoining areas.

Attempts were made to involve as many women as possible in all activities of the project and their participation was particularly encouraging. Observation of the behaviour of the springs and ponds before and after the great earthquake helped reinforce our conviction that the use of recharge ponds to increase ground water level is one of the best ways to combat the adverse effects of the currently ongoing climate change or natural calamities like the recent earthquake. In order for the effects of such an intervention to be effective in a regional or national level, it must be taken up by the mainstream mechanisms of the government. In order to emphasize this necessity, local planners, influential persons, stakeholders, and representatives of important political parties were sensitized on the need for including recharge ponds and spring protection projects in their annual and periodic plans both at the local (VDC, Municipality) as well as at the district levels. So far, the project was successful in convincing the local planners, and it is hoped that this will help create a strong demand for these activities to be continued well into the future, and in much wider areas by bringing it to the attention of planners and decision makers at the higher (regional and national) levels as well.

References

- ACWADAM, R. (2011). Hydrogeological Studies and Action Research for Spring Recharge and Development and Hill-top Lake Restoration in Parts of Southern District, Sikkim State. Advanced Center for Water Resources Development and Management (ACWADAM) and Rural Management and Development Department (RMDD), Government of Sikkim, Gangtok. http://sikkimsprings.org/dv/research/ACWADAM_report.pdf.
- CBS, (2012). *National Population Census, 2011. Household and Population by Sex, Ward Level, Kavrepalanchowk*. Kathmandu: Central Bureau of Statistics, Government of Nepal. Department of Local Infrastructure Development and Agricultural Roads. (2013). *Recharge Ponds Handbook for WASH Programme*.
- Upadhya, M. (2009). *Ponds and landslides: Water culture, food systems and the political economy of soil conservation in mid-hill Nepal*.

Chapter 5

Plenary Session IIIA
Improving Livelihoods
Resilience

Improving Livelihoods Resilience

- Chair** – Yubak Dhoj GC, DoA, GoN
- Moderator** – Juerg Merz, HELVETAS, Swiss Intercooperation
- Presenters**
- Santosh Raj Poudel, DoA, GoN
 - Bikram Rana Tharu, HELVETAS, Swiss Intercooperation
 - Raj Kumar GC, iDE, Nepal
 - Pranita Bhusan Udas, ICIMOD

Key Messages

- Improved technology will reduce burdens on women and marginal farmers. Riverbed farming (e.g., utilization of sand-covered land) is a viable livelihood option for marginal and landless farmers as an adaptation measure. Riverbed farming can go hand in hand with agroforestry and should be included in education curricula.
- Riverbed farming as a policy priority and should link to policy agenda on food security. Helvetas' Alliance for Riverbed Farming could be a good source of data in this instance.
- Planning at the watershed and catchment levels are needed to address problems that extend beyond administrative boundaries.
- MUS and WUMP approaches should be synergized for a watershed approach, and strong links will be required for success.
- Integrated water resource planning and enhanced understanding of the dimensions of upstream downstream relations are needed.
- Improper management of water and improper systems affect water efficiency and productivity.
- Investments on water systems are not linked to market systems.
- WUMP policy needs greater scaling out and uptake.
- More attention is needed for gender integration in water management planning.
- Recommendations should be simple, easy, and replicable by multiple actors.

Summary of Presentations

Santosh Poudel from the Nepal DoA discussed riverbed farming for enhancing livelihoods in the Koshi Basin. He explained that initiatives by DoA, and several national and international development organisation, are underway on riverbed farming. Some of the challenges facing riverbed farming include farmers with poor access to financial institutions, decreasing soil fertility due to siltation, rivers changing course, and finding the appropriate selection of soil, security, theft, and crop insurance.

Bikram Rana from HELVETAS highlighted the significance and effectiveness of the water use master planning or WUMP. Rana explained that HELVETAS has been using a participatory approach and helping local communities to prepare WUMPs, by supporting planning with scientific information and seeking to integrate consideration of gender. While Nepal has many levels of water acts and guidelines on the books, there is a lack of planning at the watershed and catchment levels to address problems that extend beyond administrative boundaries. WUMPs help address these shortcomings.

Rajkumar GC from iDE discussed multiple use water systems (MUS) and micro-irrigation technologies (MIT) for the Koshi Basin. GC said that even though systems are allocated for single use, people use them for many purposes. Improper management of water and improper systems affects both the efficiency and productivity of water. Investments on water systems are not linked to market system. MUS is low-cost technology that can reduce workloads for women. MUS and WUMP approaches should be synergized for watershed approaches and strong links will be required.

Pranita Bhusan Udas from ICIMOD said many good gender practice had been implemented through WUMP preparation and pond rehabilitation initiatives. She said there is was a need to scale out and increase the policy uptake of WUMP. As one example, Udas described the impact of pond rehabilitation in Sipapokhari, Nepal, where

women farmers can now access more water and have a greater role in income generation activities like fishing and vegetable farming.



Riverbed Farming for Enhancing Livelihoods: Cases from Koshi River Basin

Santosh Raj Paudel¹⁶

Abstract

Riverbed provides great opportunity for livelihood improvement of small, marginal and landless farmers. In the short term, riverbed farming may increase farmers' vulnerability to environmental shocks. In the medium and long term, it increases households' resilience and creates rural employment opportunities, and Department of Agriculture (DoA) has less initiatives in this sector whereas non-governmental actors have initiated several activities related to riverbed farming in their respective working districts. It could be part of a community-based adaptation to the impacts of climate change and a good livelihood option for the small, marginal, landless and women farmers.

Introduction

Agriculture is the major sector of the Nepali economy contributing about one-third (31.23%) of the national economy (CBS, 2014) and livelihood of 65.6 percent population (MoAD, 2014). Nearly half of the small farmers and a majority of the two percent of the population in Nepal – that is landless – live below the national poverty line (Schiller, 2014).

Nepal has more than 6,000 small and big rivers including four major watersheds: Koshi, Gandaki, Karnali and Mahakali. The Koshi River basin lies in the eastern part of Nepal and is counted as one of highest silt yield rivers in the world due to extensive soil erosion and landslides in its upper catchment areas (Kafle et al., 2015).

As a consequence of climate change, landslides, soil erosion, flash floods, droughts and famine have been nationwide issues and are in increasing trends. Agriculture is highly affected by climate and climate change induced disasters, which in turns lead to unsustainability of the livelihood of the vulnerable rural poor. Heavy floods during the rainy season have converted large areas as wasteland in many parts of Terai Nepal. As a result, there is significant area in Nepal under riverbeds and riverbank, and the area is increasing every year and thousands of families have been displaced from their farming profession to the landless situation (FORWARD, 2015).

Over the past few decades, there has been spiralling population growth making arable land limited for food production. Instead of threatening people's life, it provides great opportunity for livelihood improvement of such small, marginal and landless. Progress on poverty can be achieved by using such riverbed under cultivation, i.e. riverbed farming.

What is Riverbed Farming?

Riverbed farming is understood as the 'cultivation' of riverbed land during the dry season, or of land that is subject to annual flooding. It has shown to be an encouraging measure to alleviate poverty of the landless and land-poor households of the Terai region in Nepal. The main crops of riverbed farmers are watermelon followed by cucumber, bitter melon, bottle gourd, green pumpkin and smooth gourd.

Characteristics of Riverbed Farming

Riverbed farming was introduced in the Terai region of Nepal by Indian immigrants who did not possess land for cultivation. The characteristic feature of riverbed farming are low initial investment, no land ownership required,

¹⁶ Department of Agriculture, Government of Nepal

use of formerly unused land through lease, local adaptation to climate change, no extra irrigation is necessary if the groundwater table is < 1 m, no waste water is produced, 98% of inputs are sourced on-farm and all waste is recycled or re-used on-farm (Gurung, 2014).

Why Riverbed Farming?

Seasonally dry riverbeds are an under-utilized resource that can be used for sustainable horticultural crop production. Cucurbit vegetables are produced for household consumption and market sale. Besides that banana farming and fish farming are also in practices. In the short term, riverbed farming may increase farmers' vulnerability to environmental shocks. In the medium and long term, it increases households' resilience and creates rural employment opportunities (Katharina et al., 2013).

Policy and Programmes

Several policies are related to livelihood improvement of the small, marginal and women farmers. National Agricultural Policy, 2004 adopted special facilities for target groups. Target groups were farmers having less than half a hectare of land and lacking irrigation facilities, farmers belonging to Dalit and Utpidit (underprivileged) classes and other marginal farmers and agricultural workers (MoAD, 2004). The current Thirteenth Plan (FY 2013/14–2015/16) envisages that credit facilities will be provided to small and marginalized farmers and forest entrepreneurs and traders under simplified, easy-to-grasp conditions (NPC, 2013). Whereas, 27-Point Commitment of MoAD (20161) also committed special targeted program, support and facilities for such groups. Besides that, MoAD (20162) has formulated 'Marginal Community Targeted Program Implementation Guideline 2072' for the support of such marginalized people. In 2013, the national riverbed farming policy, "Local Riverbed Farming Promotion Policy–2070" was drafted, and the final version is awaiting for approval from Council of Ministers. Implementation guideline has been drafted by Ministry of Federal Affairs and Local Development (HELVETAS, 2014).

DoA bears the responsibility to support and help achieve food security and poverty reduction by the transformation of agriculture through diversification and commercialization (DoA, 2016). As majority of the farmers are small, marginal and women, it is impossible to reduce poverty without increasing the opportunity employment for such groups. But there is no specific program on riverbed farming instead of providing supports to such groups through various programs.

DoA through District Agricultural Development Offices (DADO) is implementing riverbed farming activities as targeting small, marginal and women farmers to support poverty reduction and improving food security as own devolved agricultural extension program and in collaboration with non-governmental partners.

Organization Involved in Riverbed Farming

Several governmental and non-governmental actors have initiated activities related to riverbed farming in their respective working districts. DoA is in the preliminary stage of the implementation and dissemination of riverbed farming technology. Non-governmental organizations such as Forum for Rural Welfare and Agricultural Reform for Development (FORWARD), HELVETAS Swiss Inter-cooperation, Inclusive Development of the Economy Programme (INCLUDE) represented by GIZ, Lutheran World Federation (LWF), Mercy Corps, Micro Enterprise Development Programme (MEDEP) and Poverty Alleviation Fund (PAF) have initiated the Riverbed Farming Alliance (RFA) with an objective of promoting riverbed farming in Nepal, exchange of experience, and improvement of inter-organizational learning (Gautam, 2015).

Area Available for Riverbed Farming

About 6,000 rivers flow towards the southern region of Nepal, where they cover large areas and over time have developed huge riverbeds. About 78 thousands hectare of land is potential for riverbed farming (Table 7). As per Gautam (2015) riverbed in Nepal in various districts which can be used for farming is as follows:

Table 7: Estimated availability of riverbed area by development region and district

S.N.	Region/District	Riverbed area (Ha)	S.N.	Region/District	Riverbed area (Ha)
	EASTERN	28,485		WESTERN	8,302
1	Saptari	8,427	13	Bara	1,406
2	Sunsari	6,994	14	Nawalparasi	4,283
3	Jhapa	4,997	15	Kapilvastu	2,142
4	Morang	3,528	16	Rupandehi	1,877
5	Udayapur	2,304		MID-WESTERN	9,844
6	Siraha	2,235	17	Bardiya	4,176
	CENTRAL	23,855	18	Dang	3,711
7	Makawanpur	5,914	19	Banke	1,957
8	Mahottari	4,851		FAR-WESTERN	7,523
9	Sarlahi	3,542	20	Kanchanpur	4,799
10	Rautahat	2,971	21	Kailali	2,724
11	Parsa	2,752		NEPAL	78,009
12	Dhanusha	2,419			

Source: Gautam (2015)

Major Activities Implemented by Department of Agriculture (DoA)

Technical support

- Advisory service: The District Agricultural Development Office (DADO) provides plant protection expertise and technical backstopping
- Training and awareness raising: The Regional Agricultural Training Centre of the DoA trains the local resource persons. After training, they help to raise awareness among landless and land-poor farmers of the advantages of riverbed farming and they also give them technical training and extension services.
- The DADO provides Agriculture Service Centre level training and on the spot mobile training

Support/subsidies

- Group formation and mobilization
- Subsidies on agricultural inputs such as seeds, organic manure, fertilizers (chemical as well as organic especially vermicompost), agricultural tools/equipment, bio-pesticides, plastic sheets
- Subsidies on small irrigation scheme establishment and rehabilitation
- Subsidies through youth targeted commercial vegetable production program and fish mission program

Coordination/collaboration

- Coordination and collaboration with INGOs/NGOs and other partners

Riverbed farming activities in Koshi River Basin

- The DADOs are implementing limited riverbed farming activities through devolved agricultural extension program along with youth targeted commercial vegetable production program in the district. Besides that FORWARD Nepal, in collaboration with DADO of Saptari, Siraha, Morang, Jhapa and Sunsari districts, a Riverbed Vegetable Farming project is on-going since May, 2011 (FORWARD, 2015) (Table 8).

Gender in Riverbed Farming

Women make up 56 percent of riverbed farmers and the proximity of the fields to the home as very important, highlighting the multiple roles females play domestically and as producers (FAO, 2011). Social sustainability of

Table 8: Riverbed farming activities in KRB by DADO

Districts	Present scenario and activities implemented
Sunsari	Implementing youth targeted commercial vegetable production program on riverbed with focused on youth, low income marginal people. Especially cucurbits (pointed gourd, sponge gourd, bitter gourd, watermelon, etc.) are grown. About 4200 metric tons (mt) of pointed gourds worth NRs. 8.4 million was produced from 350 Ha area. Fish farming is also focused on riverbeds targeting low income people in 70 Ha with extension possibility on 420 Ha. About 600 farmers are involved and produced 245 mt of fish.
Saptari	Implementing riverbed farming project in 10 ha of Kalyanpur and Sundari Khola riverbed with 75 Households involvement and produced 60 metric tonnes of vegetables of NRs 1.16 million value. DADO provides technical supports and subsidy in vegetable seed, bio-pesticides and chemical pesticides, plastic sheet, shallow tube wells etc. Banana farming program is also in practice in 1,000 ha of river basin area.
Morang	DADO supported riverbed farmers through Youth Targeted Vegetable Program and seed subsidy. 345 farmers from 17 groups of 9 VDC are involved in riverbed farming at the riverbed of Ratua, Bakraha, NunaBakraha, Chisa and Lohandra River. Last year farmers earned NRs 7.8 million from 40 Ha of riverbed farming.
Jhapa	Commercial vegetable production project implemented in 132 ha of Kankai riverbed of Shiva Satakshi Na.Pa. About 400 low income farmers' are involved and earned 4.2 million rupees from cucumber cultivation only. DADO provided economic support through Youth Targeted Commercial vegetable production program

farming has to focus on rural job creation and inclusion of females. In seven of the nine villages in Kailali and Kanchanpur districts, male outmigration for work has slowed or ceased since the introduction of riverbed farming (Katharina et al., 2013).

Impacts on Livelihood

Riverbed farming is an activity that contributes significantly to increasing farmers' incomes, and materials for mulching, fencing and shelter are available locally. From 224 kilograms of inputs, only .01% of it came from off-farm i.e. improved seeds and chemical inputs produces 16,496 kilograms of vegetables per hectare (Katharina et al., 2013).

Study conducted by Katharina et al. (2013), on Kailali and Kanchanpur districts of Far-Western Nepal shows that farmers earn an average of US \$2,478 per hectare, which translates to \$335.66 per household from 4 Katha (1,352m²) of standard plot area. Whereas a study by Gurung (2014) stated that riverbed farmers harvested an average of 16,500 kg of vegetables per hectare, which are consumed (25%) in the household, and sold (75%) at market with gross agricultural margin per hectare of NPR 135,154 (US\$ 1,533.34) and NPR 18,020 (US\$ 204.44) for a 1354 m² plot.

Riverbed farming is labour-intensive during field preparation and harvest times. Riverbed cultivation employs 24 people per hectare, who at the beginning are all from the farmers' immediate households (Katharina, 2013).

With increased income from riverbed farming people have started investing in other businesses. e.g., small retail shops, poultry, animal husbandry, sewing, and purchasing of tractors. Ultimately it is contributing to improve health, hygiene, education levels and schooling rates of the community (GIZ INCLUDE, 2014).

Issues and Challenges on Riverbed Farming

There are some issues related to riverbed farming crucial for the livelihood improvement of the farmers involved.

- It is seasonal and only one crop can be grown in a year
- Commercialization of riverbed farming needs more investment as poor, small and marginal farmer's involved in farming
- Sustainable income generation of the small, poor and land less farmers as it is seasonal in nature
- Low investment by farmers due to poor access to financial institutions
- Technical knowhow of the farmers and frontline extension workers
- Decreasing soil fertility due to siltation

- Risk of recurrent of flood and changing course of river that can damage the crop and riverbed prepared for farming
- Appropriate selection of site: no extra irrigation is necessary if the groundwater table is <1 m, which reduces the cost of irrigation and fertilizer management is crucial as it is practiced in sandy soil. Sometimes late monsoon and early monsoon heavily damage the crop.
- Security threats on stolen of the produce because riverbed farms are generally away from village or settlements
- Protection of crop from wild animal by fencing the farm boundary
- Crop insurance is necessary to minimize the crop losses due to the risk of flooding and damaged from wild animal

In spite of these challenges, riverbed vegetable farming is an appropriate means of livelihoods of many landless and land-poor families by utilizing the wastelands.

Conclusions and Way Forward

Riverbed farming is a low-environmental-impact, easy-to-learn, cost-effective technology allowing landless households to produce on unused marginal lands. By utilizing an under-exploited resource and enhancing farmers' production skills on marginal soils, leasehold riverbed farming increases marginal farmers' options for sustainably coping with the effects of climate change. So, riverbed farming could be part of a community-based adaption to the impacts of climate change and a good livelihood option for the small, marginal, landless and women farmers. Besides that, an integration of other agro-ecological issues, such as agro-forestry and reforestation of the riverbanks, is a good opportunity.

As DoA is in preliminary stage in the implementation and dissemination of riverbed farming technology, it expects coordination, collaboration and supports for the improvement of the livelihood and food security of such marginal, small and landless households and the technical capability enhancement of the frontline extension workers with all concerned stakeholders through existing as well as new initiatives and programs.

References

- CBS. (2014). *National Accounts of Nepal 2014/15*. Central Bureau of Statistics, Ramsaha Path Kathmandu, Nepal.
- DoA. (2016). *Annual Progress Report 2014/15 (Barshik Pragati Partibedan 2071/72)*. Harihar Bhawan, Lalitpur, Nepal: Department of Agriculture, Ministry of Agricultural Development, 2016.
- FAO. (2011). *The Role of Women in Agriculture*. ESA Working Paper 11-02. Rome: Agricultural Development Economics Division, Food and Agricultural Organization.
- FORWARD. (2015). *Annual Report 2014/15*. Forum for Rural Welfare and Agricultural Reform for Development. Bharatpur, Chitwan, Nepal.
- Gautam, K. R. (2015). *Riverbed Farming in Nepal: A documentation on the Process and Methodology*. GIZ Inclusive Development of the Economy Programme (INCLUDE).
- Gurung, H. (2014). *Technology factsheet: Leasehold riverbed vegetable farming*. HELVETAS Swiss Intercooperation Nepal.
- HELVETAS. (2014). *Annual Report*. HELVETAS Swiss Inter-cooperation Nepal.
- GIZ INCLUDE (2014). *Riverbed Farming in Dang: A pro-poor approach in income generation*. GIZ Inclusive Development of the Economy Programme (INCLUDE).
- Kafle, K. R.; Khanal, S. N. & Dahal, R. K. (2015). Dynamics of the Koshi River on the Perspective of Morphology and Sedimentation with Emphasis on Post Disaster Impact of the 2008 Koshi flood. *Journal of Science, Engineering and Technology*. Kathmandu University. Vol. 11, No. 1, August, 2015, pp 71-92.

- Katharina, S; Kriesemera S. & Gerster-Bentayab, M. (2013). Smallholders' Adaptations to the Effects of Climate Change: The Sustainability of Leasehold Riverbed Farming in the Terai. Paper Presented In Conference on *International Research on Food Security, Natural Resource Management and Rural Development* organized by the University of Hohenheim, Tropentag 2013, Stuttgart, Germany September 17-19, 2013.
- Katharina, S. (2014). *Assessing the Sustainability of Leasehold Riverbed Vegetable Farming for Landless and Land-poor Households in the Terai of Nepal*. Master thesis, University of Hohenheim, Institute for Social Science in Agriculture, Bruno-Stürmer Str. 1 60529 Frankfurt / Main Hohenheim, July 26, 2014.
- MoAD. (2004). *National Agricultural Policy*. Ministry of Agricultural Development, Singha Durbar, Kathmandu, Nepal.
- MoAD. (2014). *Statistical Information on Nepalese Agriculture 2013/2014*. Government of Nepal Ministry of Agricultural Development, Agri-Business Promotion and Statistics Division, Agri Statistics Section, Singha Durbar, Kathmandu, Nepal.
- MoAD. (20162). *Marginal Community Targeted Program Implementation Guideline 2072*. Ministry of Agricultural Development, Singha Durbar, Kathmandu, Nepal.
- MoAD. (20161). *27 Point Commitment of Ministry of Agricultural Development*. Ministry of Agricultural Development, Singha Durbar, Kathmandu.
- NPC. (2013). *An Approach Paper to the Thirteenth Plan (FY 2013/14–2015/16)*. National Planning Commission, Government of Nepal, Singha Durbar, Kathmandu, Nepal.

Establishing Water Use Priorities and Enabling Effective Rehabilitation Response, the Local Water Use Master Plan

Bikram Rana Tharu¹⁷, Rabin Niraula¹⁷, Nilhari Neupane¹⁸, Harshana Shrestha¹⁸, Santosh Nepal¹⁸

Abstract

Since 2014, ICIMOD and HELVETAS Swiss Intercooperation Nepal have collaborated for action research to develop Water Use Master Plans (WUMP) in three Nepal districts – Sindhupalchowk, Sindhuli and Saptari – representing the three ecological zones – the mountains, mid-hills, and the plains of the Koshi River Basin. This action research aims to develop local level water use plans at Village Development Committee (VDC) level and then upscale these plans to sub-watershed and watershed levels. Household surveys, technical, and participatory approaches were employed to collect socio-economic and technical information for the WUMP preparation.

The preliminary results of the collaborative action research and HELVETAS' previous work in the Upper Melamchi catchment of Sindhupalchowk show that water use priorities are focused more on irrigation schemes and multiple water use systems. The conflicting water demand between competing interest groups (i.e., upstream fishery communities and downstream rice growers) are being resolved through negotiation processes as part of WUMP formulation in this area. In Sindhuli, there is scope for incorporating the upstream-downstream dimension along the Adheri Khola catchment. The catchment has potential for tapping water in the upstream area, which can fulfil the irrigation demands of downstream. In Saptari, additional groundwater potential has been identified. In addition to water priorities, a WUMP study in this area was found to be very useful to plan for disaster rehabilitation for resilient livelihoods. Data collected in this WUMP process were used extensively to design and implement relief and rehabilitation activities in Sindhupalchowk.

Introduction

As a primarily agrarian country, water has a critical function in Nepal's economy. Water scarcity, poor water quality and unsustainable supplies limit economic development and can lead to adverse health and livelihood conditions for mountain communities. While much of the literature focuses on improved water availability for economic growth and development, scarcity and poor management aggravate water challenges during natural disaster, as was evident after the 2015 earthquake in Nepal.

The Nepal Multiple Indicator Cluster Survey 2014 indicates 6.8% of the population depends on drinking water from unimproved and unprotected sources while 48% rely on wells, springs, and tube wells. Forty-five percent have access to private or public pipe system water supplies (CBS, 2015). Water from pipe systems is still unsafe in terms of quality. In topography like Nepal's, water availability does not always equal accessibility. 4.5% of households travel more than 30 minutes to reach a water source, this category indicates as poor service level, while 21.9% of those who are also considered having access to improved water are travelling less than 30 minutes to the source (CBS, 2015). Average water fetching time less than 30 minutes per trip indicates the service level is acceptable (moderate).

Among several development priorities, water resource management is also practised at VDC level. The Local Self-Governance Act 1999 provides a framework for VDCs to coordinate local development planning and effective implementation of development activities. Unlike large water projects such as hydropower, irrigation, and water

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supply, local communities completely rely on the planning process and development activities conducted by their respective VDCs to secure local irrigation, drinking water, and other water uses. Though VDCs are charged with coordinating local development planning, including water resource management and implementation, they still lack capacity to demonstrate effective planning and implementation, mainly due to a lack of information and skill capacity. For these reasons, HELVETAS initiated community-led WUMPs in 1998 to provide detailed information to increase the capacity of local governments in water resource management.

WUMP Background

In Integrated Water Resources Management (IWRM), developing an institutional framework capable of integrating human systems is a considerable challenge. WUMPs provide a plan through which local governments and communities interact, exchange knowledge, acquire and obtain ownership over the water management plan, and commit to agreed roles responsibilities for its planning, implementation, monitoring, and reflection. The process applies a participatory approach of change envisioned in the IWRM concept. WUMP is not only a water management plan, but also a means to engage local communities to address adaptation needs in the context of climate change. The process promotes dialogue among local stakeholders, augmenting the participatory and equity principles of IWRM. WUMP maps all water resources, creating an inventory of existing uses and the potential use of water resources. It promotes multiple uses of water (Rautanen et al., 2014) to maximize livelihood benefits. The planning process of a WUMP is backed by principles of gender equality and social inclusion (Rautanen and White 2013). WUMPs enhance the development capacity of local communities, local institutions, and water sharing processes for equitable distribution (Rautanen and White, 2013). The relevant country laws for the entry of IWRM into local contexts without losing the benefits of IWRM. IWRM in its logical unit - the hydrological boundary - requires significant investment. It also includes components to build adaptation capacities in the face of adverse effects of climate change and natural disasters. As a country facing water scarcity, Nepal needs entry points for the development of IWRM. Participatory WUMP at the VDC level can be taken as the entry point for translating IWRM yardsticks.

Participation takes shape when local communities come together to make water supply management and use choices (Rautanen et al., 2014). Democratically-elected representatives from institutions establish human connections to the economy, society and politics; therefore, the institution is the unit of management for WUMPs; in Nepal's case, the village-level Water Sanitation and Hygiene Coordination Committee (VWASH-CC) fills this role, representing each VDC ward with equal gender representation.

Objective of the Paper

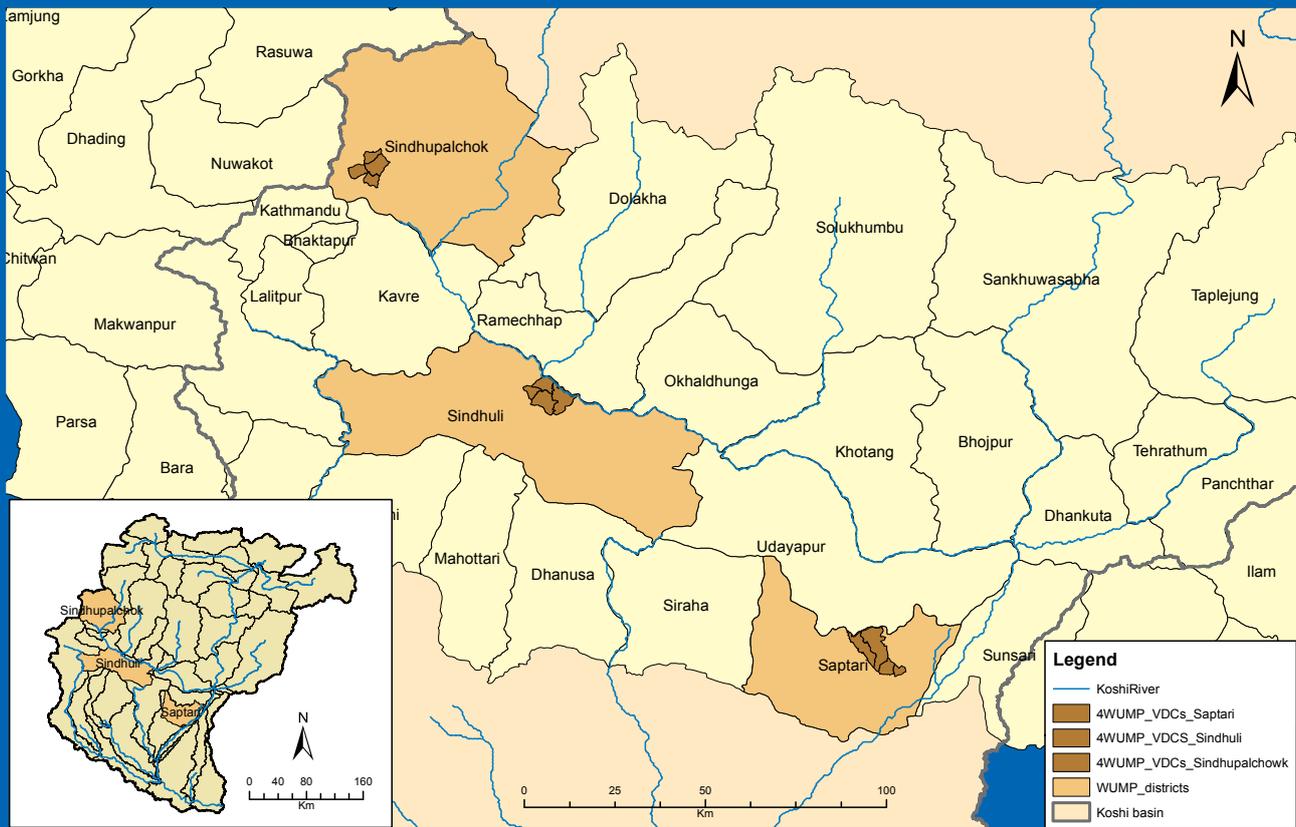
The overall objective of the WUMP is to facilitate equitable, efficient, and sustainable utilization of water for improved livelihoods. It is based on participatory assessments of available water resources, participatory prioritization and planning, coordination with aligned stakeholders, and capacity building of the stakeholders involved. This article explores to what extent WUMP implementation in several ecological zones of Koshi Basin of Nepal is contributing to achieving overall WUMP objectives. Additionally, we present some insights from the earthquake affected VDCs of Sindhupalchowk to understand how WUMPs are helping to develop resilience in the post-disaster context.

Study Area and Methods

ICIMOD and HELVETAS Swiss Intercooperation have collaborated to upscale local water use master planning at the sub-watershed and VDC levels. ICIMOD and HELVETAS collaborated to initiate pilots in three ecological zones in Nepal's Koshi Basin: Sindhupalchowk, Sindhuli and Saptari (Figure 17).

After the disaster, out of three sites (Sindhupalchowk, Sindhuli, Saptari) HELVETAS Swiss Intercooperation Nepal responded in Sindhupalchowk district. A case of Mahankal VDC from Sindhupalchowk is presented where a WUMP had already been prepared in 2014 under the Water Governance Project funded by IDRC Canada. This work provided a basis against which to compare before and after disaster. We expect this knowledge to serve as a milestone on how WUMPs can actually improve the resilience of communities during such times.

Figure 17: Location of Water Use Master Plan coverage VDC in Koshi Basin



Findings

Sindhupalchowk case (Mahankal)

Mahankal in Sindhupalchowk lies in the Melamchi watershed within Indrawati sub-basin of the Koshi Basin. The area represents mid-hills to high-hills topography with an elevation range of 950 to 2,700 meters above sea level. A majority of the inhabitants are Tamang, Sherpa, Newar, Dalits and Brahmins. Based on a 2014 field survey, Table 1 shows the ethnic composition of the district.

Interesting characteristics in the settlements among different casts/ethnic groups exists. Sherpa's reside at the top of the mountain in cluster where fewer water sources are available. Most of the water sources are available at elevations lower than the settlements which makes development of water infrastructures costly and less feasible. Tamang mostly reside mountain and hill slope just below the Sherpa's community mostly in clusters where allocation of water resource is viable but development of infrastructures very costly.. Dalit clusters are scattered along the hill and foot hill of the mountains. Their clusters are sometimes far from the Brahmin and Chhetri's households. They are sometimes denied allocation of water resources from the common sources primarily due to prevailing social structures and taboos

Table 9: Ethnic composition of WUMP Implemented VDC, Mahankal, Sindhupalchowk

Ward No.	Household			Total
	Dalit HH	Janjati HH	Other HH	
1	38	85	109	232
2	5	116	1	122
3	0	110	0	110
4	0	107	0	107
5	0	113	0	113
6	0	119	0	119
7	0	132	0	132
8	6	108	11	125
9	3	6	113	122
Total	52	896	234	1,182
Percentage	4.4	75.8	19.8	

Source: Field Survey, 2014

which is slowly diminishing than the previous. Newars, Brahmins, Chhetri and others are settled primarily in the valleys (like wards 1 and 9 in the study area) with abundant water supply for drinking and irrigation, and hence, they have greater economic activity and agricultural opportunity.

The use of existing water resources, mainly for drinking, determines the service available to the communities. Table 2 shows the means and percentages for the different types of water collection systems in the study area. Few families mostly from Dalit also use water during summer directly from open sources such as streams and springs which is sometimes not safe for drinking.

In Mahankal, access to safe and affordable water for all seems to require much effort and financial resources. Table 2 shows that wards 4, 5 and 7 have no household access to managed piped water. A proper WUMP can address inequities like this.

Table 3 presents the water priorities of the various wards in the whole VDC. The priorities are made through full participation of the local communities and local stakeholders in a ward level meeting where as technical inputs were provided by the WUMP's facilitators and technical team. From the table, it can be inferred that in all wards, the first priority was drinking water which shows drinking water is really a constraints. In most of the wards, local community prioritized for Multiple Water Use System (MUS) schemes. In MUS schemes are small water schemes primarily for the purpose of drinking water and the surplus water is diverted to small scale kitchen gardening and family pond. Unlike the case of mid-hills and plain, where community is more interested in irrigation schemes, the first priority in Sindhupalchowk is mostly found for drinking water.

The major output of a WUMP is a representative prioritisation of water supply and irrigation schemes, which are highly contested among local communities during the allocation of annual VDC budgets. A total of 21 drinking water supply schemes and 24 multiuse systems are prioritised in Mahankal VDC water use master plan.

Similarly, 18 irrigation schemes are prioritised in the plan which draw largely on participation and consensus for equitable sharing of water.

Dialogue during WUMP preparation is used to resolve conflicts for competing uses, such as water for fisheries and expanded canals for irrigation. The upstream fishery owner paid for the expansion of the canal so the fish farm receives sufficient water while the downstream irrigation system suffers no loss in the quantity of water receives.

Out of these prioritised schemes, those affected by the 2015 earthquake were immediately prioritised for rehabilitation after the disaster, which enabled effective response. Community people were devastated by earthquake and in a position to allocate time for assessment and to conduct conversation for priorities. In such a scenario, WUMP was the only document in existence to provide reference to community attitudes prior to carrying out rehabilitation. It not only saved time but also ensured equitable response.

Table 10: Types of water sources for domestic use

Ward No.	Type of water source used by HH				Total (HH)
	Managed piped water	Dangling piped water	Kuwa	Spout/Dhunge Dhara	
1	46	120	13	31	210
2	82	28	0	0	110
3	9	101	0	0	110
4	0	104	30	0	134
5	0	113	0	0	113
6	37	82	0	0	119
7	0	126	0	0	126
8	51	57	8	5	121
9	47	72	2	0	121
Total	272	803	53	36	1164
%	23	69	4	3	

Source: Field Survey, 2014

Table 11: Example of WUMP's scheme prioritization

Priority order	Project type	Name of scheme	Ward No.
1	Drinking Water Supply	Pakha Mul Chitre Pipse DWS	4
2	Multi Use System	Kopole muni lava gaaun MUS	7
3	Multi Use System	Homrang khola blon thing MUS	5
4	Multi Use System	Aarkhale Siran MUS	6
5	Multi Use System	Chachok khola syantan blown MUS	5
6	Multi Use System	Paakha gaaun bharati MUS	7
7	Multi Use System	Kalumurung yakar biman MUS	6
8	Drinking Water Supply	Gengabaa khola chitre pipse DWS	4
9	Multi Use System	Kaya singe tole MUS	7
10	Drinking Water Supply	Baadhi gaaun pandhera sudhar DWS	4

Source: Field Survey, 2014

Post-Disaster Scenario

In 2015, Nepal was hit by major earthquake with a magnitude of 7.8 Richter scale on 25 April and a second major quake of 7.3 on 12 May which damaged 95% of the households in Sindhupalchowk. In the immediate months after the quakes, food, drinking water and sanitation emerged as burning issues in the earthquakes hardest-hit areas (Rasul et al., 2015). In Mahankal, the WUMP in place improved the VDCs ability to restore its water supplies by providing information on households and the conditions of the water supply.

Moreover, Village Water Supply and Sanitation Hygiene Coordination Committee (V-WASH-CC) of Mahankal, which was responsible for the development of WUMP, formed a Relief Management Committee mainly because it already consisted of the locally accepted different actors in the VDC, such as the VDC Secretary, the health post representative, political leaders, ward representatives and teachers. The committee coordinated with village level disaster management, which kept the local participation active without much interferences from the outside. WUMP supplemented different information that were required for the planning and conduction of response and rehabilitation after disaster. Our study team learned the following evidences from WUMP's pilot area helpful to improve the community's resilience in response to disasters recovery and rehabilitations:

- Household information of different clusters (villages) allowed to plan the quantity of response material and dropping points with responsible persons to take care for delivery and distribution of response material.
- In any kind of long term planning or emergency, local mechanisms and institutions can be vital to managing resources such as the VDC and V-WASH-CC in the case of WUMPs. The existence of such committees ensures and improves governance and promotes resilience.
- Information is crucial for good governance. While most of the physical structures and the local level institutions as well were collapsed due to the earthquake, management of resources need first-hand information to understand the status. Much of this valuable information was provided by the area WUMP.
- Ward representatives and VDCs can be more accountable once they are clear about roles and responsibilities informed by the information provided by the WUMP.
- Prioritisation exercises during WUMP preparation provided insight to locals on what resources were available and what should be immediately replicated post-disaster. This improved distribution transparency.
- The equitable distribution of resources was practised by the committee based on the identification of marginalised and disadvantaged groups and by evaluating extent of the disaster.

Building Resilient Communities in the Koshi Basin

Each of the study sites employs a WUMP that attempts to address water challenges unique to that area. In Melamchi, the Sindhupalchowk district demonstrates competing water uses in agriculture, fisheries and the planned Melamchi inter-basin water transfer project, which will aggravate water hardship in the area as climate change brings more extreme precipitation and prolonged droughts to the area.

In Sindhuli, people in the Ghokshila watershed face severe water hardship during dry periods. The local residents of Ghokshila have complained about drying water sources and severe outmigration. To deal with these problems, the WUMP suggested mapping for different water management options, including rain water harvesting for household consumption and 3R (recharge, retention and re-use) measures to conserve and revive water resources where such resources are already limited.

In Andheri Khola catchment of Sindhuli where Ratanchura and Jalkanya VDCs (upstream) and Bhimeswor (downstream), these VDCs provide an interesting perspective on upstream downstream linkages of land and water management. While most of the springs originate in upstream VDCs, the flowing water irrigates fertile plain lands

Table 12: Water sources and agriculture status in the study area

VDCs	Water sources (numbers)	Total cultivated area (ha)	Irrigation coverage (%)
Jalkanya	86	227	48
Ratanchura	13	70	47
Bhimeswor	13	355	43

Source: Field survey, 2016

in downstream Bhimeswor. Due to higher water availability, the irrigation facility available in the downstream areas yields more production per unit area.

However, despite these strong water linkages between upstream and downstream VDCs, we did not find any institutional linkages between the groups. Although problems related to water sharing are solved by stakeholders within VDCs, they stayed within their areas and did not approach neighboring VDCs to coordinate their interdependence. The information on water sources in the upstream (Jalkanya) and the water used in downstream (Bhimeswor) provide a basis for these VDCs to discuss conservation and management of water resources for competing uses.

In Saptari district, in the Mahuli watershed, the groundwater is the main source for drinking, and surface water and groundwater pumping are the main sources for irrigation. The surface water from the Mahuli Khola is not sufficient for irrigation and makes cultivation difficult in the summer. The groundwater for drinking is poor quality and requires testing for physio-chemical parameters. For fisheries and livestock, residents used rainfall and runoff retained in ponds. Improving resilience in these areas of the Koshi Basin is also based on a locally-developed WUMP, which has established water resource development priorities that focus on improved access of communities to water.

How WUMP is Contributing to Resilient Livelihoods?

Socio-economic changes coupled with climate change have impacted water resources and posed serious challenges to people's livelihoods. WUMPs can provide support for resilient livelihoods by contributing to these different livelihoods assets:

Human capital: Capacity building for local stakeholders, women groups, and community's people (beneficiaries) by hiring local staff and training them in WUMP planning and execution.

Financial capital: Increased farm income due to greater availability of irrigation facilities to strengthen financial capital.

Social capital/institutional capital: The formation of V-WASH-CC, water users groups, women groups, and sanitation groups to strengthen the role of Nagarik Manch.

Physical capital: Water-related schemes/infrastructures such as drinking water, irrigation infrastructure, water and sanitation structures, river protection structures, and multiple water use systems help to promote physical capital at local level.

Natural capital: Preparation of a water resource inventory, land cover, land use map, and forest cover map to understand the natural resources available in the community.

Conclusions

WUMP is an instrument to strengthen resilient livelihoods not only in ideal conditions, but also in extreme conditions and disasters. WUMPs attempt to incorporate the indicators of good water governance into local administrative structures. Participation of community members at the grassroots level is ensured by the WUMP, as well as open information, which reduces the influence of power and augments balanced decision making. The preliminary lessons of the collaborative pilots discussed in this paper have provided positive results in terms of local water planning, prioritization of schemes, and coordination with local stakeholders. WUMP has been found to play a significant role in strengthening livelihood assets and fostering holistic and sustainable development of a community.

Information collected by WUMPs was equally useful in earthquake response and rehabilitation work. WUMPs establish priorities for drinking water schemes, irrigation, and various other water uses, which are critical post-disaster for determining how basic services are established and livelihoods are maintained. Preparing a WUMP after disaster is not advisable. WUMP should be in place.

These pilots in our study suggest the need of upscale WUMPs in other parts of Koshi basin where the role of local government should be more pronounced in future. Capacity building of the stakeholders is crucial for WUMP upscaling. Lessons from upstream downstream interdependencies suggest that WUMPs should be considered for implementation at the catchment level as well.

References

- Central Bureau of Statistics, (2015). *Nepal Multiple Indicator Cluster Survey 2014, Final Report*. Kathmandu, Nepal: Central Bureau of Statistics and UNICEF Nepal. <http://unicef.org.np/uploads/files/597341286609672028-final-report-nmics-2014-english.pdf>
- DoLIDAR/MoFALD. (2013). *Managing water depletion using recharge pond*. Ministry of Federal Affairs and Local Development Nepal.
- Inlogos. (2009). *Assessment of village development committee governance and the use of block grants*. Kathmandu: Ministry of Local Development and United Nations Development Programme.
- MoE & Nepal Government (1992). http://www.moen.gov.np/pdf_files/Water_Resource_Act_2049-english.pdf
- Rasul, G., Sharma, B., Mishra, B., Neupane, N., Dorji, T. & Khadka, M.S. (2015). *Strategic Framework for Resilient Livelihoods in Earthquake-Affected Areas of Nepal*. Kathmandu: ICIMOD.
- Rautanen, S. L., van Koppen, B. & Wagle, N. (2014). Community-driven multiple use water services: Lessons learned by the Rural Village Water Resources Management Project in Nepal. *Water Alternatives*, 7(1), 160-177.
- Rautanen, S. L. & White, P. (2013). Using every drop—experiences of good local water governance and multiple-use water services for food security in far-western Nepal. *Aquatic Procedia*, 1, 120-129.

Multiple Use Water Systems and Micro-Irrigation Technologies for Koshi Basin – Lessons from Gandaki Region, Nepal

Raj Kumar GC¹⁹

Abstract

The article reviews the experience of International Development Enterprises (iDE) Nepal implementing Multiple Use Water Systems (MUS) in the rural hills of the Gandaki region of Nepal and analyzes the extent to which lessons learned can be transferred to the Koshi Basin. The article concludes that MUS combined with micro irrigation technology (MIT) creates an innovative and sustainable model for rural farming families helping to provide access to a reliable domestic water supply and the ability to grow high value vegetables. The by-design MUS approach, developed by iDE, addresses multiple water needs and priorities. It is designed to fit local water resources, existing physical environments and local settings. iDE's experience indicates that MUS was instrumental in improving income and the livelihoods of small holder farmers in the Gandaki basin where it has been implemented. Accordingly, MUS is being scaled up in that region. Evidence from available literature also confirms that MUS should be economically viable and sustainable in the mid hills of Nepal, and that it should be transferable to other parts of the country. There is, however, no evidence in the literature of MUS implementation on a basin wide approach. Additional research and demonstrations of MUS will enhance the understanding of the application of MUS in the Koshi Basin.

Introduction

Water management context in Gandaki and Koshi Basin

Most hill communities in both these river basins do not have year-round reliable access to water. Communities mostly depend on hand-carried water from springs. Affordability of infrastructure (for example existing drinking water supply systems) in the hills of Nepal is an important consideration because most hill farmers are poor, with low levels of production and income. Most communities have limited water supply infrastructures and the majority of those systems are in poor conditions, resulting in little access to water for multiple uses. A lack of clean, easily accessible, reliable domestic water is a major burden for women and children, especially in the hills of both basins.

Farmers in these areas are primarily dependent on rainfall for their crops. They have too much water during the monsoon rainy season (June -September) and too little during rest of the year. Discharge from springs is highest at the end of the rainy season and reduces gradually through the dry season. Consequently, the majority of small farmers depend on seasonal rains for irrigation.

Less than half of the farmers in Nepal, primarily in the lowlands of the Terai, have year-round irrigation. Of these, most use traditional furrow or flood irrigation requiring large quantities of water delivered by pumping or diversion from a distant stream and delivered by a ditch or canal. Irrigated areas in the hills and mountains are much smaller than in the Terai. Streams and rivers located below hill villages cannot provide water needed for multiple uses due to the high cost of carrying water by hand or pumping water uphill (ICIMOD, 2015). Affordability is a critical consideration because most hill farmers are smallholders, often with subsistence levels of production.

Numerous natural rivulets and springs provide promising opportunities for the development of smaller irrigation and water supply systems in the hill communities. The challenging circumstances of the hill communities can

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be overcome with development of these small water sources/ springs. Authorities normally do not give priority to develop such small sources, which have generally been ignored by past development interventions (GC, 2010). Key constraints that are common to both areas include the non-availability of year round irrigation, small land holdings, a lack of planning regarding water resources, the opportunity and need to improve smallholder agriculture and small untapped and/or underutilized water sources.

Multiple Use Water Systems (MUS) in Nepal

Rural hill communities in Nepal typically depend on natural springs for water. They need water for multiple uses and collect it from different water sources in the vicinity without an established plan. This unplanned delivery of water can invite social conflicts in the use and allocation of water (O'Hara et al., 2016; GC, 2011). Domestic water is the main priority of the households. The water authorities in Nepal design water system for domestic use, and generally do not consider the irrigation needs of small users from the same system. Households do, however, use water from these systems for other purposes, including agricultural use. Such unplanned use of water limits the economic benefits of water supply systems and affects their sustainability (GC, 2010). This becomes the starting point for planning, designing, and delivering water services through a by-design MUS.

Water authorities in Nepal have gradually begun to see the untapped potential for planning and development of small-scale water resources beyond the boundary of single-use investments and mandates (O'Hara et al., 2016). MUS water systems can provide sufficient water for domestic needs (45 litres per person per day) and productive use using micro irrigation technology (400- 600 litres per household per day). Therefore, MUS by-design is an approach that meets both domestic and agricultural needs in a planned way. This is the MUS approach in Nepal, developed and designed by iDE.

Construction costs for MUS are about 50 percent less than a comparable single use drinking water supply scheme because the community contributes labour, local technicians and locally available materials. Thus, MUS reduces the cost of providing separate systems for drinking water and irrigation, conveying water to the community for both uses through a single system. As a result, MUS significantly reduce the cost of water resource development, distribution and system management.

MUS have been extensively developed in Syangja, Kaski, Tanahu, Lamjung and Makwanpur districts of the Gandaki basin and surrounding areas. There has not, however, been much work done with MUS in areas of the Koshi Basin, other than a few MUS installed by iDE in the Sindhupalchowk and Dolakha areas. Since 2003, iDE Nepal along with partners Winrock, SAPPROS, CEAPRED and AEC have implemented MUS in the Gandaki area through the SIMI, LEMI, UJALLO and BDS MaPs projects funded by USAID.

The overall goal of these projects was to help rural and marginal farmers increase their income and improve livelihoods. To achieve the goal, iDE Nepal worked with farmers to facilitate their use of micro irrigation technologies for growing high value crops and connect them with local, regional and national markets (Sharma et al., 2009). In the course of the project implementation, farmers using MIT were dependent on domestic water supplies for irrigation of vegetable plots, which supplies were not sufficient, since these water systems were designed for domestic use only. iDE, who pioneered the concept of MUS in Nepal, was the key partner in these projects that took the lead role of designing and implementing MUS systems that integrated MIT.

MUS became the preferred solution in these communities because they did not have access to reliable irrigation water, but wanted to grow off-season vegetables. MUS provided adequate water in all seasons to meet both domestic and productive needs as per the specified design criteria of 45 liter/person/day domestic and 400-600 litre/household for productive use. These new MUS systems were appreciated by communities and by collaborating partners, while resulting in improved livelihoods for poor farmers (Sharma et. al, 2009). Initial successes led to the expanded implementation of MUS in other parts of the Gandaki basin.

Research Method

This study examines iDE's experience developing MUS in Nepal. It describes the fundamental features of the MUS approach and key principles for success. It discusses the benefits and impacts of MUS in the Gandaki basin and examines key elements needed for replication of MUS in the Koshi Basin. Finally, the study examines the challenges of scaling the MUS approach and lessons learned.

The methodology in undertaking the study involved:

i) an extensive review of iDE project documents and reports; ii) review of literature, published and unpublished reports and past studies; and iii) interaction with personnel in government agencies and development organizations involved with the development and promotion of MUS and micro-irrigation technology. The agencies that were identified for visits and interaction included IDE, DoA, IWMI, FMIST and Support Activities for Poor Producers of Nepal (SAPROS). These agencies were identified based on their substantial involvement and support in the development and promotion of MUS in different parts of the country. The qualitative information received was organized and analyzed to support the focus of the study.

Main Findings

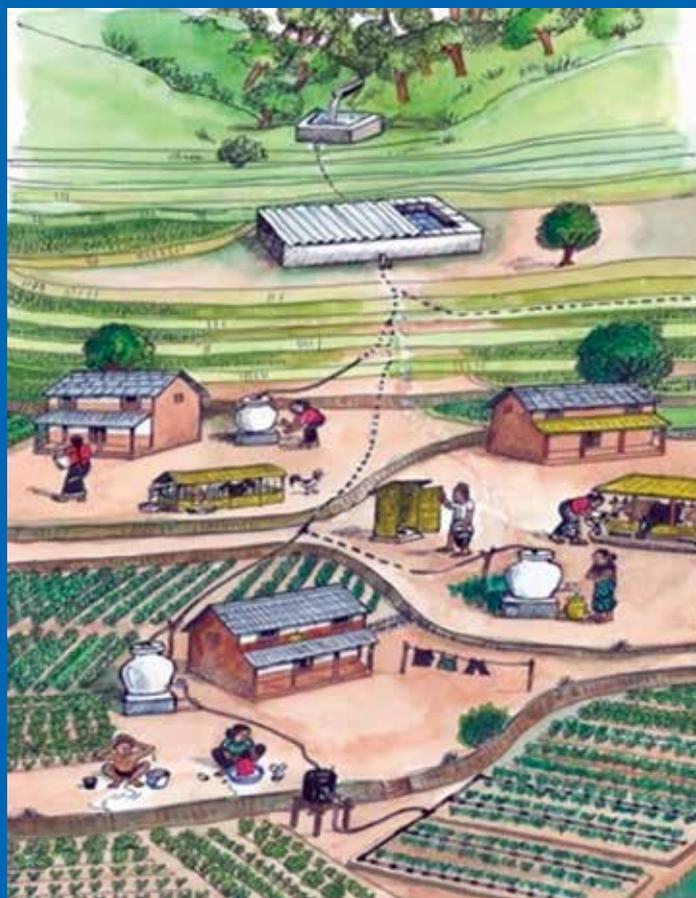
Key elements of MUS

MUS closely aligns with key practices and principles outlined below that led to the success of MUS in Gandaki (O'Hara et al., 2016; GC & Colavito, 2015; Clement et al., 2015; Sharma et al., 2009; GC, 2016). Given the similar context of Koshi with Gandaki as outlined in 1.1, the following principles should be equally valid for the Koshi Basin.

Context specific design: MUS are designed to match the local conditions. These include landscape, location of water sources and the amount of water available at the source. Location of springs/ water sources will demand different technical solutions. For example, gravity MUS are used if the water sources are located above the water; solar MUS, electric lift MUS, and Hydram MUS are planned for communities where water sources are located below the settlements. The choice of these technological options is made based on the type of water source, amount of flow, distance of water source from the community,

The MUS infrastructure consists of an intake at the source, domestic water tank, irrigation water storage tank, piped water distribution system, drinking water and irrigation taps. For gravity systems, water from a higher elevated spring source is collected into one or more reservoirs and conveyed by gravity through high-density polyethylene (HDPE) pipes to the village. Such gravity fed systems are appropriate when the settlement is located at an elevation below the spring water source. For the communities above their water source, a powered pump solution is required and iDE has developed an appropriate solar and electric MUS solution.

The typical gravity MUS configuration has two tanks. This configuration helps ensure an uninterrupted supply of drinking water for multiple uses. The domestic use tank is filled directly from the spring source, while the irrigation tank is filled with the excess from the domestic tank. The two-tank system allows users to monitor water levels more easily (iDE, 2015). Overflow from the domestic tank is piped to the production tank to insure compliance with government policy that gives priority to domestic use. Water is then provided to households using drinking water and irrigation taps. A gravity-fed normal MUS costs about \$ 3,000 serving about 35 households on average.



water quality and other related factors. Within each of these technological options, MUS models are prepared to fit the local setting. The available local resources such as labour, material and skills available at the local level influence the design.

Participatory design process: The specific needs and priorities of the community also play a role in selecting a given system. The community is involved in a feasibility and water resources assessment to understand historical water flow at the source. The community provides input on different models (as outlined above) appropriate to the setting. In addition, indigenous knowledge and skills are fully considered from source identification during prefeasibility to the project handover to the MUS user committee at completion (O'Hara et al., 2016).

Technology combination: MUS utilize different existing proven technologies such as ferro-cement tanks, soil cement tanks and micro irrigation technology. MUS components are designed with simplified construction methods utilizing minimal amounts of material (GC, 2016). They are low cost, easy to install and maintain and can serve as an individual technology for water collection and distribution. MIT has proven to be an important technology to be used in combination of MUS at the farmer's plot to grow vegetable crops while dealing with the basic problem of water scarcity. MUS projects in Nepal have demonstrated that the use of MIT in conjunction with MUS enhance land, water and labour productivity. Other water harvesting systems (such as roof water harvesting) can also be combined with MUS to work together where appropriate.

MUS management: The community is fully mobilized and involved at every level of planning, construction, and management of a MUS system. A key approach to ensuring sustainability of MUS is to organize rural households into a well-managed user group that can establish and maintain the system (Clement et al., 2015; GC, 2016). Each MUS community appoints a committee that is responsible for management, repair, and maintenance. These committees collect fees from users on a monthly basis to fund regular maintenance and repairs (iDE factsheet, 2015). The committees also employ a local paid manager responsible for system operation. The MUS community also provides that a portion of the increased income earned by farmers for the MUS is used to pay for a MUS caretaker. These management provisions are guided by a constitution with a set of norms developed by the MUS users themselves.

MUS linkage to input and output market systems: A key element of the MUS approach is keeping farmers linked to input supply systems and local collection centres, helping to ensure that they produce a sufficient quantity of high-quality products (iDE, 2014; GC & Colavito, 2015). This process ultimately creates an enabling environment for smallholders to invest in MUS and micro irrigation. MUS increase the volume of production and enable production through the dry season, making collection centres profitable and sustainable year round (Clement et al., 2015). Collection centres can also play a key role in identifying and assisting to organize members to develop MUS systems.

Capacity building: Capacity building training on participation, governance, water management and market driven vegetable production is provided to the MUS users. Training on improved seeds, crop management, crop selection and market knowledge are typically provided. Users also receive training on how to protect water sources and the watershed, as well as on how to use climate-smart technologies like MIT and IPM. Major decision-making by community members is enhanced through extensive training and capacity building in related agricultural methodologies.

Benefits and impacts

The benefits and impacts of MUS have been reported by several studies including Clement et al. (2015), GC & Colavito, (2015), GC (2010) & DeBoer, (2007), and various iDE partners and project reports, including:

- **Increase in income:** An IWMI study found MUS to be very economically sustainable, with a benefit-cost ratio of 11 to 1. Other benefits (non-financial return) were also significant (Clement et al., 2015). iDE impact surveys have shown that income increased from the sale of high value seasonal and off season vegetables by over US\$250 per year per HH from an average plot size of 125 sq.m. iDE's experiences have shown that the highest returns come from linking MUS to development of high-value and climate-smart agricultural value chains.

- **Time saving and reduction in drudgery:** MUS drastically reduced time carrying water per day, more than compensating for increased labour for vegetable production, mainly by women and children. Even in the lean season (March-June), the availability of MUS has dramatically reduced women's workload from fetching water from distant water sources. It has been estimated that 22.8 working days of time saving in a year could be attributed to the Phulbari MUS in Syangja (GC, 2010). The saved time was used for resting, taking care of children, caring for livestock, attending training and group meetings (GC, 2010; DeBoer, 2007).
- **Improved sanitation and hygiene:** The increased availability of clean drinking water near households contributed to increased household latrine access and improved hygiene of household members, resulting to significant decrease in water borne diseases including diarrhoea and pneumonia. A study by GC (2010) showed that clothes washing within households increased from 60% to 100% when a MUS was in close proximity (GC, 2011). MUS communities also receive training on how to prevent contamination in the water storage tanks to better understand good hygiene practice.
- **Improved nutrition through consumption of increased vegetable production and increased purchasing power.** A study by GC (2011) in different MUS of Gandaki basin showed increased household vegetable consumption from a very limited 2-3 kg per week to almost 7-8 kg per day. Similar results have also been confirmed by Mikhail and Yoder (2008). MUS enables the cultivation of nourishing vegetables in larger quantities year round, which has been reported to improve the nutritional status of women and their families.
- **Increased Water Availability to Support Village-based Enterprises.** Water usage in households increased significantly because of water-related activities such as, washing, cleaning, and vegetable production. The use of MUS increased water usage by over 50% for household use and 95 % for irrigation (GC, 2010). About 35% of MUS users have reported that water availability for livestock has increased. As reported by farmers, 350-400 lt. of water per day was used to meet their irrigation requirements for vegetables. Water availability generally increased for most water related activities, even in the dry season (March-June).
- **Empowerment of women and disadvantaged groups through their inclusion on user committees.** There is considerable evidence that MUS supports women's empowerment. Women typically participate in training sessions, meetings, and discussions, which help them gain self-confidence from speaking in public. Women in the village also gained confidence from dealing with people from outside their village. Prior to MUS, women were often absent from making decisions about system construction and crop planning due to their all-consuming household activities. After MUS, women have more responsibility for vegetable production and marketing. This enabled them to earn income and gain more control over family finances. This increased their role in decision making in both their families and their villages.
- **Improved climate change adaptation:** MUS strengthen climate change adaptation through facilitation of improved water resource planning and management, more efficient and reliable water access and improved agricultural productivity and income (GC & Colavito, 2015). Local Adaptation Plans for Action (LAPA) have invested in MUS development. MUS offer smallholders the opportunity to reduce dependence on rain-fed agriculture and to increase the productive use of available water resources (GC & Colavito, 2015). Where appropriate, recharge ponds are planned and constructed above the water sources in collaboration with the local community, further enhancing spring flow. Many point water sources in the hills that are marginal or are threatened by environmental stresses are given priority for MUS. As incomes increase, smallholders gain incentives to conserve and protect local water sources/watersheds including construction of recharge ponds (GC, 2016; O'Hara et al., 2016). MUS follow the key principles of community-based adaptation that focuses on priorities articulated by the community.

Main lessons and challenges

- Existing single use water systems have poor functionality. A study report by the Department of Water Supply and Sewerage (DWSS) has shown that around 18% of the population reported that these systems were functioning well, 39% that these systems needed a minor repair and 43% that the systems needed either major repair or to be rehabilitated/reconstructed (DWSS, 2011; in Clement et al., 2015). On the other hand, an IWMI study found that MUS are more sustainable than single use systems; indicating that 87.5% of the MUS surveyed are still fully functional or need minor repair versus 56.8% of the single-use domestic supply systems surveyed. Reviving existing non-functional domestic water supply systems using the MUS approach has also proved to be effective.

This is also an opportunity for rural poor households in the Koshi Basin.

- A study of MUS in Syangja and Kaki in Kaski (GC, 2010) and other studies in Gandaki revealed that households who hold very marginal and poor lands and also belong to socially and economically disadvantaged groups have generally not received the full benefits from MUS. Opportunities for diversifying agricultural production are limited in these situations. This also limits income gain from MUS, which is the key source for system maintenance and upkeep.
- iDE's experience demonstrates that it takes a longer term effort to mobilize a homogenous Dalit and marginalized communities to ensure their participation throughout the MUS process and for them to own the project. These communities have proven to be weak in creating and organizing management functions for MUS. Where water user groups are well organized through a water user committee and norms are developed to run the group farmers are more likely to receive the full benefits from MUS. In order to sustain MUS, the user committees need to be empowered and trained to manage, maintain and run the system.
- Literature indicates that several springs that supply water for MUS are increasingly drying up across the mid-hill regions of the Nepal. Experiments have shown that the construction of recharge ponds and improving vegetation have helped to revive or increase the life of the drying springs by increasing recharge rates during the monsoon (ICIMOD, 2015; O'Hara et al., 2016).
- The by-design MUS model is effective for improving water planning, increasing water security and efficiency and reducing conflicts in managing multiple water demands. This is a controlled and regulated system that supplies water to households for multiple purposes in a designed quantity. The key benefit of a by- design system is that the users gradually become trained to apply water for multiple uses in a planned way. For instance, households using water for domestic use also start growing crops near their homestead. This is often a missed opportunity in the absence of a planned system. The needs and priorities for multiple water needs of smallholders are reflected in the MUS design and users have also accepted it.
- MUS is a productive infrastructure that allows users to significantly increase their incomes from the sale of vegetables. When linked to agricultural and marketing systems, MUS further improve returns. MUS user groups are built and maintained by management of an economic opportunity, in particular the income derived from the sale of crops, not by project resources. The returns provide incentive for communities to pay for repair and maintenance, protect water source watersheds and promote the management of MUS.
- There is a growing understanding of the MUS approach and benefits. It is increasingly being recognized that rural water supply systems should be designed for multiple uses per the needs and priorities of local communities (Rautanen & GC, 2011; GC & Colavito, 2015). IDE's experience shows that more than 50% of the funds needed to construct a MUS system come from local government institutions. Other projects, programs, and organizations have gradually started to develop MUS. MUS has proven to be a practical and sustainable model for extending access to water services and providing multiple benefits to rural communities (GC & Colavito, 2015). It has not, however, been scaled up widely in Nepal because of institutional silos in government and because major donors separate investments for drinking water and irrigation (GC & Colavito, 2015). Some work has been accomplished to enhance the recognition of MUS for investment within government bodies. In 2008, MUS was formally recognized by the government of Nepal as an appropriate investment opportunity for local government funds. Existing government policies have not, however, addressed multiple use water needs in an integrated and systematic way. To overcome this challenge will take a long-term effort of analysis, policy advocacy, and stakeholder mobilization (GC & Colavito, 2015). The proposed MUS scaling pathway for Nepal is further documentation, consolidation and advocacy of the ongoing domestic and community-based MUS innovations (Van Coppen et al., 2011, in GC & Colavito, 2015). Priority attention needs to be given to building the MUS capacity of government, NGOs and private sector partners through technology transfer in institutionalizing MUS.

Conclusions

MUS systems provide sufficient safe water for domestic use and enable farmers to earn income throughout the year from reliable irrigation. MUS by - design in conjunction with MIT has been a good model for improving water resource planning, saving water, increasing agricultural returns, improving livelihoods and promoting gender equity.

MUS have proven to be a practical and sustainable approach for extending access to water services and providing multiple benefits to rural communities in parts of the Gandaki Basin and other parts of the country. MUS is an integrated approach that encompasses the development of local infrastructure, building local institutions as well as water governance. Local knowledge, skills, technologies, water resources and markets are fully considered and combined in this approach as needed.

There is growing interest and understanding of MUS benefits and recognition that rural domestic water supply systems should be designed for multiple uses in accordance with local needs and priorities. iDE and its partners have promoted the MUS approach in the last two decades in a manner that has enabled the government and key stakeholders to invest in MUS for better planning regarding scarce water resources. Successful implementation of MUS in the Gandaki basin has greatly contributed to the increased investment and recognition of MUS.

The Koshi and Gandaki basins have many similarities with respect to socio-economic conditions, geography and water resources. Moreover, the high functionality, relatively short payback periods and significant impacts of MUS in the Gandaki area indicate the potential for these successes to be replicated in Koshi and elsewhere in the hills of Nepal is high if the appropriate community mobilization and technical and financing mechanisms are developed. This will require that the capacity of local government and the community to participate in the overall process of MUS planning and development be enhanced. The use and implications for the technology in the particular setting of the Gandaki basin has, however, been fairly limited. It is recommended that comprehensive demonstrations of MUS be conducted along with research to determine the extent of technology transfer in the Koshi areas and in a basin wide approach.

Sectoral policies for drinking water and irrigation is a key challenge for the wider scale up of MUS. Institutionalization of MUS through government policy development will allow MUS to be replicated nationally.

References

- Clement, F. Pokhrel, P. & Sherpa, T. (2015). *Sustainability and replicability of Multiple-Use Water Systems (MUS)*. International Water Management Institute (IWMI), 2015, Kathmandu.
- de Boer, J. (2007). *Study on costs and benefits of multiple use water services in Nepal*.
- DWSS. (2011). *Nationwide coverage and functionality status of water supply and sanitation in Nepal. Final Report*. National Management Information Project (NMIP). Panipokhari, Kathmandu: Department of Water Supply and Sewerage.
- GC, R. K. (2016). *Multiple-use Water Systems (MUS) – iDE’s approach to design, development, and impact*. *Proceedings of the MUS International Workshop*. International Workshop on Multiple-use Water Systems for Climate Resilience, February 25–26, 2016.
- GC, R. K., Colavito, L. (2015). *Benefits of Multiple-Use Water Systems (MUS) with micro irrigation for the smallholder farmers in the rural hills of Nepal*. Sixth International Seminar Proceeding on Small Scale Irrigation Systems: *Challenges to Sustainable Livelihood*. 15–16 February, 2015, Kathmandu, Nepal.
- GC, R. K. (2011). *Experiences from Multiple Use Water System in Nepal - A case study of Phulbari village of Syangja district*, 6th Rural Water Supply Network Forum Publication, Uganda.
- GC, R. K. (2010). *An evaluation of Multiple Use Water Systems in Mid-hills of Nepal. A case study of Phulbari Multiple Use Water Systems in IDE’s project area of Syangja district*. M.Sc. Internship report. Wageningen University, the Netherlands.
- ICIMOD. (2015). *Issue Brief. Reviving the drying springs. Reinforcing social development and economic growth in the Midhill of Nepal*. February, 2015.
- iDE. (2014). *Cost-benefit analysis supporting anakulan interventions. Cost-benefit analysis of iDE interventions designed to mitigate climatic extremes and environmental problems - BRACED Project Development Phase*, 2014.
- iDE. (2015). *Multiple Use Water System (MUS) factsheet*. <https://fmistnepal.files.wordpress.com/2016/01/mus->

factsheet.pdf (accessed on 2nd August, 2016).

Mikhail, M. & Yoder, B. (2008). *Multiple use water service implementations in Nepal and India. Experience and lessons for scale-up*. International Development Enterprises (iDE), Lalitpur, Nepal.

O'Hara, C., Pariyar, M. & GC, R. K. (2016). *Case study on community based adaptation: The MUS approach in Nepal*.

Rautanen, S-L. & G. C., R. K. (2012). *Multiple-Use Water Services (MUS) – Nepal country paper*. MUS Roundtable workshop paper, Bellagio Italy.

Sharma, K., G. C., R. K. & Colavito, L. (2009). *Experience of Multiple Use Water Services (MUS) implementation in Nepal*. International Development Enterprises (iDE), Nepal.

van Koppen, B. & Smits, S. (2011). *Multiple Use Water Services Scoping Study Synthesis, findings of five MUS country (Nepal, India, Ethiopia, Ghana, Tanzania) scoping studies*.

Water Management Practices for Resilient Livelihoods in Koshi Basin of Nepal: An Analysis from a Gender Perspective

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Govinda Basnet²¹, Arun Regmi²¹

Abstract

Mainstreaming gender issues in water management policies is complex. The popular approach is affirmative action to establish women's participation in decision making and capacity building activities. Studies related to affirmative action to encourage women's visibility in decision-making forums through quotas has resulted in both positive and limited outcomes. Some women representatives have made use of the opportunity to address their concerns, but passive representation due to cultural barriers and social values tend to mute the effectiveness of these opportunities. Women's token participation is often manipulated as evidence of successful gender integration, but studies show that inequities persist. In water issues, this situation raises the impetus to know what key policy elements could promote gender equality in water management practices. Studies on mainstreaming gender conclude that there is limited knowledge on what elements and practices are necessary to successful integration of gender. The purpose of This study is to identify gender issues to be addressed in water management policy and programs. The study is based on case studies located in Koshi Basin

For this study, we reviewed water management practices in Nepal, analyzed secondary data on good water management practices, and conducted key stakeholder consultation involved in water programs. We focused on seven water management practices, including programs on water-induced disaster management and enhancing access to water. Through a case study method, we analyzed the gender implications of enhancing asset levels and services, agencies and possibilities to change the rules in favour of individuals and communities. We conclude that the programs have enhanced level of assets and services, agency to solve individual problem.

However, there are limited examples on changing institutional rules either at the family or community level for long term sustainability of the system, which could have provided continuity in enhancing the assets and services. We conclude that policy and programs that facilitate the process of crafting of local water management institutions could provide opportunities to frame and change rules in terms of creating more meaningful gender representation. Water related programs, without clear framework that guides the formation of institutionalising the initiative through local or beneficiaries organisations. has left a vacuum for institutional space.

Government policy calls for the formation of water users' association for irrigation and drinking water at large scales, but for smaller scale water management (e.g., conservation ponds, water harvesting ponds) such users committees are lacking. User committees at these smaller scales could have a positive gender impact if formed.

Background Information

The Koshi River Basin between China, Nepal and India, is an important transboundary river basin in the Hindu Kush Himalaya (HKH), consisting of approximately 40 million residents. Though the basin has surplus water, access to water for consumption and livelihoods is one of the major challenges due to increasing water scarcity and growing competition among habitats. Topographical challenges include a high rate of seepage in the sloppy

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terrain of mountains and hills, and subsurface flow in that plains that result in dry winters with stressful moments of water scarcity. Water-induced disasters such as landslides and floods enhance this stress by season. These natural calamities have challenged the livelihoods of people who depend on farming, forests, and other natural resources for daily living. The significant temporal and spatial variation in rainfall within the Koshi Basin exacerbates these challenges. Eighty per cent of rainfall of the basin occurs in three months (July – September).

Foran et al. (2015) argue that the impact of water related stressors in the Koshi Basin have gendered impacts, the outcome of persisting inequalities in access to assets and resource. They note that inequality in land ownership and across a range of institutions, creates discrimination against women as their mobility is restricted and thus limits their ability to improve their access.

Many organizations are working in the Koshi Basin to tackle water-related livelihood problems. Water-related interventions from the government and non-government organizations have made genuine efforts to improve livelihoods of the people by enhancing people’s access to water and improving protections against water-induced disaster. However, analysis of these improvements is generally lacking.

This paper aims to provide an overview of good water-related good practices in the basin in terms of addressing gender disparities. We also provide lessons learned for policy uptake on mainstreaming gender aspects in water programs.

Methodology

The study was carried out in two phases. In phase one, we mapped good water management practices implemented by different organizations working in the Koshi Basin. We mapped these practices based on information gathered from secondary review, and face to face and telephone interviews with key informants in Nepal. We attempted to obtain a representative sample of informants from the mountain, hill, and Terai regions of Nepal.

In phase two, we selected seven good practices within the Koshi Basin and analyzed case studies of these practices from a gender perspective. The seven practices are pond irrigation, conservation ponds, rainwater harvesting, community-based early warning systems, capacity building to reduce vulnerability to risk, recharge ponds, and water use master plans (Table 1). Detailed field studies of the selected practices was carried out to collect at least three cases of women and marginalized community members to understand the impact of the specific interventions on their livelihoods. We consulted with local officials to identify the respondents who could represent the marginalized community members as key informants. Other respondents were selected using a snowball sampling technique that began with recommendations from the key informants. The strength of snow ball sampling is that it provides an opportunity to identify respondents based on people’s perceptions of given variables, in this case, which community households were considered “marginalized.”

Table 13: Gender analysis of seven practices

Program	Location
Reducing climate risk through capacity strengthening of women and vulnerable communities	Dahapokhari, Ward number 9, and Borbang, ward number 8 (Haibung VDC, Sindhupalchowk District)
Water Use Master Plan for effective governance	Pipse and Chitre of Ward number 4 and Galthum Bazar of ward number 1 (Mahankal VDC, Sindhupalchowk)
Conservation pond	Deurali, ward number 5 and 1 (Sipapokhare VDC Sindhupalchowk)
Pond irrigation	Timilsinagaun, ward number 9 (Jaishithok VDC, Kabhrepalanchok)
Water re-charging pond	Timilsinagaun, ward number 9 (Jaishithok VDC, Kabhrepalanchok)
Rain water harvesting for livelihood improvement	Jorsalla, ward number 1 (Mithinkot VDC, Kabhrepalanchok)
Community-based early warning system	Ratu Khola, Mahottari

In our study, we conceptualize gender inequity and inequality in society as due to unequal power relations shaped by social structure on access to and control over resources; differential capabilities and abilities, and lack of opportunities to voice concerns and reframe the rules that matters to individual or a group (Agarwal, 1994; Fraser et al., 2004; Sen, 1985). Except in the Chinese part of the Koshi Basin patriarchal social structures favor male inheritance of family property and provide men with preferences to make decisions (Agarwal, 1994; Tamang, 2000). Hence, the status of women and people from certain caste groups are marginalized compared to men and people from privileged social groups. Women of lower caste as well as class experiences double the burden of deprivation (Bhasin, 2000).

We start from the additional premise that water-related interventions can influence three interrelated domains of gendered social change. An intervention that enhances an individual's status on assets and services will enhance the voice, influence, and agency that ultimately empowers an individual to change the rules that affects him or her. This conceptualization is inspired by Gender Equality and Social Inclusion Assessment of 2005 (World Bank & DFID, 2006).

In water related programs, the first domain of assets and services includes entitlement to water related services, technology, and other associated assets. The second domain of agency refers to the processes by which choices are made and put into effect (Kabeer, 2005). Being able to voice, influence, and agency is intangible, but it is important parameters that influence human action towards wellbeing. These are integral components of empowerment. Empowerment is something that has to come within, than someone empowering others. Enhanced levels of assets and services will provide multiple opportunities to make choices that can enhance the resiliency of an individual and family through enrichment on agency. Enhanced opportunity to have voice and influence will lead to changing statutory as well as customary rules, the third domain of change that matters to women and marginalized community members (World Bank & DFID, 2006).

Findings: Assets, Agencies and Institutions

The first phase of the study mapped 25 programs under six broader themes as good practices that have positive impact, positive impact defined as either improving livelihoods through access to water or reducing vulnerability to water induced disaster. Irrigation programs focussed on promoting pond and nonconventional irrigation technology in the hills. Livelihood diversification through promotion of alternative farming in the river bank and fish farming in buffer zone targetted to uplift the livelihoods of marginalised community is found to be directly benefiting the socio economically challenged community in lower belt. Community based early warning systems had positive results for improved preparedness and increased levels of security in the flood plains.

After selected seven programs from the initial pool, in phase two we found that each of the seven had a positive impact for enhancing livelihood assets. Interventions on water security enhanced the level of water availability for irrigation, drinking water, and other household purposes. By collecting water in a pond, people did not need to engage in night irrigation. A collection tank for drinking water has reduced the time and work necessary that women expend to obtain water. Women within the community-based early warning system expressed an increased level of security in Mahottari district. Respondents who had increased access to irrigation water used it for commercial farming of tomatoes, cabbage, and flowers. These crops have enhanced the economic assets of women. Women who handled the cash from their crop farming have invested the money in children's education and expressed increased levels of self-esteem.

However, in all cases, maintenance was a challenge and there was need for collective action to maintain water systems. However, this collective action did not take place, indicating a lower level of agency among women. Though at an individual level, respondents tried different measures to multiply the benefit of access to water after the interventions, it did not result in collective action. Women and men of lower castes tried new ideas on fish farming and cash crops after gaining increased access to water. For example, in Sipapokhari, a woman respondent convinced her husband to farm fish in the conservation pond. Though her effort to convince her husband failed, she continues to try Rudraksha plants, which were not farmed in the area before. For this crop, she uses water from the conservation pond.

The increased level of agency at the individual and household levels aimed at multiplying the benefits of having access to water is not observed to collective problems such as system degradation, specially in the programs that did not have clear implementation strategy to form beneficiaries committees or organisations. Hence, programs that had not formalized their community management structures in program design have experience limitations due to an institutional void. Community members were unclear on institutional rules and regulations, indicating the possibility of the emergence of water conflicts and degradation of the system. In such situations, changing the institutional rules in favour of a marginalized group is not possible until and unless local actions develop appropriate institutions.

Overall the analysis of water programs to empower women and marginalized individuals shows that all programs have succeeded on enhancing assets and services, with about seventy percent of the cases demonstrating an enhancement on voice, influence, and agency. However, only in few cases were women and marginalized individuals able to effect change in institutional rules.

Conclusions: Lesson Learnt for Policy Uptake / Upscaling

Based on the findings of an in-depth gender analysis of 21 households of seven water management programs, we conclude with the following three measures to be addressed in policies and programs to achieve gender transformative change through water management programs:

- Include measures to enhance assets and services of women and marginalized communities;
- Include provisions to institutionalize community water management; and
- Create opportunities to increase participation of women and marginalized community members in decision-making fora to raise concerns.

References

- Agarwal, B. (1994). Gender and command over property: A critical gap in economic analysis and policy in South Asia. *World development*, 22(10), 1455-1478.
- Bhasin, K. (2000). *Understanding gender. Kali for women*.
- Dahl, H. M., Stoltz, P. & Willig, R. (2004). Recognition, redistribution and representation in capitalist global society: an interview with Nancy Fraser. *Acta Sociologica*, 47(4), 374-382.
- Foran, T., Hahiri-Dutt, K, Neupane, N., Gurung, C. & Wahid, S. (2015). *Multiple inequalities: women and livelihoods in the Koshi river basin Crawford Symposium*, Feminisation of agriculture in South Asia and its implication for food security. Australian National University.
- Kabeer, N. (2005). Gender equality and women's empowerment: A critical analysis of the third millennium development goal 1. *Gender & Development*, 13(1), 13-24.
- Sen, A. K. (1985). *Commodities and capabilities*. Amsterdam; Oxford: North-Holland.
- Tamang, S. (2000). Legalizing state patriarchy in Nepal. *Studies in Nepali History and Society*, 5(1), 127-156.
- World Bank & DFID. (2006). *Unequal Citizens- Gender, caste and ethnic exclusion in Nepal* World Bank/DFID.

Chapter 6

Plenary Session IIIB
Improving Livelihoods
Resilience

Improving Livelihoods Resilience

- Chair** – Bashu Dev Lohanee, Dol, Nepal
- Moderator** – Kamala Gurung, ICIMOD
- Presenters**
- Fraser Sugden, IWMI, Nepal
 - Mina Devkota Wasti, CIMMYT, Nepal
 - Rabindra Singh, Practical Action, Nepal
 - Pratap Thapa, aQysta, Nepal
 - Aditi Mukherji, ICIMOD

Key Messages

- The Argument-Representation-Implementation (ARI) framework can be useful in improving policy formulation and implementation.
- Water use master plans (WUMP) promoting gender equity and social inclusion can be scaled out by the Government of Nepal.
- Socioeconomic and practice changes brought by WUMP in the community are well documented. Training on gender aspects of hydrology and water management should be provided to enhance women's roles.
- Reviving springs and rehabilitating recharge ponds are key to managing water supply, and important for studying local water resources use. The institutional process for water use planning needs further study.
- Collective farming can strengthen marginal farmers/tenants to increase productivity, enhance their bargaining power, and overcome scale and tenure related constraints to investment in irrigation and technology.
- Low-cost irrigation technologies such as Barsha pumps and solar powered irrigation pumps (SPIP) are vital for sustainable crop intensification among small land holders.
- The aim of piloting irrigation technologies and models, such as SPIP, is to support the government in finding the most appropriate models and designing suitable subsidy packages.

Summary of Presentations

Fraser Sugden presented on the role of marginal farmers and women in irrigation management. He shared some technical innovations being piloted by IWMI in four VDCs of Nepal in which marginal farmers and tenant farmers are key beneficiaries of the projects. These farmers face contemporary agrarian stress in the form of climate change, rising cash demands, worsening migration, inequalities, and dowry demands. Due to migration, the responsibility for agriculture has fallen to women who are burdened with work and paid less. Sugden said some effective, potential solutions include collective leases of land from landowners, sharing labour costs, joint ownership and management, and shared investment in pumps and fertilisers. Fallow lands, which often lack irrigation, have to be utilised in absence of landlords. Farmers need to be able to improve their bargaining power with landlords.

Mina Devkota Wasti from CIMMYT discussed sustainable intensification of staple crop systems in the eastern Indo-Gangetic Plan. Wasti said there should be a strong channel between communities and partners through different strategic pathways. Young people are not interested in agriculture, so there is a need for innovative technology to improve their economic opportunities.

Rabindra Singh from Practical Action and Pratap Thapa from aQysta presented on the impact of low-cost irrigation technologies on livelihoods and gender. They explained that conventional irrigation schemes are challenging in Nepal due to its terrain and social dimensions. Marginalised households are left out of many conventional irrigation systems. Micro technologies are more successful for marginalised people as they are affordable and have simpler technologies. Affordable technology will help women address their multiple water needs including drinking, sanitation, cleaning, washing, irrigation, and feeding livestock. Thapa explained the advantages of a Barsha Pump, which can uplift 40,000 litres of water every day, requires no electricity, and brings no operating cost to the farmers. The Barsha Pump initiative is underway in Surkhet, Nepal.

Aditi Mukherji from ICIMOD discussed solar pump interventions and its promise for livelihood improvement. Mukherji explained how India and Bangladesh have a clear implementation policy and model. She explained that the solar powered irrigation pumps (SPIP) model is affordable to poor farmers through low-interest financing of the purchase.

Currently in Nepal, four SPIPs are being installed for demonstration purposes this year. Using a randomized control trial, Mukherji’s team is testing the impact of three financial models: subsidy, load, and rental. Two key advantages of SPIP are reduced cost on diesel use and suitability for vegetable farming. She said she hoped Nepal’s Alternative Energy Promotion Centre (AEPCC) and DoI would support SPIPs as appropriate throughout the country. Mukherji described solar energy work in Karnataka, India, that could be used for support schemes for solar electricity production. In Nepal, for example, the ADB 90 MW solar project in the Terai could provide grid-connected electricity for irrigation.



Tenant Farmer Collectives for Sustainable Intensification of Agriculture: Reflection from Mithilanchal

Fraser Sugden²³

Introduction

The Mithilanchal region lies in the heart of the lowland Koshi Basin, and spans the Nepal-India border. For decades, it has remained one of the most peripheral regions of South Asia. Central to the reproduction of poverty in this region is the deeply inequitable land ownership structure, a relic of the medieval and colonial tax administration and caste hierarchy. Land tenure insecurity is one of the most significant challenges facing agriculture in the larger Eastern Gangetic Plains (Sugden and Gurung, 2012, Sugden et al., 2014), and tenant farmers who cultivate the land of others for rent, remain one of the most vulnerable groups. The region is now facing new patterns of agrarian stress, with the combined impact of climate change and multi-scalar political-economic processes such as price rises for inputs (Pant, 2011) and rural monetisation (Sugden et al., 2014). This is placing even more pressure on tenant farmers, for whom the rent burden absorbs a large portion of their annual farm output.

There has been a long established scholarship on agrarian relations in the Eastern Gangetic Plains including the persistence of landlordism and semi-feudal relations of production (Karan, 2003, Rodgers and Rodgers, 2001, Thorner, 1982, Kishore, 2004). However, recommendations for addressing the land tenure crisis remain elusive. This paper attempts to shed light on some possible solutions for tenant farmers through the collectivisation of production, identifying both the opportunities as well as the remaining challenges to overcome. Collective farming has been often written-off as irrelevant in the 21st century – yet a new model of collective production has the potential to revolutionise smallholder irrigated agriculture and gender empowerment in the Gangetic plains. They have the potential to allow producers to overcome tenure related investment barriers, increase their bargaining power with land owners, while building resilience to external pressures. This can only be considered a half way step towards more radical forms of land reform – a prospect, which is highly unlikely without significant political change. The suggestions are nevertheless, of broader significance as reinvigorated collective models of production may represent a longer term model for a more equitable agrarian future in South Asia, even in a post land reform context.

Methods

This paper takes a case study from a village in Bihar's Madhubani district to understand both the local social structure, and the options for sustainable agricultural intensification through tenant collectives. The data was collected between 2015 and 2016. After a large census survey of the village, the tenant collectives were established in late 2015 with the support of local NGO Sakhi Bihar, the Indian Council for Agricultural Research (ICAR), and the International Water Management Institute. The initiative is part of a larger project Improving Dry Season Agriculture for Marginal and Tenant farmers in the Eastern Gangetic Plains, led by the University of Southern Queensland. A series of timed field visits at different points in the cropping cycle were carried out between the winter and summer planting of the 2015-16 agricultural year. Aside from regular interactions and focus group discussions with collective members, in site observation of groups in the field and group meetings were conducted.

Tenancy in Mithilanchal

The extent of tenant farming in Bihar and Nepal has always been difficult to manage, with agricultural surveys often underestimating the true extent of the problem. Past surveys however, have shown that it is highly variable, with the proportion of tenants or part tenants representing between a third and two thirds of the population depending on

²³ International Water Management Institute, Nepal

the village (Sugden et al., 2015). What is apparent is that it is largely dependent upon the local power of landlords. This depends on a combination of mostly historical processes including past political struggles by the peasantry, the fertility and ‘desirability’ of the land, the political influence and occupational profile of the traditional landlord class, and the selective impact of past land reform programmes. In the case study village of Bhagwatipur of Bihar’s Madhubani district, around 27% of farmers are tenants, renting all their land from others under sharecropping arrangements, where the landlord retains half of the harvest. A further third of the households rent part of their land from others while holding small private plots, usually of less than 0.2ha. There is a very small class of landless labourers, as well as a number of small land owners who are not presently renting land, yet may move in and out of tenancy periodically according to family needs.

Investments in irrigation are essential to build resilience to increasingly erratic rainfall and to extend cultivation into the dry months for food security. However, a lack of capital, marginal holdings and tenure insecurity act as a considerable constraint for tenants in accessing water. Although fixed rent contracts are increasing, sharecropping remains the predominant form of tenancy. For any investments which are made in the land, the landlord retains half of the increase in output. There is therefore no incentive for tenants to invest in irrigation or improved inputs, when any increase in productivity will be taken away. In this context, male outmigration is increasingly an essential component of household livelihoods, and remittances, combined with meagre outputs from farming, sustain households. Neither is able to meet their subsistence needs on their own, and migrant wages have not increased to levels which can cause demand for tenancy to drop.

Women are increasingly in charge of managing the land. While this can offer avenues for gender empowerment, it can also increase their vulnerability. Deeply inequitable gender ideologies often constrain women from access to agricultural services and participation in the public sphere. With males absent, they often have a reduced bargaining power when negotiating for services such as water from groundwater markets (Figure 18).

Figure 18: **Farmers return from the fields: groups were able to share the costs of land preparation**



The case for the agricultural collective

To address the problem of landlordism and its role in stifling investment, radical redistributive land reforms would certainly play a critical role. However, this appears unlikely so long as landed interests remain entrenched in the bureaucracy. The kind of grassroots mobilisation, which made reforms possible in 1970s West Bengal (see Banerjee et al., 2002) appear overly optimistic in the case of Bihar and adjoining parts of Nepal.

Against this backdrop, one potential form of mobilisation amongst landless and poor farmers is the pooling of land, labour and resources for improved political power and increased productivity – the small scale collectivisation of agriculture. In an important article, Agarwal (2010) makes a compelling case for a reinvented group approach to farming, which can overcome contemporary agrarian stresses such as feminisation of agriculture, poor economies of scale, diminishing plot sizes and landlessness. This approach would move beyond just taking a group approaches to purchasing inputs, securing credit and marketing – the model of most contemporary ‘cooperatives’ but would also involve collectivisation of land, capital, and even labour.

In the context of collectivisation in the Soviet bloc, as well as experiments in Tanzania, Ethiopia and Latin America, Agarwal (2010) notes how productivity stagnated, and incentives were low. This was primarily due to their size and top down nature, the limited participation of producers in planning (particularly for women), and the fact that participation was often not voluntary. The few successful collectives from this period were those which were small in scale, with high solidarity and social affinity amongst participants, and where participation in decision making was present, resulting in many post-socialist collectives surviving. Agarwal (2010) thus proposes a new model of collective production which is voluntary, and includes small groups of between 10 and 20 households who are socio-economically homogenous. Decision-making must also be participatory, benefits must be distributed equally, and there should be rules and penalties in place for non-performers.

Since the 1990s, a new model of collective farming has emerged in India – which is oriented to the needs of land poor women farmers. Successful collectives have been set up in Bihar by local NGOs such as Pragati Grameen Vikas Samiti (PGVS), who have mobilised 149 landless women farmer groups, out of which 62 are operating collective farms in the state. The Madhubani based NGO and project partner, Sakhi, broke new ground by setting up fishing collectives in the 1990s and 2000s, following similar principles, empowering in the underprivileged Mallah (traditional fisher) community in this remote part of Bihar. Inspired by the success of the fishing coops and of collective farming programmes such as those by PGVS, staff from Sakhi and the International Water Management Institute (IWMI) discussed the prospect as early as 2013 of replicating the collective model in farming and combining it with the introduction of cutting edge irrigation and land management practices. This would address both the biophysical and social-institutional factors which have blocked agricultural development in the region.

The collectives in Bhagwatipur

The collective experiment was initiated for the winter dry season in November 2015 by Sakhi, IWMI and ICAR. In Bhagwatipur, 4 farmers groups have been set up. Two mobilise existing smallholders and group them together for shared training, irrigation and marketing, and another two follow the collective model. Out of the collective groups, the first farm of 1.4 hectares is farmed by a group of 12 people, mostly women, the majority of whom are landless. The second farm is around 1 hectare and is farmed by a group of 5 women.

The women signed a joint lease with local land owners with Sakhi playing a facilitating role. They were able to negotiate a fixed rent contract which offers far greater incentives and benefits to tenants than a sharecropping contract. They began collecting monthly contributions to a savings fund a before the start of the winter season, and the group shared the investment in fertiliser and land preparation, before planting potatoes, wheat and mustard. Following the harvest, they planted summer vegetables.

The advantages of collectivisation

There are a number of clear advantages from the collectives which were observed following the first winter crop in Bhagwatipur.

Labour management

One of the primary advantages of the collective is the opportunity it presents to save time, a key issue for women in the context of male outmigration, where the work burden has had a long lasting and negative impact on women's wellbeing. Labour intensive tasks such as plantation and harvesting traditionally require some hired-in labour, and finding workers on time can be a critical constraint. A delayed plantation can result in lower productivity. Now however, with collective production, all tasks are done as a group and this ceases to be a problem. Group members also noted that in the past, each farmer would have to follow up on tasks such as going to the market to buy fertiliser. Now it can be delegated to one member, giving remaining group members time to engage in other activities – a significant benefit at a time when the female work burden has risen. Each group member also brings in new skills and experiences, and knowledge in the group is in effect, 'pooled' along with the land itself.

One concern by the project team was of group members not contributing labour on time or 'shirking', a long running critique of collective production. Indeed, heated conflicts over who spent longer in the field on a particular day had arisen by the end of the first season. The group is however working to resolve these by creating a time sheet, and through a clear division of responsibilities. This includes delegating certain tasks to certain individuals. A constitution has been developed with rules on labour contribution, and if someone can not contribute for a particular task, they have the option of paying for a labourer to replace them, or sending another family member. Past experiences of collectives have shown that peer pressure ensures that everyone does their bit (Agarwal, 2010). It is hoped that over time the cohesiveness of the group will improve, making this a reality (Figure 19).

Figure 19: Women from the collection farming group and nutrients to the potato crop



Women from the collective farming group add nutrients to the potato crop the operation of a contiguous plot and improved irrigation

A collective group can more easily pull together capital for investment in agricultural equipment such as tractors to deal with labour scarcity, and most importantly, in irrigation equipment to build resilience to droughts. This can of course, also be achieved through ordinary marketing or input supply cooperatives whereby an investment is shared amongst multiple households. However, by collectively pooling land as well, the group would have the advantage of operating a contiguous plot. This would allow farmers to make more effective use of tube wells and pump sets. Interviews and focus groups in the field sites and the survey, revealed that rented and owned land parcels are often scattered across multiple locations – and this was a considerable barrier to irrigation expansion and mechanisation.

In Bhagwatipur, now the farmers are farming a contiguous plot of land rather than scattered rented holdings, and they can share the costs, irrigation becomes a lot more feasible. Group members reported that in the past, the amount of land which was cultivated in the winter dry season depended on how much residual monsoon moisture was left in the soil. Given the high cost of irrigation which utilises expensive diesel pump sets, large areas would be left empty after the rice was harvested, awaiting next years' rains. However for the winter season, the group collectively operated a pump set which was shared between groups. Following training in water management through a ridge and furrow method, they cultivated potatoes, as well as traditional staples such as wheat. In the pre-monsoon season from April, the fields of Madhubani were usually entirely empty. The exception was the collective land where the groups have now planted vegetables. New technologies such as solar pumps will be piloted from the next season. Of course, the technological benefits of a group approach are not restricted to irrigation. With Sakhi's support the groups were also able to experiment with zero till method of wheat cultivation and laser levelling. Such technologies which require mechanisation are not usually feasible for single farmers operating small plots of rented land, but become possible when land is pooled between families through a collective.

Increased bargaining power

Collective tenant production groups also transform the traditionally unequal relationship between tenants and land owners. The improved productivity is already winning the support of local land owners, while providing them an incentive to invest capital on their land or encourage their tenants to improve land use or management. Tenants are now sitting in meetings with landowners to discuss investments on the land and cropping decisions, interactions which were reportedly rare in the past.

In the long term, it is hoped that group engagement with landlords can increase the bargaining power of tenants when negotiating rental contracts, with a move away from exploitative sharecropping arrangements to fixed cash rent contracts. The collective may also be able to negotiate with the landlord for other services, such provision of the necessary documents for certain subsidies which are often out of reach for tenants without landlord support. In the long term, a collective lease may allow tenants to more easily claim their legal rights to tenure security should a meaningful programme of land reform be implemented in the future. It may also be a precursor to a group collectively purchasing a plot (Agarwal, 2010).

Conclusions

This paper has proposed tenant collectives as a significant opportunity for Mithilanchal's tenants to increase productivity, enhance their bargaining power, and overcome scale and tenure related constraints to investment in irrigation and technology. In spite of failed efforts at collective agriculture in past decades, the paper has reviewed a range of small scale and democratic collectives, run by close knit groups of farmers.

One unusual paradox however, is that the collective leasing of land itself depends on the support of the same landlord-tenant relations which it seeks to undermine. The model therefore can only flourish following a meaningful redistribution of land. Nevertheless, in the long term, the group solidarity and mobilisation through group lease collectives could allow tenants to more easily claim their legal rights to land should a meaningful programme of

land reform be implemented in the future. At the same time, it could pave the way for mobilisation at a national and regional level via larger political movements for both land reforms itself, as well as more equitable trade regimes and policies for farmers.

This paper has presented an agenda for research into an often overlooked or dismissed system of production. Considerable work is still to be done to test, tailor and develop multiple models of collective production suitable to the diverse and complex social formation of the Eastern Gangetic Plains, and to meet the needs of South Asia's most vulnerable farmers.

References

- Agarwal, B. (2010). Rethinking agricultural production collectivities. *Economic and Political Weekly*, 64-78
- Banerjee, A. V., Gertler, P. J. & Ghatak, M. (2002). Empowerment and efficiency: tenancy reform in West Bengal. *Journal of political economy*, 110(2), 239-280.
- Karan, A. (2003). *Changing Patterns of migration from rural Bihar*. Migrant Labour and Human Rights in India, New Delhi: Kanishka Publishers, 102-39.
- Kishore, A. (2004). Understanding agrarian impasse in Bihar. *Economic and political Weekly*, 3484-3491.
- Pant, B. D. (2011). *Soaring food prices in Nepal: Causes and consequences*. IIDS: Kathmandu.
- Rodgers, G. & Rodgers, J. (2001). A leap across time: When semi-feudalism met the market in rural Purnia. *Economic and Political Weekly*, 1976-1983.
- Sugden, F. & Gurung, G. (2012). *Absentee landlordism and agrarian stagnation in Nepal: A case from the Eastern Tarai*. Nepal Institute of Development Studies.
- Sugden, F., Maskey, N., Clement, F., Ramesh, V., Philip, A. & Rai, A. (2014). Agrarian stress and climate change in the Eastern Gangetic Plains: Gendered vulnerability in a stratified social formation. *Global Environmental Change*, 29, 258-269.
- Sugden, F., Silva, S. D., Saikia, P., Maskey, N. & Kumar, A. (2015). *Irrigation and water management constraints for marginal and tenant farmers in the Eastern Gangetic Plains*. IWMI Report.
- Thorner, A. (1982). Semi-feudalism or capitalism? Contemporary debate on classes and modes of production in India. *Economic and Political Weekly*, 1961-1968.



Chapter 7

Parallel Sessions
Technical Working Groups

Technical Working Groups

There were two groups during the parallel sessions, focused on two key issues:

Group 1: Improving the policy advice that comes from livelihood research in the Koshi Basin

Group 2: How to bring synergies among the different actors (researchers, policymakers, implementers) to improve the livelihood in the Koshi Basin.

Group 1: Gender specific research, ARI framework

Moderator – Kamala Gurung, ICIMOD

Facilitators – Pranita Bhusan Udas, ICIMOD

– Shawahiq Siddiqui, Indian Environment Law Organization (IELO)

– Nilhari Neupane, ICIMOD

Key Messages

- Livelihoods-related research in Koshi Basin should be focussed on increasing access of marginal farmers and women to irrigation.
- Need for intervening low-cost irrigation technologies which should be gender-focussed.
- Subsidy policy, crop insurance, value chain and market access are other instruments should be considered to increase the access of marginal farmers to irrigation.

Discussions

Moderated by Tira Foran from CSIRO, Group 1 session was divided into two sub group. The session's objective was to improve the specificity of strategic recommendation or policy advice on existing gender specific livelihood studies or projects in Koshi Basin using ARI (Argument-Representation-Implementation) framework.

The first sub group was facilitated by Nilhari Neupane from ICIMOD and discussed on improving access of marginalised households to irrigation. The group presented that the reasons for less access to irrigation could be topography, river stream at valley and settlement in higher topography. Spatial and temporal distribution of water due may also affect receiving the necessary amount of water when needed. The group also highlighted on how the marginalised groups had less voice in planning and decision making process.

The group presented their ideas on what actions should be taken. They suggested that there should be subsidy for new irrigation technology, promote insurance crops to encourage farmers to continue farming, ensure that conventional and non-conventional system should go hand in hand. In addition, there is a need for integrated settlement at the village level. They addressed the issue of how lack of technology and tool affected functionality. The role of non-conventional system should be promoted at appropriate places. Market access remains a major issue and that the supply chain needs to be linked to the farmers. The participants also highlighted on the policy approach. The importance of non-conventional irrigation technologies should be promoted to improve the access of the marginalized households to irrigation. They raised concerns about the weak value chain for the irrigation technologies at the local level. Scattered settlements increase per unit cost. There is an absence of the skilled human resource, and the water sources are limited.

The second subgroup discussion was facilitated by Pranita Bhushan Udas and Shawahiq Siddiqui to reflect on the 'social and cultural institutions' as a theme in relation to the gender issues in the Koshi Basin, more particularly in the Nepal and in the context of the water-livelihoods-gender nexus and the



ARI framework presentation. The group reflected on the existing social norms and values, both positive and negative and their impact on local/household level water management and water related decision making in the villages in Nepal. Untouchability, restricted access to water due to caste, purity of women as one of the unspoken but a key issue restricting women to use and manage water within the household, even if it's fetched by women themselves and violation of human rights were discussed as major issues having water-livelihoods-gender nexus in nearly all the villages in Nepal.

The group highlighted that government policy approach in Nepal is inclined towards quantitative goals rather than the qualitative aspects of improving water governance. The physical coverage of schemes (e.g. number of household covered under piped water supply) is given preference. They categorically pointed out the limitation of Water Use Committee (WUC) to open a bank account, which is considered to be a major policy impediment. There are also a few structural issues with respect to the WUC. The group suggested actions on sensitization and capacity development, considered as indispensable to improve the existing state of affairs on gender and water management in Nepal. They highlighted that WUMP should be used as a tool to discuss the issues associated with gender and water perspective in a more nuanced manner.

The VDCs have gender mainstreaming guidelines. However, the performance evaluation criteria does not include gender aspects as one of the essential criteria. Women-centric projects are not selected at the VDC level. Sensitization of political parties is also essential as they take up party position in the village development plans in which women issues are neglected, and village agenda becomes a male dominated agenda. Minimum Conditions and Performance Measures (MCPM) is a tool to evaluate the working of VDC by the Ministry of Urban Affairs, Government of Nepal. The group suggested that having gender indicators under this tool is important and useful policy intervention. The law requires that there ought to be 33% of women representation in all committees at the village level. However this is not complied with. Although, Nepal has gender sensitive budget making process, MCPM does not include adequate gender sensitive indicators.

Group 2: Communication strategies and impact pathway

Moderator – Shahriar M Wahid, ICIMOD

Facilitators – Arun Bhakta Shrestha, ICIMOD
– Aditi Mukherji, ICIMOD

Key Messages

- Synergy among the different actors in Koshi needed
- Important task is to find out the existing knowledge gap in the Koshi Basin.
- Mapping all the stakeholders and key actors in the Koshi is the second steps.
- More synergy can be produced through collaborative research, multi-stakeholder's workshop, joint field work and exchange of ideas.

Discussions

Moderated by Shahriar M Wahid, the group focussed on how to bring synergies among the different actors (researchers, policymakers, implementers) to increase the water availability and improve the livelihood in the





Koshi Basin. The group discussed on the key knowledge gaps. They discussed about the lack of coordination, and the same knowledge being reproduced repeatedly. They suggested that there was a need to develop a common methodology for addressing gender equity in water nexus approach and knowledge should be put into practice. They also emphasised on the need for data and monitoring for better information on water availability and demand.

The group discussed about the constraints for women to participate in decision making processes on water management. The issue of male outmigration and lack of training and education for the women were some of the major constraints in addition to the social structure. There is an issue of unpaid work, household burden on women due to especially male outmigration. Women are forced to take up additional responsibilities in the farm and other agricultural activities. One of the key constraints is also the property rights of the women and their limited access to assets and resources. They recommended actions were suggested for more collaborative research, organising multi stakeholder research, increased knowledge sharing needed through field work and exchange of information and studies. They suggested that the issues on knowledge gaps were:

- Technology demonstration
- Farmer's exposure to new technology
- Subsidy/grant information
- Research
- Media outreach
- Community based monitoring and evaluation
- Capacity building
- Crop insurance
- Crop diversification
- Drought , flood resisting mechanisms

The group suggested that the best ways to share knowledge were through media outreach both at the local and national levels through the FM community radio, newspapers and television. To ensure that messages are reached widely across the rural community, social mobilisers like Ama Samuha (Mother's Group) should be used. Training and educational, knowledge-sharing workshops/seminars should be held through NGOs and community based organisations. In addition, national and regional level workshops can help to provide a good platform to share knowledge and hold policy dialogues to reach at the policy level.

Chapter 8

Concluding Session
Way Forward, Conclusions
and Policy Messages

Concluding Session

Way Forward

Chair	– Eklabya Sharma, ICIMOD
Moderator	– Shahriar M Wahid, ICIMOD
Remarks	– Bashu Dev Lohanee, DoI, Nepal – Yubak Dhoj GC, DoA, Nepal
Vote of thanks	– Nilhari Neupane, ICIMOD

Key Messages

- Research and development needs to be closely coordinated. Research-piloting- and policy for the implementation can be an effective approach for development.
- Strong linkage among countries needed between Nepal, China and India in Koshi river basin.
- Science and policy connect are key to water management.
- Research and sharing knowledge should be applicable at the ground level.
- Gender equity discussion should be core part of water management
- Promote women capacity development in new agriculture technology, land ownership
- Improved knowledge and competence- ground water-energy nexus needed

Chairing the session, ICIMOD's Deputy Director General (DDG) Eklabya Sharma remarked that the transboundary Koshi River basin provides a strong linkage between the basin sharing countries China, India and Nepal. The



transboundary management helps to nurture the ties between these countries not only geographically. They have roles to play in linking both the communities and policy makers through the science and knowledge produced by the researchers. The decisions made by the policy makers should be implemented on the ground to benefit the people.

DDG of DoI Bashu Dev Lohanee said that research and development needs to be closely coordinated. The Department of Irrigation has in collaboration with DoA created a new section for non-conventional irrigation technology. Research-piloting and policy for implementation should be proper way of development, he said.

In his closing remarks, Shahriar M Wahid said that there were opportunities in the Koshi River basin for improved knowledge and competence on promoting water-livelihoods-gender nexus. The science-policy connect is important to reach out to both the policy makers and communities.

Conclusion and Policy Messages

This chapter summarizes the main conclusions of the workshop and presents policy recommendations to improve the linkages between food, water, and energy (nexus) in the Koshi River Basin (KRB).

Key Trends and Issues

The KRB directly or indirectly supports the livelihoods of more than 40 million people, who struggle with challenges related to poverty, food security, irrigation, drinking water, outmigration, increasing fallow lands, and water-related hazards (landslides, floods and droughts). Compared to other river basins, the average per capita water availability in Koshi is high, but still water scarcity occurs in the dry season.

Empirical evidence from Koshi shows a decrease in water availability over the years for both productive and domestic use, and an increase in the number of drought and flood events. Drought appears to be more severe in upland communities while flooding was more prominent in the downstream areas. An increased incident of disasters is expected to exacerbate these conditions in coming years.

The impacts from water-induced disasters are more detrimental to the women and poor as these groups are more closely linked with water-based livelihoods and they have limited adaptation options with which to address these challenges. Access to reliable and sufficient water supply for both productive and domestic uses will be critical for achieving food security, economic development, and improved rural livelihoods in the KRB.

Recommendations

Farmer Managed Irrigation Systems (FMIS) should broaden its dimensions at the basin scale and incorporate the changing socio-economic contexts and hydrological components to make it more dynamic and adaptive.

FMIS represents a 75% share of irrigation systems in Nepal. FMIS exists in the Koshi Basin, but a full inventory of the system is lacking at present. FMIS has changed in recent years to become more gender-inclusive, and represents a preferred adaptation option against the impacts of climate change and other socio-economic drivers of change. FMIS perspectives need to consider the broader view of river basin management by incorporating upstream-downstream linkages and a GESI perspective to make it more adaptive and dynamic.

Multiple Water Use Systems (MUS) and Water Use Master Plans (WUMP) could be key instruments for water management in the Koshi river basin

MUS has emerged as an innovative approach to provide safe water for domestic use and to enable farmers to earn income throughout the year from reliable irrigation. A household can benefit an average of \$250 per year from MUS after satisfying their domestic demand. It enables higher water use efficiency, increases agricultural returns, improves livelihoods, and promotes gender equity. MUS can be a good model for the Koshi Basin as it has been successfully piloted in the neighboring Gandaki Basin, which bears many socio-economic and biophysical resemblances with the Koshi Basin.

WUMP is a tested instrument to strengthen gender-inclusive resilient livelihoods through integrated water resource management. It is based on participatory methods and complementary with a GESI perspective. WUMP offers adaptation options at local scale for drivers of climate, biophysical and socio-economic change, and disaster risk reduction through improved local water use planning.

Upscaling WUMP and MUS to higher levels not only improves water resource management but also balances gender and other governance issues. But sectorial policies of drinking water, irrigation, disasters, watershed

management pose a key challenge for upscaling. Analysing WUMP and MUS approaches from the perspective of water-livelihoods-gender will encourage practitioners and researchers to move out of their silos and foster enhanced cooperation and coherence in planning.

Recharging springs could be a viable option for addressing water scarcity in the mid-hills and should be upscaled at geographic and governmental administrative levels.

Mobilizing local communities to help recharging springs and ponds in the mid-hills of the Koshi Basin is an innovative approach that has yielded encouraging results. Studies show that periods of drinking water scarcity was reduced significantly after recharge pond construction. With greater availability of tap water, the time for fetching water for domestic use was reduced significantly, leaving women more time to care for their children, to work in their homes, and to pursue other income generating activities. Recharging springs also increased water availability for livestock.

It is strongly recommended that these activities are expanded to wider areas to attract the attention of planners and decision makers at the higher levels.

Riverbed farming could improve the livelihoods of poor and landless people, but it is not a long-term option

Riverbed farming has been identified as an attractive livelihoods option for sustaining livelihoods for the landless poor and women. The Koshi Basin holds thousands of hectares of land, which can be utilized for riverbed farming. Studies suggest the farm revenue from these areas could be higher than conventional farming in some instances.

But riverbed farming is not a long-term solution. Rather it is posed as means for women and poor groups to escape deeper levels of poverty and earn enough income to take on other forms of employment. However, for riverbed farming to succeed long term, more coordination among researchers, local markets, finance institutions, and line agencies such as agriculture, agroforestry, and water resources is needed.

Collective farming models could be an option for marginal landholders

Collective farming presents an option for the poor and marginal land holders to increase their land productivity, enhance their bargaining power, and overcome scale and tenure-related constraints to investment in irrigation and technology.

Women are increasingly in charge of managing land, and collective farming can offer avenues for gender empowerment and introduce gender-friendly technologies. Piloting work in Mithilanchal has yielded some encouraging results, but more research for upscaling is needed.

Gender-friendly technological interventions for addressing water availability should be upscaled

Ensuring water access to households is a necessary, but not sufficient condition for creating sustainable livelihood improvement. Gender-friendly technologies are also needed, particularly in regard to water.

Many gender-friendly technologies and good practices already exist in the basin, and others are gaining popularity. These technologies should be well-documented and upscaled.

One notable technology intervention is the solar-powered irrigation pumps. A randomized control trial in the Saptari district is testing three financial models of solar pumps—subsidy model, loan model and rental model—to find which is most appropriate and useful in terms of gender. Nepal's Alternative Energy Promotion Commission and the Department of Irrigation will use these findings to support efforts to expand the use of this technology, and others such as the Barsha Pump.

Capacity building of women and marginal community groups should be encouraged

Successful water resource management and water resource development require that all stakeholders have sufficient capacity to support the work and decision making required (Hartvelt and Okun, 1991). In the wake of significant outmigration of males, women and elderly have assumed greater responsibility for domestic and productive use of water. In the absence of land ownership, these groups have limited access to water resources and are usually excluded from decision making around water. Hence, women and marginal groups require training in institutional and technical aspects of water so they can properly be involved in better water management.

Women's participation in water management decision making should be encouraged and institutionalized.

In the HKH generally and the Koshi Basin in particular, women's participation in local level water institutions appears satisfactory, but at higher levels their presence and participation decreases dramatically. Therefore, women's participation in water-related institutions and their roles in decision making at higher levels should be encouraged. This will help to bring access that is more equitable to water resources. Empirical evidence shows more equitable access to water resources increases agricultural productivity, economic return, and irrigation efficiency (Scherr, 2000). Policy makers should focus to create enabling environments to increase the participation of women and marginalized community members in decision making bodies.

Upstream-downstream linkages should receive more careful scrutiny and consideration

There has been a growing recognition of upstream-downstream linkages as downstream communities have high dependence on upstream areas for dry-season irrigation, hydropower, drinking water, and soil fertility (Rasul, 2014). However, while this relationship is generally acknowledged as true, in the Koshi Basin it is poorly understood. Good water management and technology interventions in the upstream generate positive externalities downstream and vice-versa. Similarly, most of the water related disasters at upstream also have impacts in the downstream. The upstream-downstream dimension of river basin has to be integrated into water-livelihoods-gender nexus framework, which enhance integrated water resource management. For this piloting, data/knowledge can be the entry point.

ARI Framework could be a suitable tool for improving policy formulation process

An ARI framework can be useful in improving policy formulation and implementation. ARI can deliver robust, specific support to advance a socially inclusive, climate-resilient policy formulation by analysing dynamic issues such as the water-livelihoods-gender nexus where many interdependencies exist. The data gap on the nexus makes effective policy making more challenging and complex.

Researcher, policy makers and implementers should work more closely

The workshop recommended that researchers, policy makers and development practitioners work closely, and in greater coordination to tackle the water-livelihoods-gender nexus in the Koshi River Basin. Policy-relevant action research should be operationalized at local levels, focusing gender equitable development through better water resource management. Evidence generated from this research should be used to support the policy and implementation. The DoA and DoI of Nepal are open to support such collaborative action research on the ground and keen to use the findings of such grounded research in their future policy making.

References

- Hartvelt, F. & Okun, D. A. (1991). Capacity building for water resources management. *Water International*, 16(3), 176-183.
- Rasul, G. (2014). Food, water, and energy security in South Asia: a nexus perspective from the Hindu Kush Himalayan region. *Environmental Science & Policy*, 39, 35-48.
- Scherr, S. J. (2000). A downward spiral? Research evidence on the relationship between poverty and natural resource degradation. *Food policy*, 25(4), 479-498.

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Fraser Sugden is a development geographer by training, specializing in the political economy of agriculture, water management and resilience. He is the Country Representative for IWMI Nepal, and the Gender, Youth and Inclusion theme leader for the CGIAR program on Water, Land and Ecosystems. His research interests are in rural class and gender relations and their role in mediating access to water and other land resources – particularly in the context of outmigration and climate stress. He has worked extensively in the eastern Gangetic plains, Eastern Himalayas, as well as China, Vietnam and Bangladesh. He is presently leading participatory action research with farmers in North India and Nepal on farmer collectives.

Govinda Basnet has a Ph.D. in Environmental Anthropology from the University of Georgia, Athens, USA, in 2007. Currently, he is working as a Freelance Consultant in the fields of environmental conservation, water resources management, climate change, and community development. Coming from Solukhumbu district, he has worked extensively in remote areas of Nepal. His research focuses on dynamics of water resource management and environmental conservation and won research grants from institutions like National Science Foundation and Wenner-Gren Foundation for Anthropological Research (USA) among others.

Min Bahadur Gurung is an Associate Institution Development Specialist at ICIMOD. He has more than 30 years of experience in research and development in the field of agriculture, rural livelihoods, participatory adaptation planning, and gender transformative change in the Hindu Kush Himalaya. At ICIMOD, his work is focused on climate resilient value chain development and improving rural livelihoods through diversifying mountain niche products, better planning, and management. Prior to joining ICIMOD, he worked in several social development projects funded by DFID, ADB and UNDP in Nepal.

Nilhari Neupane is the Socio-economic Analyst at ICIMOD. He has more than ten years of experience in research and development in the field of agriculture, water management and livelihoods in the Hindu Kush Himalaya. At ICIMOD, his work is focused on improving water access and availability for domestic, and productive use through better planning and management. Prior to joining ICIMOD, he contributed for Home Grown School Meal Program, a sustainability component of World Food Program (WFP) in Kenya.

Prachanda Pradhan been working for last 35 years to promote the knowledge and understanding about farmer managed irrigation systems in Nepal and elsewhere. He was the Professor of Public Administration and the Dean of Institute of Business Administration at Tribhuban University, Kathmandu, Nepal. He was a Research Associate at the John Kennedy School of Government, Harvard and Fulbright Visiting Professor at the Center for International Studies, Cornell University and Visiting Scholar at Workshop in Political Theory and Political Analysis, Indiana University, USA.

Pranita Bhusan Udas is a gender, water and adaptation specialist at ICIMOD. She has over 15 years of experience in the water sector, and has published several articles and book chapters on gender and water issues. She was a contributing gender expert for Water Resources Project Preparatory Facility of Ministry of Irrigation on preparing GESI Guidelines. Her current research engagement is on understanding gender vulnerability in changing climate context under HI-AWARE research program. She is also involved in preparing Gender Monograph of Census 2011 together with Central Bureau of Statistics, Nepal government.

Raj Kumar GC is a PhD student in the Planning, Governance and Globalization program in the school of Public and International Affairs at Virginia Tech, USA. Previously, he was the Director of Water Resources and Engineering Program and a member of senior management for iDE Nepal. His research will focus on the socio-technical and political dimensions of local water management serving subsistence farming villages in under-developed countries, referenced as Multiple-use Water Services (MUS). Raj has eight years of professional experience working with development agencies.

Ram Chandra Bastakoti is trained agricultural economist and natural resource management specialist. His past research focused on institutional and socio-economic aspects of irrigation management and climate change adaptation. His expertise is in agriculture and natural resources economics, agricultural policy, water governance, irrigation and water management at different levels, climate change adaptation, network and coordination, project management. He has worked with a wide range of organizations in different countries in South and South-East Asia.

Santosh Nepal works as a Water and Climate Specialist at ICIMOD. He has been involved in research activities related to high mountain hydrology, climate change, upstream downstream linkages and local water resources management in the Himalayan region for about 10 years.

Santosh Raj Poudel is a Senior Agri-Economist in monitoring and evaluation section at the Department of Agriculture, Ministry of Agricultural Development (MoAD), and Government of Nepal. Previously, he worked as a Planning Officer for MoAD.

Srijana Shrestha is the Coordinator for Safety and Security at HELVETAS Swiss Intercooperation Nepal. She was also focal person of Gender Equality and Social Inclusion and Poverty (2010-2015) and Team Leader of Elam plus program and Riverbed Farming project (2007-2009) in HELVETAS. She has authored several publications including Gender Equality and Social Inclusion and Poverty Guideline, Caste based anti-discrimination and untouchability guideline, sexual harassment and mobbing policy.

Tira Foran is a human geographer who has worked on governance issues since 1996. He was schooled in Bangkok during the 1970s, a period of political upheaval in Indochina. His PhD studies examined conflicts around hydropower and electricity governance in Thailand. He is currently a researcher at the Commonwealth Scientific and Industrial Research Organisation (CSIRO) in Canberra, with particular focus on collaborative approaches to cross-sectoral development planning.”

Xueqian Song is an Associate Professor of Management, Supervisor of Master Degree Candidate from Chengdu University of Information Technology. Her researches focus on public services and regional development in mountainous area. She has published 22 journal papers and two co-authored books since she started her career in university in 2005.

Yiping Fang is Full Professor of Human Geography, Supervisor of Ph.D. Candidates from Institute of Mountain Hazards and Environment, Chinese Academy of Science. He is recognized within the fields of human geography and the environment for both his critiques of and contributions to balancing mountain environmental protection and development. He is a very active scholar with one solely authored book; three additional co-authored books, fifteen co-edited books, and 142 academic papers publications in different scientific journals.

Annex

Workshop Agenda

Annex 1: Workshop Agenda

Day 1 (24 March 2016)

9:00–10:30	Opening session
9:00	Registration
9:30	Welcome Address – Dr David Molden, Director General, ICIMOD
9:40	Special Remarks – His Excellency Glenn White, Honourable Ambassador, Australian Embassy
9:50	Remarks – Dr Yubak Dhoj GC, Director General, Department of Agriculture – Ashok Singh, Deputy Director General, Department of Irrigation – Dr Bharat Pokharel, Country Director, HELVETAS Swiss Intercooperation
10:10	Workshop Objectives and Overview – Dr Shahriar M Wahid, ICIMOD
10:20	Remarks – Dr Tira Foran, CSIRO
10:30	Group photo
10:30–11:00	Tea Break
11:00–13:30	Session I: Water and livelihoods issues and challenges Chair: Dr Golam Rasul, ICIMOD Moderator: Shabnam Shivakoti, Ministry of Agricultural Development
11:00	Livelihoods and food security issues in the Bihar part of Koshi Basin Dr Biplap Dhak, ANSIS
11:15	Responding to climate change: constraints and potential adaptation options in Koshi Basin Dr RC Bastakoti, IWMI
11:30	Challenges and opportunities for Farmer Managed Irrigation System in Koshi Basin of Nepal Dr Prachanda Pradhan, FMIST
11:45	Empirical livelihood analysis and its potentiality for regional planning and policy advice Dr David Fleming, CSIRO
12:00	Adaptation against rural household vulnerability at up reaches of Koshi River Dr Xueqian Song, Chengdu University of Information Technology, China
12:15–13:15	Discussion
13:15	Concluding Remarks: Chair
13.30	Lunch break
14:30–17:00	Session II: Gender and water resource management Chair: Dr Prachanda Pradhan, FMIST Moderator: Dr Manohara Khadka, Swiss Agency for Development Cooperation
14:30	Argument – representation – implementation (ARI): Improving the policy advice that comes from livelihoods research: Dr Tira Foran, CSIRO
14:45	Gender equality and social inclusion in Water Use Master Plan: Srijana Shrestha, HELVETAS; Neeta Thapa, ICIMOD
15:00	Recharge ponds for protection of springs in the mid-hills of Nepal: Experience from pilot study in Kavre: Binod Sharma, NWCF
15:15–15:45	Tea break
15:45–16:45	Discussions
16:45	Concluding Remarks: Chair
17:00	Introduction of group work for Day 2: Dr Shahriar M Wahid
18:00	Reception Dinner at Hotel Himalaya

Day 2 (25 March 2016)

09:00–10:40	Session IIIa: Improving livelihoods resilience Chair: Dr Yubak Dhoj GC, Department of Agriculture Moderator: Dr Juerg Merz, HELVETAS		
9:00	Riverbed Farming for enhancing livelihoods: cases from Koshi River basin Mr Santosh Raj Paudel, DoA		
9:15	Local water use master plan and rehabilitation response – livelihood contribution, Koshi Basin Mr Bikram Rana and Mr Rabin Niraula, HELVETAS and Dr Nilhari Neupane and Mr Harshana Shrestha, ICIMOD		
9:30	Multiple Use Water Systems (MUS) and Micro- Irrigation Technologies (MIT) for the Koshi Basin – Transferring Learning and Experience from the Gandaki Basin Mr Raj Kumar GC (iDE, Nepal)		
9:45	Existing good practices of water management for livelihood improvement in Koshi Dr Pranita Bhusan Udas, ICIMOD		
10:00	Discussion		
10:30	Concluding Remarks: Chair		
10:40–11:00	Tea break		
11:00–13:00	Session IIIb: Improving livelihoods resilience Chair: Mr Bashu Dev Lohanee, Department of Irrigation Moderator: Dr Kamala Gurung, ICIMOD		
11:15	The role of marginal farmers and women in irrigation management: reflection from Terai and Bihar part of Koshi Basin (cases from ACIAR work): Dr Fraser Sugden, IWMI		
11:30	Sustainable intensification of staple crop system in Eastern Indo-Gangetic Plain (IGP) Dr Mina Devkota Wasti, CIMMYT		
11:45	Impact of low cost irrigation technologies on livelihoods and gender Mr Rabindra Singh (Practical action) and Mr Pratap Thapa (aQysta)		
12:00	Solar pump interventions and scope for livelihoods improvement, experience from WLE Dr Aditi Mukherji, ICIMOD		
12:15	Discussion		
12:45	Concluding Remarks: Chair		
13:00–14:00	Lunch break		
14:00–16:00	Session IV: Group Discussion Moderator: Dr Tira Foran, CSIRO		
14:00–15:30	Parallel Group work 1 Improving the policy advice that comes from livelihood research in the Koshi Basin Gender specific research ARI framework Cluster analysis	Parallel group work 2 How to bring synergies among the different actors (researchers, policymakers, implementers) to improve the livelihood in the Koshi Basin Communication strategies and Impact pathway	Facilitator: Group 1 Dr Tira Foran; Dr David Fleming Dr Nilhari Neupane; Dr Pranita Bhusan Udas; Dr Shawahiq Siddiqui Facilitators: Group 2 Dr Aditi Mukherji Dr Shahriar M Wahid Dr Arun B Shrestha
15:30–16:00	Group presentations		
16:00–16:30	Tea break		
16:30–17:30	Session V: Concluding session Chair: Dr Eklabya Sharma, ICIMOD; Moderator: Dr Shahriar M Wahid, ICIMOD		
16:40	Concluding remarks: Bashu Dev Lohanee, Deputy Director General, Department of Irrigation		
16:50	Concluding remarks: Dr Yubak Dhoj GC, Deputy Director General, Department of Agriculture		
17:00	Concluding Remarks: Chair		
17:15	Vote of Thanks: Dr Nilhari Neupane		



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