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## Nepal: Issues and opportunities for investment

### Nepal's water resources are an integral part of national economic growth

Nepal is a water-rich nation with over 6,000 rivers, a total mean annual runoff of 224 billion cubic meters, and a per capita water availability of about 9,000 cubic meters that ranks 68 out of a total of 169 countries. Despite this seeming abundance, the country has to cope with acute water scarcity, a major constraint on Nepal's efforts aimed at economic development and poverty alleviation.

### Key messages

- Water availability and access are key constraints to poverty reduction and food security.
- Maintaining enough water for agriculture will become increasingly difficult due to climate change and competition for water with urban users, industry and the environment.
- Major new investments are needed to improve water availability and access in river basins, broaden our understanding of how major drivers of change influence water availability and access, and devise adaptive management strategies to deal with these changes.

### The context

IWMI's research initiatives aim to improve water availability and access in river basins, broaden our understanding of how major drivers of change influence water availability and access, and devise adaptive management strategies to deal with these changes.

### Key water issues

#### Policy and institutions

Nepal has ambitious plans to develop its water sector. Institutional mechanisms for water sector management are critical components for successful implementation of Nepal's Water Resources Strategy (2002) and National Water Plan (2005). Public agencies, water users' associations (WUAs), private sector entrepreneurs, non-governmental organizations (NGOs), academic institutions and professional bodies are all active stakeholders.

The government has adopted the principles of Integrated Water Resources Management (IWRM) and River Basin Management as the basis for planning and managing water resources. Practical implementation depends on coherent policies and legislation that encourage and regulate the private sector, support community participation and provide dialog platforms for multi-stakeholder groups.

## Climate change

Global warming is expected to cause rapid and dramatic changes in the timing of the monsoon rains and release of snow and glacier melt.

The Nepal Himalayas comprise a geologically active zone in which rainfall and river flow varies tremendously in time and space. Nearly 30 million people are vulnerable to recurrent floods, landslides and droughts.

Building resilience to current conditions will help prepare for the rapid changes to come as the climate changes in response to rising global temperatures and, at the same time, contribute to institutional capacity for managing water-induced disasters.

## An environmental action plan for watersheds and aquatic ecosystems

Himalayan watersheds and aquatic ecosystems cover a total area of 191,000 square kilometers, of which 74% lie within the borders of Nepal. Increasing demand for water is already causing measurable damage.

The 44 action programs outlined in the National Water Plan will need backup and support in the form of ongoing assessments, monitoring and evaluation,

methodologies and strong institutional mechanisms for managing watersheds and aquatic ecosystems.

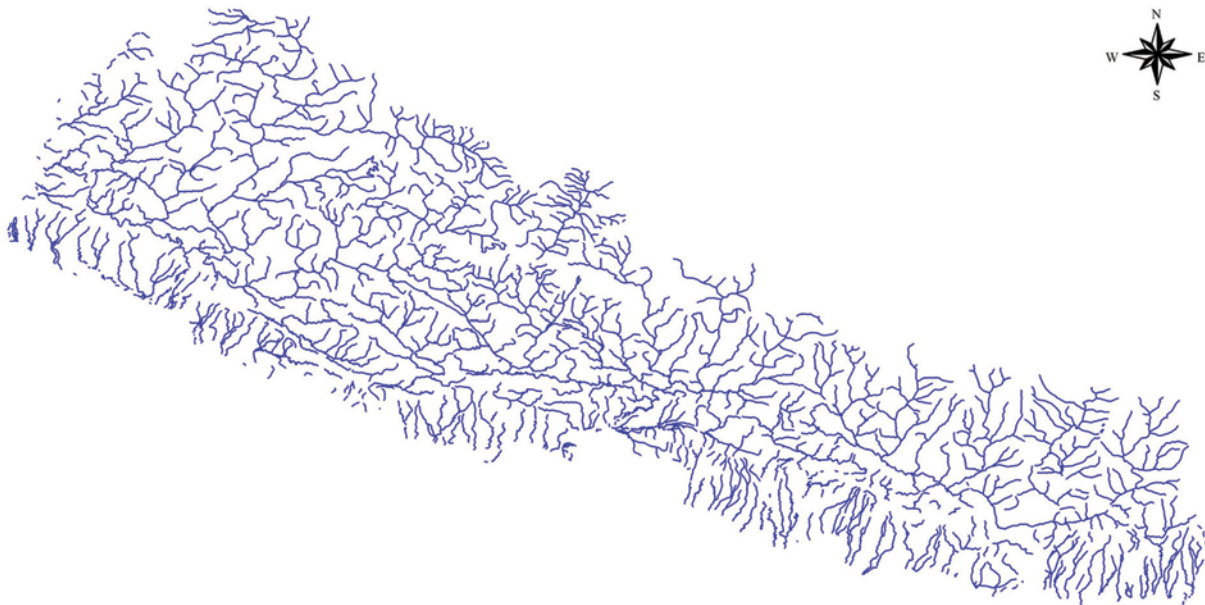
## Revitalizing irrigation

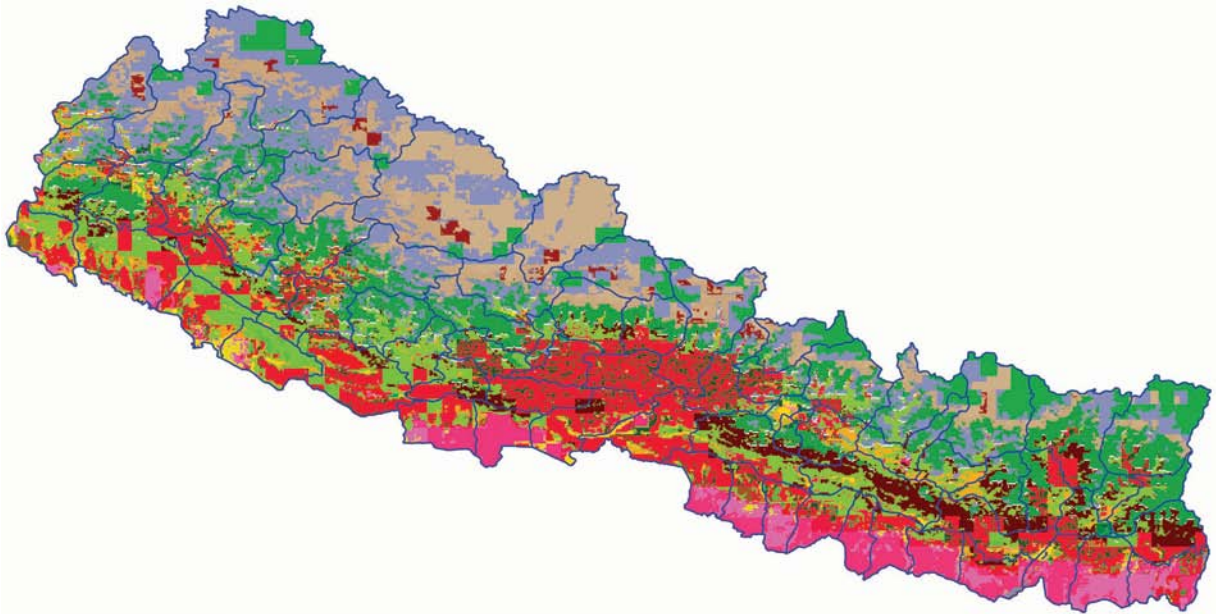
The government has established irrigation as the prime contributor to improving agricultural production and stabilizing agricultural production. Over 80% of Nepal's population depends on agriculture for their livelihoods. Agriculture consumes 99% of all water withdrawn, but only 24% of arable land is irrigated.

Farmer-Managed Irrigation Systems (FMIS) have a long history in Nepal. Over 15,000 irrigation systems are operated and managed by farmer groups. More than 60% of the irrigated land is managed by farmers' WUAs. Despite this commitment, the overall productivity and efficiency of FMIS and WUAs remains low. There is much yet to learn before the full potential of these institutions can be achieved.

## Groundwater irrigation and electricity

Electricity is currently the constraining factor for groundwater extraction and agricultural development in Nepal's hilly terai regions. Sustainable groundwater governance will depend on a policy that includes





GIS and remote sensing tools are essential for modern water resources information systems (Source: IWMI).

appropriate supply and pricing of electricity, and community participation in the distribution and collection of fees.

## Water Resources Information Systems and River Basin Management tools

Nepal urgently needs a functional water resources information system (WRIS) that includes spatial and time series data on hydrology and meteorology, water uses and their inventory, demography, and land use data and maps. Water-related information and data are currently managed by multiple agencies.

Policymakers and water managers need appropriate river basin management institutions and tools to make use of the information gathered for effective water resources assessment, water allocation and conflict resolution.

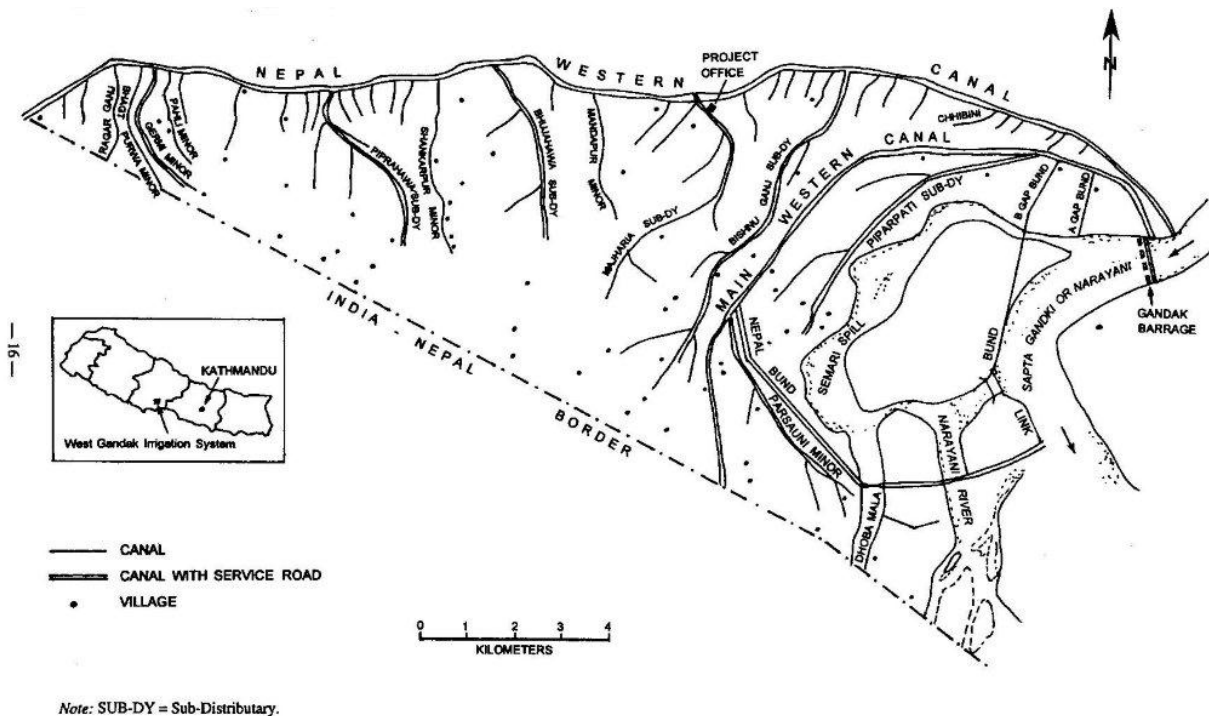
## IWMI research in Nepal

The involvement of IWMI in research on water issues in Nepal dates back to 1986 with the signing of a Memorandum of Understanding (MOU) with the Water and Energy Commission Secretariat (WECS) and funding from the Ford Foundation. The initial mandate was to

promote and strengthen irrigation research capability in Nepal and to undertake research activities in FMIS.

**Farmer-Managed Irrigation Systems:** Among IWMI's early contributions were inputs to policy formulation on FMIS in the deliberations of the National Planning Commission, who were then finalizing an irrigation master plan for Nepal. Research showed that FMIS were outperforming systems managed by central agencies, and that paved the way for irrigation management reform oriented to farmer participation in the operation and maintenance of public irrigation schemes. The move towards IMT schemes was based on the proven success of FMIS.

**Banganga Irrigation System:** The Department of Irrigation (DoI) asked IWMI to help develop and implement an action plan on participatory management. The Banganga Irrigation System was selected as the project site. The research was supported by the Agricultural and Rural Development Office of the United States Agency for International Development (USAID) Mission to Nepal. The Banganga Irrigation System was a subproject under the Command Area Development Project during the period 1982-1989. The overall objective was to develop a set of effective approaches for establishing improved irrigation



IWMI carried out action research on irrigation management transfer (IMT) in the West Gandak Irrigation System in the western part of Nepal, which has a command area of 8,700 hectares (Source: IWMI).

management practices (by increasing the participation of water users) that could be used by the DoI throughout Nepal.

**West Gandak Irrigation System:** IWMI carried out action research on IMT in the West Gandak Irrigation System in the western part of Nepal, which has a command area of 8,700 hectares. The main aim was to determine what kind of support services were needed to ensure that WUAs effectively carry out the responsibilities vested in them. Results showed that rehabilitation and improved management led to a general increase in agricultural productivity.

**Innovative methodologies:** IWMI and collaborators developed a 'nested systems framework' for analyzing irrigation performance that was widely accepted as a new perspective on irrigation management and opened the way towards innovative concepts in water productivity and basin management.

**Water management in river basins:** In the late 1990s, the Government of Nepal (GoN) launched a large-scale inter-

basin water transfer project to divert water out of the Indrawati River Basin to meet the drinking water needs of Kathmandu, located in the Bagmati River Basin. Several case studies were conducted in the Indrawati River Basin and one of its subbasins to assess the potential impacts of bulk water transfer.

Funded by the Ford Foundation, researchers carried out a preliminary assessment of the project impacts and local water use in the basin. They also analyzed constraints and opportunities for managing water resources based on the principles of IWRM. This major study produced four detailed case studies conducted by researchers at IWMI's Nepal office and the WECS.

**Formal and informal water institutions:** Researchers found that the institutional framework in the river basin had evolved 'ingeniously' to manage local water supplies, and there were also cases where local institutions had evolved to resolve conflict issues in small tributaries. The question was whether such informal institutions would be adequate to resolve issues on bulk water transfer outside of the basin.

**Water accounting and water balance in the basin:** Researchers prepared a summary of water balance situations in the Indrawati River Basin. Detailed water accounting and water balance estimations were carried out to assess the hydrological consequences of the proposed water transfer out of the basin under the Melamchi Water Supply Project.

**Process documentation research:** Given the large scale of the diversion project and potential for conflict, it was important to understand the mechanisms that various groups adopted for negotiation and decision making. Research substantiated the need for more interaction between project officials and local stakeholders, and better sharing of information by project officials. One outcome was the first-ever use of compensation packages in water supply projects in Nepal.

**Inclusion and exclusion processes:** Studies showed that processes of inclusion and exclusion in the irrigation sector bear considerable impact on the livelihoods of local

people. Access to irrigation ensures a permanent income to households compared to those who are excluded from such facilities.

**Gender and irrigation:** IWMI's research on gender was pioneering at a time when the role of gender in irrigation management was poorly understood. An important study on gender in irrigation management was carried out in the West Gandak Irrigation System where researchers explored women's roles in decision making. This action research project took steps to encourage women's participation in WUAs and succeeded in increasing the number of women in WUA subcommittees. Other studies suggested the need for capacity building for women as a means of increasing their role in decision making.

Later research showed how women's involvement in smallholder irrigation can be significant. A study on drip irrigation, for example, showed how simple technologies can have a positive impact on women's lives by reducing the time required for 'water work'. Likewise, an assessment



Control gates divert water to two different water user groups when they are planting (Photo credit: Karen Conniff, IWMI).



Terraced fields are a typical landscape feature in the hilly areas of Nepal (Photo credit: Karen Conniff, IWMI).

of Multiple Use Schemes showed how women can be empowered by the cash income from vegetable farming, exposure to training and outside contact.

### Future investment needs

Water availability and access are key constraints to poverty reduction and food security. Maintaining enough water for agriculture will become increasingly difficult due to climate change and competition for water between urban users, industry and the environment.

IWMI's research initiatives aim to improve water availability and access in river basins, broaden our understanding of how major drivers of change influence water availability and access, and devise adaptive management strategies to deal with these changes.

IWMI is seeking partners and funds for the following research projects.

### Sustainable storage development in the greater himalaya region

The ambitious targets set by the National Water Plan will require rapid development of water infrastructure, including storage facilities, which are essential for mitigation of floods and droughts and long-term food security.

There is a need, therefore, to reexamine natural and artificial storage options in the light of climate change and overall national water needs, and to develop a comprehensive plan for storage development.

The aim of this research initiative is to facilitate conceptual rethinking of water storage and broaden perspectives on storage options among farmers, policymakers, donors and researchers.

## **Water storage at source (S@S) in upland watersheds in Nepal**

In Nepal, 80-90% of rainfall occurs during the monsoon months from July to September. Huge volumes of water frequently cause flooding, while the short duration of the monsoon season leads to water scarcity in the dry season. To mitigate floods and droughts means delaying the flow of water during the wet season and building water storage infrastructure to hold water for distribution in the dry season.

The purpose of this initiative is to assess measures that can be undertaken to create a distributed system of water storage in upland watersheds.

## **Environmental water needs – developing a national methodology**

Development of water infrastructure to meet the growing demand for irrigation, energy, and urban and domestic needs will put enormous pressure on the aquatic environment. Sustainable agriculture, fisheries and other livelihood strategies require that environmental water demands be incorporated in the planning stage of development projects. Nepal's water resources are currently underdeveloped, which makes now an ideal time to introduce environmental water thresholds into the overall national water management strategy.

The purpose of this initiative is to develop a methodology to quantify environmental flow requirements in Nepal, and to make flow calculations an integral part of the national WRIS.

## **Avoiding future drought losses – a national perspective**

While Nepal is not generally seen as a drought-prone country, it does in fact experience frequent drought events. The last such event was a severe winter drought lasting from October 2008 to May 2009.

The purpose of this initiative is to conduct a post-drought analysis by using cost estimates of the damage caused by the October 2008 to May 2009 drought. These figures would help estimate the investments necessary to minimize the cost of damage caused by future droughts. The study will also examine coping strategies and suitable technologies that smallholder farmers can use to reduce risks and vulnerabilities.

## **Making the National Water Plan operational: The case of the Bagmati River Basin**

Within the GoN, the WECS is at the apex of policy and planning formulation for developing and managing the nation's water resources in a river basin context. The challenge now is to translate these policy documents into practice.

The purpose of this initiative is to operationalize the National Water Plan by providing some of the required tools and methods using the Bagmati River Basin as an example.

## **Rejuvenating irrigation in Nepal**

This initiative will examine various ways to enhance the performance of the irrigation sector. The proposed research is aimed at: resolving difficulties within the existing framework of policy and legislation; enhancing the role of civil society actors in irrigation management; improving the operation and maintenance of irrigation systems; and identifying new investments needed to develop irrigation facilities, including the development of groundwater resources.

## **Benefits of integrated development of the Ganges River Basin under changing climatic conditions**

The Ganges River Basin is shared by China, Nepal, India and Bangladesh. People here are among the poorest in the world, despite the basin's rich natural endowments of land and water. Harmonized, integrated development of the Ganges Basin could ensure food security, socioeconomic development and environmental protection, as well as political stability in the region. Coordinated basin development could also become a key strategy for adaptation to climate change. The key potential areas for collaboration are hydropower, improved agricultural water management, and flood and drought management.

The purpose of this initiative is to quantify spatial and temporal water availability and demand in the Ganges Basin, assess the impact of climate change and future water resources development, and document the potential benefits of integrated regional basin development.



## Source

This Water Issue Brief is based on the following publications:

Pant, D.; Samad, M. 2010. *Synthesis of IWMI work in Nepal*. Colombo, Sri Lanka: International Water Management Institute. (IWMI Working Paper 138). doi:10.3910/2010.213

An IWMI concept note by Luna Bharati.

## Related IWMI publications

### Open access (electronic version freely accessible via the internet)

Bartlett, R.; Bharati, L.; Pant, D.; Hosterman, H.; McCornick, P. 2010. *Climate change impacts and adaptation in Nepal*. Colombo, Sri Lanka: International Water Management Institute. 35p. (IWMI Working Paper 139)

Bhattarai, M.; Pant, D.; Mishra, V. S.; Devkota, H.; Pun, S.; Kayastha, R. N.; Molden, D. 2002. *Integrated development and management of water resources for productive and equitable use in the Indrawati River Basin, Nepal*. Colombo, Sri Lanka: International Water Management Institute (IWMI). 75p. (IWMI Working Paper 041)

Pant, D.; Gautam, K. R.; Shakya, S. D.; Adhikari, D. L. 2006. *Multiple use schemes: Benefit to smallholders*. Colombo, Sri Lanka: International Water Management Institute (IWMI). 40p. (IWMI Working Paper 114)

Pant, D.; Thapa, S.; Singh, A.; Bhattarai, M.; Molden, D. 2005. *Integrated management of water, forest and land resources in Nepal: opportunities for improved livelihood*. Colombo, Sri Lanka: International Water Management Institute (IWMI), Comprehensive Assessment Secretariat. 34p. (Comprehensive Assessment of Water Management in Agriculture Discussion Paper 2)

Smakhtin, V.; Shilpakar, R. L. 2005. *Planning for environmental water allocations: An example of hydrology-based assessment in the east Rapti River, Nepal*. Colombo, Sri Lanka: International Water Management Institute (IWMI). 25p. (IWMI Research Report 089)

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